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THE CANADIAN TRANSPORTATION RESEARCH FORUM

Theme:

BRIDGING

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Welcome to CTRF's 25th Annual Conference. Bienvenue à tous.

The theme of this year's conference - BRIDGING - was the creation of conference organizers Gordon Sparks (Vice-President Program and Publication) and Andrew Elliott (Vice-President Meetings). The idea has its roots in the fact that the location of the conference, Saskatoon, is known as the "City of Bridges". A play upon words perhaps, but this theme is highly appropriate considering that transportation is a key element in bridging supply and demand in the economy and that CTRF provides a forum which bridges carriers and shippers, government and private sectors, teachers and practitioners and the many disciplines which focus on transportation.

Looking at just two of the conference topics, it can be seen that the Royal Commission on Passenger Transportation and the federal Agricultural Policy Review are bridges that must be crossed in order to develop new transportation systems and policy suited to an era of increased competition and a need for general fiscal responsibility.

Two years ago CTRF stepped off the safe and dry ground of being a staid, almost content, organization offering one annual conference (the cornerstone of our success) and a student paper competition to a bridge constructed of new people and new initiatives such as an education outreach program now offering eight scholarships, and a regular semi-annual (fall) conference. On the basis of the many good ideas of the CTRF Board members whom it has been my privilege to lead in 1989-90, I would submit that we haven't crossed our bridge yet. Because we are a dynamic organization serving a very broad constituency, considerable time may pass before our passage to firm but higher ground is over.

On your behalf, I congratulate and thank Vice-Presidents Elliott and Sparks who have devoted a tremendous amount of their time and talent to the realization of this excellent conference. Finally, special thanks to all helpers, facilitators, speakers and above all CTRF members whose present and ongoing participation make this organization what it is.

Eugene Ludwick
President

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STRATEGIC ALLIANCES VERSUS OWNERSHIP IN THE CONTAINER TRANSPORT INDUSTRY: AN EXPLORATION OF THE ISSUES

by

Mary R. Brooks and Robert G. Blunden*

Abstract

This paper will examine current trends towards vertical integration in the international movement of containerized goods, more specifically, the decision to integrate by way of strategic alliance or ownership. The paper begins by reviewing recent moves towards vertical integration of companies pursuing both global and regional strategies. It reviews their decisions, as reported by the public press, to establish integrated distribution networks and identifies potential reasons for their choice of strategic alliance or ownership to do so. This is followed by a discussion of some of the related strategic management literature that seeks to explain vertical integration decisions. The authors then propose, for consideration and discussion, a tentative model of the factors influencing vertical integration decisions in the container transport industry. The paper concludes with some preliminary thoughts for future research into the issues.

The Marine Container Transport Industry

The worldwide container transport industry continues to grow with three major trading routes dominating traffic — Far East/Europe, Far East/North America and North Atlantic. Exhibit 1 summarizes volumes on major trade routes in 1988.

Traffic on the Far East route to Europe grew by 20 percent in 1988 and is expected to continue to grow at an annual rate of 8 percent through 1992, according to the World Sea Trade Service. North American trade with both Europe and Asia is also expected to continue to grow, in part, because a

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Exhibit 1: Containerships in Service Classified by Route (as of the end of 1988)

Route	No.of Ships	TEUs	%(on TEU basis)
Japan/F.E./N. America	245	531,571	26.0
Japan/F.E./Europe	226	446,379	21.8
N.America/Europe	184	326,864	16.0
Subtotal of 3 major trades	655	1,304,814	63.8
Australia/World	137	148,376	7.2
Middle East/World	186	273,938	13.4
S.America/World	124	163,703	8.0
Africa/World	83	79,945	3.9
India/World	61	76,224	3.7
Total	1,246	2,047,000	100.0

Note: The statistics cover ro/ro ships and full containerships of 3,000 grt or above and 150 TEUs or above in capacity.

Source: NYK Research Chamber, July 1989.

significant share of the Far Eastern trade with Europe is now using landbridges from the U.S. West Coast.

Industry concentration is increasing at an alarming rate. The top 20 carriers controlled 35 percent of the slots in 1986 and are estimated to control 39 percent by 1990.[1] According to James Brennan of Temple Barker Sloan, the *Journal of Commerce* has forecast that half of annualized slot deployment on 13 major shipping routes will be held by five major carriers — Sea-Land, Evergreen, Maersk, American President Lines and NYK.[2]

Recent Events in the Container Transport Industry

According to Anderson and LaLonde, the transportation link has become very important to the competitiveness of shippers.

> Accounting for approximately 45 percent of all logistics costs and physically linking all elements of the chain, transportation provides some of the greatest opportunities for resource optimization and service improvement through cross functional management and integration.[3]

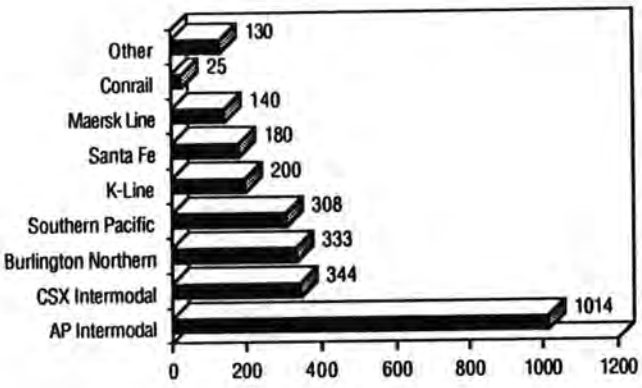
By adding value in the form of electronic data interchange (for shipment tracking and documentation transfer) and meeting the needs of highly integrated, global production systems, carriers assist shippers in their competitive posturing in an increasingly competitive global marketplace. But this has put added pressure on carriers to perform. And many carriers are integrating operations vertically to control that performance.

In April 1984, there was only one weekly eastbound double-stack train operating from LA/Long Beach to Chicago. By May 1989, there were 114 weekly eastbound services from U.S. West Coast ports, 31 from Seattle, 3 from Oakland and 80 from LA/Long Beach. Of those from LA/Long Beach, 38 moved northeast via Kansas City or Chicago and 42 east and southeast via Dallas or Houston. Service extended to the east coast ports of New England, New York, Baltimore, Charleston and Savannah.[4] Stack train ownership (see Exhibit 2) provides an interesting illustration of the strategic alliance versus ownership issue, with slightly more than one-half of the stack trains owned by American President Intermodal, one of the American President Group of Companies, and CSX/Sea-Land. Companies, like Southern Pacific, with their significant but smaller share of the stack train market, operate in conjunction with liner shipping companies like NYK in a strategic alliance in order to compete. The balance of this section presents corporate decisions, first of ownership and then of strategic alliance, to place the proposed model in context and profile a few of the companies making such moves.

Since its beginning as the pioneer of containerization, Sea-Land has grown to become a global intermodal organization with annual revenues in excess of US$2 billion and a fleet of 60 ships. In May 1986, CSX moved to gain control of Sea-Land in its bid to become the world's premier transportation company. The Sea-Land purchase enabled CSX to move into the international spotlight from its strong U.S. domestic position and saved Sea-Land from the unwelcome attentions of corporate raider Harold Simmons. [5] CSX is proud of its efforts, through acquisition, to consolidating its worldwide position in the transport industry. To quote their advertisements in the European press:

> We're CSX, the first true global transporter. If you've never heard of one before, it's because there's never been one before.[6]

Exhibit 2: U.S. Stack Train Ownership
April 1989



The *Journal of Commerce* ran a company profile of Holland's Royal Nedlloyd Group in their December 22, 1988 issue and reported that the game plan of the company for the coming years is to transform the group into "Europe's first integrated intermodal operator" with shipping, trucking, freight forwarding and distribution activities.[7] In 1986, they acquired Van Gend & Loos, the largest Dutch trucking company, from Nederlandse Spoorwegen, the state railroad. The gamble is to make Nedlloyd one of the top logistics companies in the world. The strategy has been questioned as it would require a major investment in the trans-Pacific trade, and many industry watchers view that as unlikely in the short-term.

As part of Nedlloyd's efforts to gain control of their intermodal networks and rationalize their total service package, they have also expanded into the business of port operation. Nedlloyd has merged its 44 percent of Europe Container Terminus and its wholly-owned subsidiary Quick Dispatch BV. (stevedoring) with a trading company by the name of Internatio-Muller NV, whose subsidiary Muller-Thomsen Rotterdam BV, will give the new company formed, Europe Combined Terminals, the opportunity to seek control of Europe's largest port Rotterdam.[8]

Other lines are also focussing on the land-side. Similar consolidation of stevedoring and shipping companies in the port of Antwerp has also happened; in July 1988 Compagnie Maritime Belge (CMB) acquired terminal operator Hessenatie Neptunus NV, adding it to its stevedoring subsidiaries, Stevedoring Co Gylsen and ABT-Stocatra, and thereby controlling more than a third of the cargo-handling capacity of the port of Antwerp. P&O, a Trafalgar House subsidiary, operates the Port of

Felixstowe and is concentrating on constructing its inland trucking network as well.[9]

The consolidation and vertical integration which has already taken place in North America by CSX/Sea-Land and American President Companies is being repeated in Europe by the strong regional carriers as well as those with a global vision. Compagnie General Maritime (CGM) now dominates much of the over-the-road reefer business in its efforts to control more of the door-to-door end of this business, all part of a strategy intended to build up intermodal container operations in niches that have been ignored by the bigger lines rushing for global domination.[10]

> The shakeout in the European liner shipping industry has left most countries with one dominant carrier. P&O, Nedlloyd and Hapag-Lloyd are virtually unchallenged in their national markets.[11]

To these, we can add that the consolidation by CMB, A.P. Moller Group and its Maersk subsidiary, and CGM of their individual operations mean that Belgium, Denmark and France will each be dominated by one mega-carrier.

Meanwhile, the restructuring of Atlantic Container Line (ACL) affords some insight into the effectiveness of consortia in today's market. Bilspedition AB, a trucking and forwarding firm based in Gothenburg, has acquired both Cool Carriers AB, in the refrigerated shipping business, and Transatlantic Shipping Co. Ltd, a large container shipping company. Shortly after its acquisition of Transatlantic, the company moved to acquire its current dominant position on the North Atlantic through a restructuring of ACL, one of the largest shipping lines on the North Atlantic. Transatlantic gained full control of ACL through the purchase in November 1989 of the shares held by Cunard Steam-Ship Co. A month prior to this, Bilspedition AB, Transatlantic's parent, acquired the ACL shares held by Sweden's Wallenius Lines and France's CGM.[12] Mr. Bengt Koch, President of ACL Services Limited at the time of the acquisition, indicated that the purchase of the French and Swedish shares was a competitive necessity.

> While our original shareholding has served us well for the past 20 years or so, it was becoming increasingly evident that we need to run ACL with a simpler structure that is able to respond quickly and effectively to the demands of an ever-changing marketplace.[13]

Cunard's sale of the shares was part of a strategy by Trafalgar House PLC, Cunard's parent, to no longer participate in shipping consortia without majority control.

All of this comes less than a year after Claude Abraham, chairman of CGM, indicated in a *Journal of Commerce* interview[14] that there was still a future for the shipping consortium. He reported that a growing number of shipowners were opting out of strategic marketing alliances in favour of going it alone because of the need to differentiate their services in the eyes of shippers. In his view the consortium still has a role to play on the lighter trade routes, such as those running north-south, where a single line does not have the ability to offer the required frequency of departures. 1989 proved to be an interesting year for CGM as it sold its share in one consortium (ACL) in October and joined, in June, Italia di Navigazione SpA, Costa Container Lines and Evergreen Marine Corp. to provide weekly service between North America and the Mediterranean. However in the new consortium, Med-Atlantic, CGM maintained its own marketing identity.

Strategic alliances between shipping companies usually take the form of slot-chartering agreements, such as that which existed between ACL and Hapag-Lloyd from 1986 to 1989, or vessel-sharing agreements, like the ACL consortium which lasted two decades.

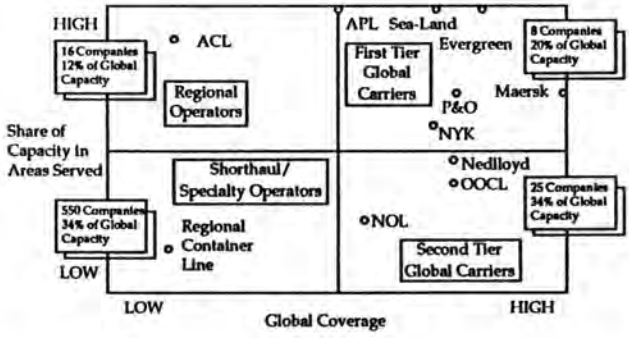
More important, however, are those alliances focussing on the door-to-door movement of containers. One example is the recently announced agreement between Nippon Liner System and the Burlington Northern Railroad and Stevedoring Services of America to operate a weekly doublestack train service from the port of Seattle to the U.S. East Coast (Chicago, New York, Boston). Alliances such as this are a critical element in the success of landbridge operations in the U.S.

Exhibit 3 concludes by identifying marine container transportation companies and their basic strategies. For example, ACL appears to be pursuing a strategy of regional market dominance with its focus on the North Atlantic trade while contracting with others to provide connecting services. CSX/Sea-Land is seeking global dominance developing a wholly-owned, integrated, door-to-door, intermodal container distribution network. The balance of the paper will develop a model to explore the corporate choice between strategic alliance and ownership after examining those forces acting on the industry.

Driving Forces in the Container Transport Industry

The strategic integration moves described above are primarily designed to develop more extensive distribution networks and appear to be in response to a number of industry and environmental trends.

Exhibit 3: Strategies of Marine Container Transport Firms



Source: Temple Barker Sloane

First and foremost is the changing structure of world manufacturing, sourcing and distribution. Production and distribution are becoming global in scope in many industries. Firms are producing for world markets in fewer locations and are sourcing their component inputs worldwide. At the same time they are becoming increasingly quality and total cost conscious. In an effort to reduce costs, firms are reducing inventories and are implementing just-in-time inventory systems. The result is an increased emphasis on total logistic costs and transportation systems.[15] Delivery must be rapid and reliable if inventories are to be minimized, plants are to avoid production interruptions and marketing channels are to avoid lost sales due to stockouts.

In such an environment shippers must have highly integrated systems capable of rapidly moving cargo and instantly tracing shipments. Any firm that can move cargo faster or trace cargo continuously has a competitive advantage over rival firms when seeking the shipper's patronage.

Technology is a significant force in integrating distribution systems through integrated information networks. The emerging North American and worldwide electronic data interchange (EDI) standards have the potential to permit real-time cargo tracing and documentation handling on an inter-firm basis. Once inter-firm EDI is fully implemented, strategic alliances of firms should be able to capture some of the advantages previously only available to fully integrated carriers. However, in the meantime, carriers able to implement fully integrated systems through their own distribution networks will have a significant competitive advantage in a market increasingly desirous of fast reliable service.

Another factor underlying the movement towards service rationalization is the effects of the *Single European Act, 1987* on European-based transportation companies. Peter Gaskell of *Seatrade* interviewed a number of shipowners to assess their attitudes about the common market and its impact on their companies. Positive feelings amongst shipowners were generally centered on the anticipated growth in internal trade and the attendant opportunities for optimizing vessel deployment and reducing costs through service rationalization. He also reported the General Council of British Shipping view that the consolidation and rationalization of differing national standards to a European standard will ease the transfer of ships between EC members.[16] Of course this ease of transfer has a downside risk to it — the rationalization of standards also allows for the consolidation of the market in the hands of a few powerful companies.

In Gaskell's survey many shipowning companies viewed the single market as an opportunity to develop a truly intermodal network for shipments coupled with a rationalized and consolidated agency network, that is, an opportunity to gain greater market dominance and take greater control over their total service package. The concomitant creation of mega-carriers is well underway. But acquisition is not the only solution to this competitive pressure and the strategic alliance has its advocates.

Insights from the Strategic Management Literature

Strategic management views a firm's strategy or strategic responses as a way of fitting the resources and capabilities of the firm to the changing conditions of the environment to achieve organization objectives.[17,18] The sections above have described some strategic responses of container shipping companies to emerging environmental trends. Specifically, some container transportation companies have sought to integrate their distribution networks vertically in an effort to better meet emerging customer needs and achieve competitive advantage over rivals. However they have employed at least two separate mechanisms to do so — expanded company owned networks and strategic alliances. Why? The academic literature can provide some insight into why firms vertically integrate and why they choose varying forms of vertical integration.

First let us examine a firm's decisions regarding its product and market scope; that is the question of the businesses the firm seeks to be in.[19] The product/market scope or domain decision relates to two issues prevalent in the container transportation industry: (1) the decision to expand into new businesses such as rail or truck container movement and (2) the decision to expand into new markets as might be required by a global or regional domination strategy.

These decisions are driven by two basic considerations — the opportunities and threats of the marketplace and the resources and

capabilities of the organization. The globalization of production, sourcing and markets; the emerging information technologies and the lessening of national trade barriers have provided opportunities for well-positioned firms to better meet the changing needs of customers. On the other hand the same changes are a threat to firms unable or slow to reposition themselves for the markets of the future as they run the risk of being out manoeuvered by more nimble competitors. However, firms cannot do everything they might like to do. Financial and human resources and organizational capabilities constrain a firm's viable courses of action. Similarly the actions of competitors constrain a firm's strategy. Does intense competitive rivalry preclude opportunities to expand the firm's market share? Are existing firms acquisition candidates?

The benefits of integration fall into two categories — (1) internal cost reductions and (2) competitive market positioning. Internal benefits affect the economics of operations and the profitability of the strategy while market positioning benefits enable firms to be more responsive to changing market needs and less vulnerable to competitors' moves.[20] Cost reductions are significant when integration permits major cost savings such as occurs when cargo booking and ship's manifest information can be transferred to connecting carriers and final consignee without rekeying. (Conservative estimates put labour savings at 8-10 percent while the National Industrial Transportation League in the U.S. has forecast savings in the order of 30 percent.) Strategic benefits are significant when integration offers the opportunity to achieve competitive advantage over rivals by product differentiation strategies or to constrain competition by raising barriers to entry. High levels of integration, on the other hand, can raise costs and risks. Costs increase when the costs of co-ordination are high and when internal suppliers are less efficient because they have a captive customer. Integration increases risks by reducing the flexibility of highly integrated firms.

Why do firms choose to integrate through ownership or strategic alliance? Clearly the resources of the firm are a consideration. Some firms having determined that they will develop expanded, integrated networks may not have the financial or human resources necessary and are forced into strategic alliances as the only way to implement their strategy. Similarly, in mature markets, integration may require the participation of an already dominant firm which cannot be acquired; a strategic alliance may be the best course of action. This latter explanation may be the correct one to explain the alliance between transpacific liner operators and American railroad companies.

The degree of control sought is another consideration. Firms can exercise much more control over wholly owned subsidiaries than they can over strategic partners. Strategic management research into joint ventures suggests that ventures perform better when one partner has dominant

control; shared control ventures perform less well.[21] Coupled with the marketing advantages cited by Claude Abraham of single door-to-door carriers, control may make ownership the preferred form of vertical integration when it can be achieved. This is especially so if a firm is to seize a competitive advantage now, while markets are restructuring, governments are reducing barriers to trade and information exchange networks are just beginning to diffuse. There may be a relatively short window of opportunity through which aggressive firms can achieve competitive advantage over rivals most effectively by integrating from door-to-door via acquisition.

A Model for Consideration

Now that the elements of our tenative model have been developed let us pull it all together so as to provide a common basis for discussion and enquiry. The model is diagramed in Exhibit 4.

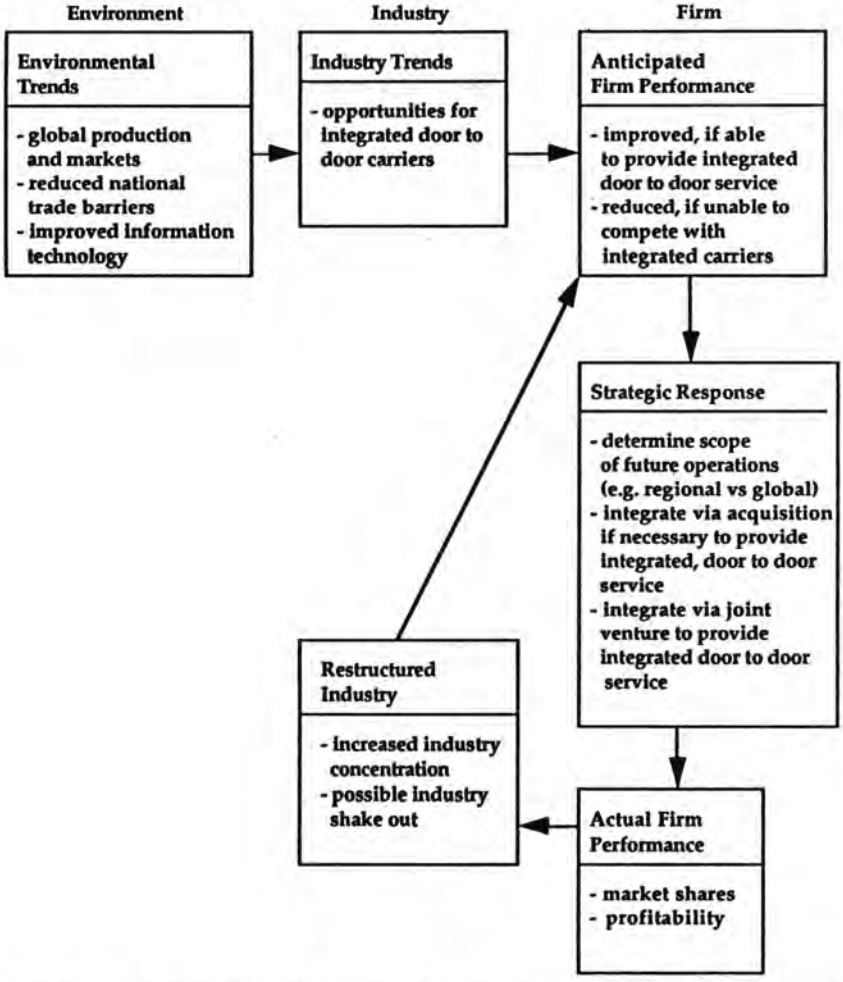
Since integration moves are in response to emerging environmental trends we will start there. Environmental trends include globalization of production and markets, reductions in national trade barriers and improvements in information technology. The needs of shippers are changing as they move toward highly integrated worldwide production, sourcing and marketing. As a result, businesses are placing greater emphasis on their total logistical costs and require speedier, more reliable transportation services from freight companies than they have in the past. At the same time, trends in information technology and the lowering of national transportation barriers are making it possible for carriers to meet these requirements.

These environmental trends lead to industry trends; opportunities emerge for integrated, door-to-door carriers.

Some firms will spot these industry trends and see in them implications for future firm performance (anticipated firm performance in Exhibit 4). Some will see opportunities to seize competitive advantage, and improve their performance, if they are able to provide an integrated door-to-door service. They may also see a threat to their future performance if competitors seize the opportunities first. Other firms may not initially perceive the industry trends or the threats and opportunities inherent in them.

Those firms which perceive threats and/or opportunities in the industry may choose to respond. That strategic response should include a reassessment of their strategy and may result in moves to develop an expanded, integrated transportation network. First the firm should evaluate its resources and capabilities relative to the emerging industry opportunities and threats. That evaluation should lead to a

Exhibit 4: A Tentative Model of Strategic Behavior in the Container Transport Industry



decision concerning the desired scope of future operations. Will the firm strive to be an integrated, door-to-door carrier? If so, globally or on a regional basis? If regionally, in what regional markets? Once the decision is made to develop an integrated, door-to-door capability and the market scope is defined, the firm must decide how to achieve the objective — through a wholly or majority owned integrated network or through strategic alliances with others to form an integrated network.

These opportunities are best capitalized upon by fully integrated door-to-door carriers who can present a single marketing identity to the shipper, implement integrated in-house information systems now, and control the movement of cargo through the complete distribution channel. On the other hand, some of these benefits can be captured through strategic alliances. Firms unable to develop door-to-door networks internally, for whatever reason, may find strategic alliances are the only viable way to position themselves against the global, integrated, door-to-door carriers.

A firm's strategic responses, or lack thereof, will have performance consequences.

In aggregate, firm strategic actions and performances will lead to a restructured industry; presumably an increasingly concentrated industry and possibly one susceptable to a shakeout.

This restructured industry, of course, is the industry within which all container transportation firms operate, both those who have initially perceived opportunity or threat and responed as well as those who have not. Firms who initially did not choose to expand their networks may now feel obligated to do so to remain competitive. The cycle continues.

Some Preliminary Thoughts on Future Research

This model is hypothetical and untested. Its purpose is to spark consideration and discussion of the issues inherent in the recent trends toward the development of extensive, intermodal, integrated container transportation networks.

Clearly there are a number of important research question and topics implicit in the model. To what extent are firms developing true door-to-door delivery capabilities? To what extent are container carriers expanding their geographic scopes? What environmental factors, perceptions and assumptions are driving these actions? What are the concentration trends within the global container transportation industry? What are the factors that influence a firm's choice to integrate through an owned network or through strategic alliances with other firms? How are they preparing for change and how will they communicate this or market this internally?

.On a more general level, research into the strategic decision-making processes of shipping company managers is long overdue. A research agenda must be developed to examine, initially describe and later seek to model and understand strategic decision making in this industry. This is an especially opportune time to launch such an endeavor because of the level of strategic change currently taking place in the industry.

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OVERSIZED CONTAINERS: THEIR IMPACT ON ATLANTIC CANADA'S TRANSPORTATION SYSTEM

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1.0 Introduction

Although more than 90% of the World's container fleet are ISO series 1 dimensions, proposals for a second series of dimension standards have been requested. The need to study container dimensions has resulted from the increasing, domestic and international, use of oversized containers. The dimensions of the ISO series 1 containers remained uncontested until the 12th International Organization for Standardization's Technical Committee 104 (ISO/TC104) meeting in Bombay in 1982. At that time pressure to increase the standard container dimensions began.

The efficient movement of containers is dependant on uniform standards. Changing dimension standards affect the effectiveness of transporting containers and, therefore, impact the operations of container carriers (ie. rail, truck, and marine), container handlers (ie. quayside and inland container transfer facilities) and transportation infrastructure (ie. ports, highway, and railway). As a result of the dependence of Atlantic Canada's container ports on the traffic from central Canada and United States, impacts on the efficiency of transporting and handling the containers are vital to the future of Atlantic Canada's container ports. Therefore, it is important to identify potential threats, such as oversized containers, to Atlantic Canada's container carriers and handlers. This paper examines (i) the factors causing the growth in oversized containers, (ii) current developments in the second series of container sizes, and (iii) impacts on Atlantic Canada's transportation industry.

2.0 International Organization For Standardization (ISO)

The International Organization for Standardization (ISO) is a worldwide federation of national standard bodies. Preparing international standards is carried out through ISO's technical committees (TC) and working groups. Future container dimensions are studied by TC104's working group 4. The series 1 standards established by ISO/TC104 led to the substantial growth experienced within the container industry in the 70's and 80's. During this period, the container sizes which emerged as the industry "workhorses" were the 40' by 8' by 8' 6" high and the 20' by 8' by 8' 6" high containers. As a result of the effort of the original committee members, more than 90% of the 5.3 million TEU in circulation are series 1 containers (Container News, 1989). To date, the ISO\TC104 has established only one series of container standards. Although minor modifications have been made to the original dimensions, the need for a new series had been thwarted until the past decade.

3.0 Increasing Container Sizes in North America

The first dimension to be increased was the 8' height restriction as many carriers were able to handle 8' 6" and 9' 6" high containers with little difficulty. Increasing the height of a container did not require modifications to container handling equipment. However, altering the height had a direct impact on highway infrastructure, such as bridge clearances. Railway tunnel clearances were not constrained by container heights until double-stack trains began to operate.

In Canada, Canadian Pacific introduced non-ISO containers: a 44' 3" long container in 1979; and a 29' by 10' 5" high container in 1981. However, it was American President Lines (APL) introduction of the 45' box into the North American domestic market in 1981 which sparked the growth of oversized containers. Opposition to changing container sizes did not occur until APL began testing 45' containers and ISO chairman Vincent Grey discussed the need to increase the container width standard (Cargo Systems, 1983). Opponents to changes in the length or width components argue that increasing these dimension would require substantial modifications to container handling equipment.

In January 1983, the U.S. Surface Transportation Assistance Act permitted an increase in highway trailer lengths and widths to 48' and 8' 6" respectively. Although this act reduced the competitiveness of series 1 containers when compared to highway trailers in the U.S., it did permit container sizes to increase to 48' in length and 8' 6" in width.

The demand for oversized containers increased with the economic growth following the 1980's recession and with the increase in minimum truck trailer dimension regulations. Oversized containers were used initially for domestic movements. The increased payload was attractive to international shippers and oversized containers soon began to move between Asian countries and North America. Demand for oversized containers continues to grow because of the increasing international movement of low density goods.

Further pressure for oversized containers arose from the use of double-stack container railcars in the United States. Double-stacked trains (DSTs) have not only improved the economics of transporting domestic and international containers, but have forced transportation "links" (ie, marine, rail and truck) to work together as an intermodal "chain".

The increasing use of international standard packages and unit loads (ie, pallets) by shippers encourages the use of oversized containers. There has been strong pressure, especially in Europe, for an increase in container width to handle two 1200 mm wide pallets abreast. The "europallet" or "pool pallet" is the European pallet which is based on module 400 mm by 600 mm package dimension. Europallets can be stowed in an oversized container without overhang or loss of useable floor space.

4.0 ISO Future Container Sizes

ISO responded to the growing number of oversized containers by creating a working group, WG4, to study future container dimensions. Sweden's representative recommended WG4 consider the following points when establishing future container sizes:

- standards have to be developed to be used;
- standards are to be based on future possible dimensions and not present least common multiples, especially truck dimension regulations;
- standards can be the catalyst of law and regulation changes (ie, truck dimension regulations and infrastructure);
- standards must allocate an appropriate lead time before full implementation; and,
- compatibility between future standards and established standards is required for immediate and total acceptance (Guillemot, 1988).

As part of this work, container dimension proposals for a second series of standards were submitted to WG4 by interested parties. The submission of these proposals allowed the WG4 to identify possible dimensions for a second container dimension series.

The future width should be a maximum of 2600mm (8' 6.36") to allow all new containers, regardless of their type and construction, to have a minimum internal width of 2492mm (96.85") which can accommodate two 1200 mm wide unit loads, side by side.

The maximum future height should be 2896 mm (9' 6") which is equal to the maximum height now under consideration by ISO/TC104 for the present series 1 containers.

The most contentious dimension to be resolved is the future length of the series 2 container. The length must:

- be compatible with international standards for packages and unit loads;
- have modular sizes (ie, series 1 sizes included 40, 30, 20 and 10 foot containers); and,
- consist of a larger and an intermediate sizes of this new series.

As a result of these requirements, the following proposed length dimensions have been submitted to ISO/TC104/WG4:

- 14935 mm (49')
- 14805 mm (48' 6.87") - Canadian supported option
- 14630 mm (48') - American supported option
- 14561 mm (47' 9.5")
- 13711 mm (45')
- 13231 mm (44.1')
- 12497 mm (41') - European supported option

(source: TC104/WG4, 1989).

- 13231 mm (44.1')
- 12497 mm (41') - European supported option

(source: TC104/WG4, 1989).

The European supported option (12497 mm) was viewed by TC104/WG4 as inappropriate as it was similar in length to the 40', series 1 standard and was not long enough to optimize the transport of low density, high volume cargoes. The American supported option (14630 mm), when compared to the Canadian supported option (14805 mm), was unable to efficiently utilize the floor space of the container. The Canadian supported option was able to use 97% of the floor space when using metric unit loads.

The length variable is the last dimension to be resolved, however this is the most contentious issue. Many experts believed the issue would have been resolved in 1989. Proponents of the series 2 container must now wait until the next ISO\TC104\WG4 meeting (Guillemot, 1988).

5.0 The Impact of Growing Container Sizes

Although non-ISO standard containers have existed since containerization began, it was the creation of the series 1 standard which assisted the growth in containerization in the 70's and 80's. However, with the increasing use of non-ISO standard containers, container handlers and carriers were unable plan future equipment needs, due to the potential number of different container sizes. Therefore, standards are vital to planners of container handling and transporting operations. However, limiting the system to one container size would not benefit the users of the container, the shippers. Therefore, it is important for planners of container handling operations to be aware of the shippers needs, the developments in domestic container dimensions, and the developments in the ISO series 2 container dimension standards. Those container handlers and carriers which are aware of these developments will be prepared for the use of oversized containers on the domestic and international markets in the future.

5.1 Railroads

Railroads are not regulated by government dimension or weight laws, but are constrained by economic, infrastructure and investment barriers. Railroad infrastructure constraints are costly to overcome and are borne by the railroad company. Increasing the height of the container, especially on double-stack trains, would have a direct impact on the railway's infrastructure, such as increasing bridge clearances. Railcars are limited by two constraints: 1) the weight capacity of the rail truck bogies, and 2) the length limits of railcars. Railways must monitor the ability of the railcars to carry the increased weights, especially the weight capacity of the bogie trucks. Larger container sizes and increased container weights have caused some railways to upgrade their truck capacity to 167,000 pounds.

DST cars are restricted to 89' by the geometrics of the track. As a result, it is not possible to carry two containers greater then 44'6" in the lower tier. However, larger containers (ie. 45', 48' and 53') can be transported 40' or 20' containers in the lower tier, or two oversized containers can be transported on the second tier with minimum overhang. Therefore, the use of the containers larger than 40 foot and less than 53 foot on DST should not pose any problems.

5.1.1 Canadian National Railroad

Canadian National Railroad (CNR) is considering a strategic shift to a container based domestic intermodal system. CNR is planning to increase its container on flat car (COFC) system. By June 1990, CNR will use 48' by 9' 6" high by 8' 6" wide containers for domestic movements, to match the cubic space being offered by the trucking industry.

TABLE 1.0
Characteristics of CNR's New and Present Intermodal Cars

	PRESENT 5-PAK	TRANSCONA 5-PAK	LAVALIN 5-PAK
NUMBER OF CARS	82	40	60
CONTAINER LENGTHS CARRIED	40'	20' 40' 45' 48' 53'	20' 40' 45' 48' 53'
LENGTH OF PLATFORM	42'	49'3"	49'3"
WIDTH OF PLATFORM	8'9"	8'9"	8'9"
DOUBLE STACK HEIGHT TWO 9'6"	21'1"	20'4"	20'4"
CAPACITY OF PLATFORM	90,000 lbs	167,000 lbs	90,000 lbs
TYPE OF CAR	ARTICULATED JOINT	DRAWBAR EQUIPPED	ARTICULATE JOINTS
NO. OF TRUCKS/PLATFORM			
70 TON	2	10	2
100 TON	4	0	4
NO. OF TRAILER HITCHES	5	10	6
TYPES OF TRAILERS CARRIED			
2 - 31'	NO	YES (10)	YES (2)
53'	NO	YES (5)	YES (5)
48'	YES (5)	YES (5)	YES (5)
45'	YES (5)	YES (5)	YES (5)
2 - 28'	NO	YES (10)	YES (2)

Source: Canadian National Intermodal 1990

CNR is currently testing two types of intermodal railcars for future use in New Brunswick and Nova Scotia. The first type is being constructed at CNR's shops in Transcona, Manitoba, and the second type is being constructed by Lavalin in Stellarton, Nova Scotia. As shown in Table 1.0 the new intermodal railcars will be capable of handling containers less than 53' in length, as opposed to the 40' limit on intermodal cars presently used by CNR. These cars would meet all the currently proposed ISO series 2 container lengths. The platform width, remaining at 8'9", would carry all proposed container widths.

The two new railcars reduce the DST height of two 9'6" containers by 9" to 20'4". Apart from the DST height reduction, DST service to the port of Halifax remains constrained by CNR's rail tunnel in Moncton, New Brunswick. Although studies to increase the tunnel's clearance have begun, the logistical and operational costs of setting up and stripping a DST at Halifax will continue to delay the establishment of the service.

The difference between the Transcona and Lavalin 5-paks is the number and capacity of rail-bogie trucks. It is estimated that the Transcona railcar will carry 86% more weight due to the drawbar equipped cars, as opposed to the articulated joints used by the present cars and Lavalin cars. As a result of the substantial increase in weight capacity, the oversized containers can be marketed to heavier commodity sectors.

By keeping abreast of trends in the North American domestic trucking industry, CNR has prepared its operations for the transporting of oversized domestic and international containers. Although Canadian Pacific Railroad (CPR) has intermodal railcars which are capable of handling 53 foot containers, CPR's Atlantic Canada division, Canadian Atlantic Railroad (CAR), does not have railcars to transport containers greater than 45' in length.

5.2 Trucking

The door to door movement of containers has benefited from the increased use of rail-truck intermodal "chains". Rail lines in Canada and the U.S. have sought to rationalize their network by abandoning underutilized trackage, and creating the need for further truck-rail intermodal moves. As a result, marine-rail-truck combinations have emerged as an efficient and economical method of transporting long haul container movements. Due to the growing truck-rail movements, vehicle weight and dimension regulations play an important part in influencing the dimensions of the container which can be moved. The U.S. 1982 Surface Transportation Assistance Act and Canada's recent RTAC Vehicle Weight and Dimensions regulations have attempted to standardize dimension regulations in North America.

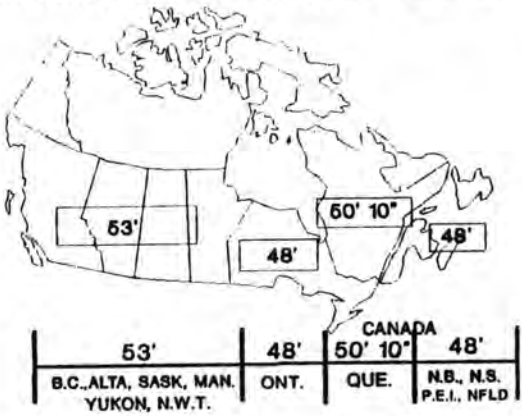
On February 12 1988, the provinces signed a memorandum of understanding to adopt RTAC weight and dimension regulations by July 1, 1989. The RTAC weight and dimension

regulations provide a minimum uniform standard of weight and dimension regulations so that carriers can use some configurations of equipment in all ten provinces. Before the RTAC regulations were proposed, weight and dimension regulations varied across Canada.

In reality, the RTAC weight and dimension regulations will not be totally uniform because some provinces are allowing more than the minimum RTAC standards. Figure 1.0 shows the current maximum trailer regulation applying to each province (Hogg, 1989).

Figure 1.0

MAXIMUM SEMITRAILER LENGTH



Source: Nix, F. 1989.

Note: Legislation permitting 53' trailers in Ontario is expected to be passed in the spring 1990.

Canada's RTAC regulations and the United States' U.S. Surface Transportation Assistance Act both provide the needed consistency in "over the road" regulations on which the intermodal system depends. It should be noted that the Canadian supported ISO series 2 container length is currently illegal in Atlantic Canada and 14 eastern U.S. states. However, Atlantic Canada is anticipated to follow Ontario's recent acceptance of tractor-trailer vehicles with an overall length of 25 meters.

Container lengths are a concern in all provinces in Atlantic Canada due to the amount of two lane Trans-Canada highways. Hence, the opposition to increasing the maximum length of containers and trailers to 16.2 meters (53'). The Atlantic Provinces Trucking Association (APTA) believe "Changes in highway equipment are forecast to come eventually but not until more of New Brunswick's highways are four

lane." (Stephen Branch, 1990) Nova Scotia is planning to extend the four-lane highway from Truro to Amherst. New Brunswick is continuing to arrange financing, with the federal government, for a $2.0 billion, 550 mile four-lane highway through the province. However, regardless of the type of highway system, it is anticipated that the maximum trailer length will be increased to 16.2 meters (53') in Atlantic Canada.

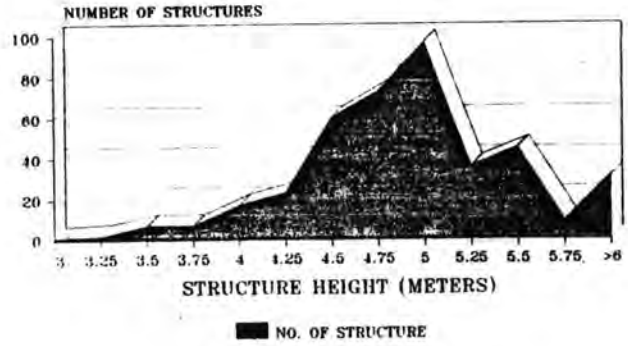
A substantial difference between the Canadian and U.S. system is the ownership of the container chassis. Within Atlantic Canada, highway container chassis are provided by the truck operator. In the U.S. the shipping lines often provide the chassis. As a result of the size of the shipping lines, volume discounts can be negotiated with chassis producers from developing countries. Halifax container carriers, such as Conrad and Armour Transport, do not require many chassis, and are unable to negotiate savings with chassis producers.

Container chassis are not utilized efficiently. Unloading and loading of the container may take days, resulting in the under-utilization. The trucking lag represents a small portion of the total bill of lading, therefore, it is not common practice for Atlantic Canadian trucking firms to apply demurrage charges on shippers who hold their chassis. Shipping lines, owning the chassis, can incorporate demurrage charges into a through bill of lading. As a result, any increase in the volume of oversized containers through the port of Halifax for the local market would result in inefficient container chassis utilization and additional costs to Atlantic Canada's highway container carriers.

Apart from a safety concern of raising the height of containers, Atlantic Canada provinces are also concerned about the increase in container heights with regards to infrastructure restrictions. Similar to the rail mode, increasing the height limits of highway bridges is extremely expensive. However, insufficient clearances can result in logistical problems to truck operators, and damage to infrastructure and container equipment. Trucking is a door-to-door operation and could be required to serve any community in Atlantic Canada. Therefore, overhead infrastructure problems are not limited to the Trans-Canada highway (TCH). In order to study the impact of oversized containers on Atlantic Canada's highway infrastructure, heights for approximately five hundred overhead structures in New Brunswick, Newfoundland, Nova Scotia, and Prince Edward Island were analyzed. The overhead heights were received from the Atlantic Provinces Transportation Commission (APTC) and include overhead infrastructure, such as: road overpass, rail overpass, pedestrian overpass, toll booths, on/off ramps, etc.

FIGURE 2.0

HIGHWAY OVERHEAD HEIGHTS ATLANTIC CANADA



SOURCE:
ATLANTIC PROV. TRANSPORTION COMMISSION
(APTC)

As shown in Figure 2.0, 57 overpass were identified to be constraints to containers 9'6" or greater and 34 were constraints to 8'6" or greater. One advantage of the ISO standards is to allow the transportation infrastructure planner to prepare for the future and correct the past.

5.3 Port of Halifax

The 1980's has seen major changes in the way ports handle containers. Load centers, landbridging, DSTs, container vessel sizes, container sizes, and trade route changes, have all changed the economics of handling containers. Containerization economics requires consolidation to gain the economies of scale necessary to efficiently utilize the capital intensive operations. As a result of the capital intensity in the container handling industry, the impact of increasing container dimensions will be considerable. The cost to accommodate larger containers with new equipment and modifications to existing equipment will be great.

The Halifax market in Atlantic Canada is not sufficient to justify two container terminals the size of Ceres Terminal and Halterm. Unlike many eastern U.S. ports which benefit from a large local market, Halifax is dependent on markets thousands of miles away; such as Montreal, Toronto, or Mid-West U.S. This distance to major markets makes Halifax unique when compared to ports such as Montreal, New York, or Baltimore. Both Halifax container terminals are serviced by a single rail line, CNR. CNR plays a major role in transporting the containers, due to the economies of scale

resulting from long haul container movements. As shown in Table 2.0, CNR carriers two-thirds of the containers from Halterm and three-quarters from Ceres Terminal. As a result of this high rail haulage percentage, imported containers are not stored on the quayside. The containers are moved from ship directly to railcar. As previously mentioned, CNR's new intermodal railcars are designed to carry container lengths less than 53' and widths less than 8'9". Therefore, storage of oversized imported containers on rail cars will not cause any problems.

Table 2.0
PORT OF HALIFAX'S CONTAINER TERMINALS

	CERES TERMINAL	HALTERM
MOVEMENTS		
RAIL	78%	65%
TRUCK	15%	25%
FEEDER	8%	5%
CONSOLIDATION		5%
EQUIPMENT		
GANTRY CRANES (NO.)	3	3
LEG SPREAD (1)	45'	57'
LEG SPREAD (2)	50'	45'
LEG SPREAD (3)	50'	47'
STORAGE CAPACITY		
(THREE HIGH)	7,000 TEU	12,000 TEU

Although storing imported containers in Halifax is not an issue, the handling of series 2 containers will result in problems. The equipment used to transport the containers from the vessel to CNR's railcars currently cannot carry non-ISO oversized containers.

As shown in Table 2.0, both Ceres and Halterm have three gantry cranes and both have ordered another crane from Liebhera for delivery in 1991. The most important dimension affecting oversized containers and gantry crane dimensions is the distance between the legs. As shown in Table 2.0, Halterm's second crane required a swivel spreader in order to move containers greater than 45' in length between its legs, and the third crane (without a swivel spreader) could not transport containers greater than 47' in length. Ceres Terminal also has one crane which is limited to containers under 45' in length. The remaining two other cranes at Ceres are limited to movements of containers 50' or less in length. Ceres terminal and Halterm have both purchased Liebhera gantry cranes with a distance of 55' between the legs.

Yard gantry cranes and straddle carriers are used to transport ISO series 1 containers by both terminals. Front

end loaders are used for the yard tractor-to-railcar transfer and transporting oversized containers from the gantry crane directly to the railcar or segregated storage area. Quayside container handling equipment and intermodal terminal equipment will be affected by changes in container dimensions. The spreader, which is the interface between the equipment and the container, is directly affected by the changing dimensions. Spreaders are used on most container handling equipment, such as quay-side gantry cranes, straddle carriers, front end loaders, yard gantry cranes, etc. In order to reduce the handling difficulties of larger containers, the corner castings are currently located in the 40 foot positions and not on the corner positions of the larger containers. Container operators must re-evaluate their handling equipment needs, that is, whether or not to purchase spreaders which can extend to greater than 40 feet. Spreader manufacturers' reasons for operating spreaders with greater than 40 foot capacity are damage reduction and speed. Positioning the spreader on a container with corner castings on the corners can be performed more accurately, reduces damage, and improves handling times and safety (Container Management, 1989). If spreaders larger than 40' are required, Halterm would invest in new spreaders, as the present spreaders could not be modified to lift containers larger than 40' in length.

Ceres' and Halterm's container stacking designs are intended for a maximum container length of 40' (or two 20' containers) and width of 8'. Currently all containers moving through Halterm are 8' in width. As shown in Table 2.0, storage capacity, assuming containers are stacked 3 high, is 7,000 twenty foot equivalent units (TEU) at Ceres terminal and 12,000 TEU at Halterm. The number of import containers equal the number of export containers, a 50/50 split. Sixty-five percent to 75% of imports are stored on CNR's railcars. Therefore, Halifax's container storage facilities are occupied by (i) export containers, (ii) import containers to be transported by truck or domestic marine carrier, or (iii) empty containers. Although containerizing low-density exports from Canada is increasing, exports on the North Atlantic trade continue to be a predominantly heavy commodity market. Therefore, the 20' and 40' in length by 8' wide container storage slots will still dominate. However, as the number of oversized containers increase, there may be a need to redesign the terminal for efficient container storage and re-equip the terminal for efficient equipment utilization.

Handling of containers is a capital intensive operation. Table 3.0 lists the costs and expected life of several pieces of container handling equipment. Standards are essential to this industry because of the required capital investment and long expected life of container handling equipment. For these reasons, discussions of changing container dimensions are met with furious opposition from the container handling industry.

Table 3.0
CONTAINER HANDLING EQUIPMENT
(1988 U.S. DOLLARS)

EQUIPMENT TYPE	CAPITAL INVESTMENT	OPERATING & MAINTENANCE	EXPECTED LIFE
QUAYSIDE GANTRY	$4,500,000	$400,000	25
YARD RAIL GANTRY (MED)	2,400,000	350,000	25
YARD RAIL GANTRY (SM)	1,000,000	270,000	25
YARD RUBBER GANTRY	825,000	250,000	15
STRADDLE CARRIER	500,000	240,000	12
REACH STACKER	425,000	205,000	10
FRONT-END LOADER (42t)	300,000	210,000	10
YARD TRACTOR	65,500	130,000	10
40' TRAILER	25,000	7,500	8

Source: UNCTAD: OPERATING AND MAINTENANCE OF CONTAINER HANDLING SYSTEMS, 1988

Developing countries are especially concerned over the possible changes in standards, as they are making significant investments to handle existing container sizes. New sizes would require further costly modifications to relatively new handling equipment and infrastructure.

5.6 Canadian Cargo

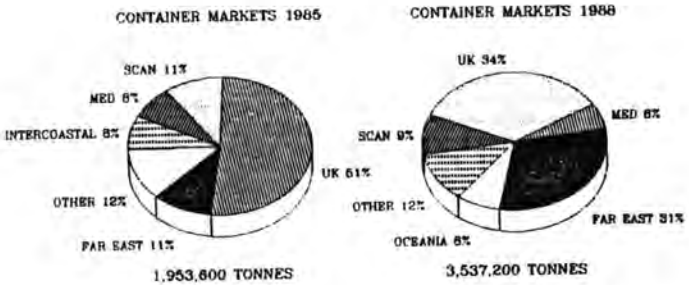
Unlike the low density commodities moving in containers between the U.S. and Asia, Atlantic Canada's high density international cargos often travel in 20 foot containers (Phillips, F. 1988). However, as shown in Figure 3.0, the port of Halifax's markets include potential oversized markets, such as the Far East and Mediterranean. Also shown in Figure 3.0, is the 182% growth in the Far East, Southeast Asia and Indian Sub-continent market between 1985 and 1988.

Markets, such as Eastern Asia, have been prime markets for oversized containers, due to the nature of their low density exports. Examples of container sizes currently used by Halterm's customers include:

- the Oceania market is strictly a 20' market,
- Halterm's largest single carrier Zim Lines, serving the Mediterranean and Far East, was once strictly a 40' carrier, currently Zim Lines is approximately 96%, 40 foot containers; and,
- round-the-world consortiums, such as OOCL, NOL, KLines are 60%, 40' and 40%, 20' containers.

FIGURE 4.0

OVERSIZED CONTAINERS
1988 CONTAINER CARGO BY MARKET



SOURCE: PORT OF HALIFAX DIRECTORIES

6.0 Conclusion

For the first time in 25 years, a second series of container dimension standards will soon be proposed to the ISO. The growing demand for the North American domestic container's dimensions have forced ISO\TC104 to acknowledge the need for uniform standards for oversized containers.

Containers are transported by all transportation modes in Atlantic Canada. Therefore, the proposed dimension standards will impact container carriers, container handlers, equipment designers and transportation infrastructure planners. Atlantic Canada's container carriers, especially the rail and road modes, has been fortunate by keeping abreast of the advances by the North American domestic container industry. Therefore, the impact of the oversized container on Atlantic Canada's surface carriers will be minimal. CNR's strategic decision to transport 48' by 9'6" by 8'6" containers by their Intermodal Division will benefit CNR when the number of oversized containers increased on the international trades.

As a result of the truck-rail importance in the domestic intermodal movements, highway container carriers will invest in chassis which are able to transport oversized containers. Atlantic Canada's rail and highway container carriers will be capable of carrying 48' by 9'6" by 8'6" by 1991.

The situation is very different on the marine side. Container carriers and handlers on the marine side are not currently prepared to handle oversized containers. Their equipment and infrastructure is designed for series one containers with maximum dimensions of 40' by 8' wide. As a

result of the minimal number of oversized containers presently moving through the port of Halifax, marine carriers and port operators do not view the oversized container as an immediate threat. However, Ceres terminal, Halterm, CAR and CNR's managers all acknowledge an inevitable increase in the number of international oversized containers being transported through Atlantic Canada's ports. Although the number of oversized containers will be small in proportion to the number of ISO series 1 containers, the cost to the transportation industry will be great. However, for the port of Halifax to remain a competitor on the North Atlantic container trade route, it is vital for all Atlantic Canadian container handlers and carriers to consider oversized containers in their strategic plans.

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POTENTIAL IMPACT ON CANADA OF NEW CONTAINER STANDARDS

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ABSTRACT

The International Standards Organization (ISO) is developing standards for a new series of large containers. There also have been proposals for heavier 20-foot containers. While the ISO considers possible standards, various non-ISO containers—particularly longer and wider ones--are becoming more common. In the United States, lengths of 45-feet, 48-feet, and even 53-feet are now in use and widths of 102 inches are standard for 48 and 53-foot containers. Standards have also been proposed for domestic containers in the US. In Canada there are a number of non-ISO containers used for domestic freight and new services with non-ISO standards are being planned. In Europe, non-ISO widths of 2.5 metres are common for containers and swap bodies. Some European container manufacturers are now building 20-containers to a new 30-tonne standard. There is a danger, according to some that, without a new international standard, the integrity of the world's containerized freight system will be jeopardized.

This paper examines the impact of proposed larger containers and proposed heavier containers on the transportation industry: container terminals, railways, truckers, and highways. It concludes that, unlike other countries, Canada is in a good position to handle whatever sizes and weights are adopted. The paper is based on research conducted for the Transportation Development Centre and work in progress on a paper for the Roads and Transportation Association of Canada. (1) The views expressed are those of the author.

1. BACKGROUND

ISO standards, which have been developing since the first 20/40 foot standards were established in 1964, have set, among other things, the following dimensions and weights for the two most common general freight containers:

- 20-foot length, 8-foot width, up to 8' 6" in height, and up to 24 tonnes (52,920 lbs) in gross weight. Until a few years ago, the maximum weight was 20.32 tonnes (44,800 lbs) and there are still many 20-foot boxes in use which are only rated to this weight.

- 40-foot length, 8-foot width, up to 9' 6" in height, and up to 30.48 tonnes (67,200 lbs) in gross weight. The 9' 6" height was

only adopted by the ISO in June, 1989, although containers of this height had been in use for some time before this.

ISO standards are voluntary. The use of non-standard containers--particularly the longer 45, 48, and 53-foot containers (United States), and the wider 2.5 metre (Europe) or 102 inch (North America) containers--is the reason why there is pressure on the ISO to adopt new standards. There are also pressures from European interests for an increase in the weight of 20-foot containers to 30 tonnes. Neither proposal, for either a larger container or a heavier 20-foot container, was adopted at the ISO's last plenary session in June, 1989. Various groups are now studying the issues and new standards may be adopted at the next plenary session in Seoul in 1991.

2. POSSIBLE NEW SIZES & WEIGHTS

There are many new sizes being considered. The most contentious item in this consideration is the debate over length. It revolves around three issues. First, over-the-road limits for trailers in various countries constrain the possibilities that may be considered. This varies from 40 feet (the practical limit in some European countries), to 45 feet (possible on trucks meeting new EEC regulations and now tolerated in some Pacific Rim countries), to 48 feet (the minimum North American standard) to 53 or more feet (an increasing number of North American jurisdictions).

Second, there is a desire to make the length optimal considering pallet sizes and unit load sizes. In order to preserve modularity, new containers should have a half-length companion also optimal in terms of their ability to carry standard unit loads and/or pallets. One of the possibilities that emerges is a length in the range of 49 feet (and a corresponding half-length). Such a container is optimal in terms of both European unit load sizes and the more common North American pallet and/or unit load sizes.

Third, there is the constraint created by the investment in equipment designed to handle current ISO containers. There is a large investment in existing ships, terminals, and handling equipment for the current 20 and 40-foot ISO containers. The development of a new standard may make these facilities redundant--that is, be retired before the end of either their financial or physical lives.

The debate over widths, while serious, is not as contentious as lengths. The choices are the current 8 feet (2.44 m) which has the favour of many of those with investments in ships and container terminals (their equipment is designed around the 8-foot width), but which is considered sub-optimal in terms of common unit and/or pallet sizes. Neither the European 1.2 metre load size nor the common 48 inch North American pallet can fit side-by-side in such a container. A second choice is the European 2.5 metres. This may become the standard for swap bodies (a container-like device that fits on the back of a trailer); it is the most common limit for highway trailers in Europe; and it is already being used for some European containers. The third choice is either 2.6 metres or 102 inches (2.59 m). These

are North American standards for highway width limits and are already common for North American 48 and 53-foot containers. Further, the road geometry of many European countries can handle this as is evident by allowances in some countries and new EEC standards for refrigerated trailers operating at 2.6 metres in width. The channel tunnel is also being built to handle 2.6 metre widths.

There has been less debate about new weights. Everyone agrees that the limit for the new larger container will be held to the current 30.48 tonnes of existing ISO 40-foot containers. What debate there has been centres on the possibility of increasing the limit of the ISO 20-foot container from the current 24 tonnes to 30 tonnes (or, perhaps, 30.48 tonnes). This creates a problem in some countries—particularly the United States--where even current ISO weights lead to overloaded axles or overloaded trucks. A study in the United States has suggested that 40 percent of current 20-foot containers are overweight in terms of federal bridge load limits (the formula used to determine allowable truck weights and required axle-spacings on most US roads). (2) The cut-off for "overweight" under this criteria--and given the chassis being considered—is 17.2 tonnes, well below the maximum ISO rating of 24 tonnes let alone the proposed 30-tonne standard. The Americans also have problems with the weight of current 40-foot containers; this is not important here as there have been no suggestions that existing ISO standards be rolled back. Europeans, on the other hand, allow much heavier axle loads than do the Americans--anywhere from 10 to 13 tonnes on a single axle (the common US limit is 9.1 tne) and 20 to 21 tonnes on tandems (versus 15.4 tne in the US). The EEC standard for single drive axles will be 11.5 tonnes by 1991. Heavier axle loads, and fewer constraints about the distance between axle groups, allow European trucks to carry heavier loads over shorter wheelbases. This, in part, explains the pressure from some quarters for an increase in loads that can be carried in a 20-foot box.

These are the main points in the debate over new container standards. There are other points: railways in Europe have problems with some sizes; railways on both sides of the Atlantic may have to replace some equipment if a large number of new, heavier 20-foot containers appeared; and there are a range of third-world concerns (the capital required to invest in new facilities).

3. CONTAINER MOVEMENTS AND CONTAINER CHARACTERISTICS

Table 1 shows a summary of available data on container movements in Canada. There were 13.6 million tonnes of containerized freight, of which 12.6 million were international, handled at Canadian ports in 1988. This represented about 1.3 million TEUs (20-foot equivalent containers). Port statistics, though, do not account for all container activity. The railways handled 926 thousand TEUs in 1988 and a further 341 thousand trailers, some of which carried domestic containers. The trucking industry also handles most containers in Canada at some stage of their trip. Sometimes this may only be a few miles of urban roads as a truck picks up or delivers a container to a maritime terminal or a rail intermodal yard. At other times, it may involve hauls between Vancouver and Seattle/Tacoma or even, on

Table 1 SUMMARY OF CONTAINERIZED FREIGHT MOVEMENTS IN CANADA

Container Traffic at Canadian Ports

TOTAL (a)

	Domestic Tonnes 10^3	International Tonnes 10^3	TOTAL Tonnes 10^3
1985	652.9	9,093.2	9,746.1
1986	1,510.0	9,799.3	11,309.3
1987	1,431.1	10,847.3	12,278.4
1988 (preliminary)	984.9	12,592.9	13,577.8

THREE LARGEST PORTS (b)

	Vancouver		Montreal		Halifax		TOTAL	
	tne 10^6	TEUs 10^3	tne 10^6	TEUs 10^3	tne 10^6	TEUs 10^3	tne 10^6	TEUs 10^3
1985	1.61	178.2	4.42	481.5	1.95	263.1	7.99	922.8
1986	2.00	222.8	4.94	531.5	2.26	270.8	9.21	1,025.1
1987	2.41	280.8	5.53	574.5	2.79	331.8	10.73	1,187.1
1988	2.73	305.7	5.73	560.4	3.54	412.2	12.00	1,278.3

Inland Container Traffic

RAIL (c)

		CN Rail	CP Rail	TOTAL
1987	TEUs	360,000	395,000	755,000
	trailers	250,000	120,000	370,000
1988	TEUs	480,000	446,000	926,000
	trailers	225,000	116,000	341,000

TRUCK (d)

1987	Total for-hire shipments	33.7 million
	containers movements (crude estimate)	0.6 "

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a) StatsCan data (1988 by telephone)
b) Data supplied by individual Ports
c) Data supplied by CN and CP Rail (3)
d) StatsCan, cat #53-222 (estimate for containers is weak)

occasion, from Vancouver to Central Canada. A very rough estimate of the quantities handled by trucks is 0.6 million, although the true number could be considerably higher than this. A significant number were the empty return of a container to a terminal.

Some observations on the available data are:

- o Containerization and total freight activity: Total tonnes of containerized freight is modest in comparison to the total volumes at Canadian ports (362.2 million tonnes in 1987). But this hides

the value of both the commodities handled by the containers and the value of the service provided. In some ports, such as Montreal, containerized freight accounts for as much as 25 percent of total activity as measured by tonnes. For the railways, containers, along with piggyback trailers, account for between 10 and 15 percent of total revenues.

- Growth of containerization: International containerized freight at Canadian ports has increased by 93% in the last six years (1982 - 1988), and domestic containerized freight, handled by the ports, has increased by 54% over the last five years.

- Competition with US ports: International container routings ignore the border between Canada and the United States. Containers with an origin or destination in one country cross the border to use a port in the other. Roughly half the volume of containers through Montreal is US mid-west traffic. On the west coast, many containers with an origin in or a destination from Canada are using American ports. The annual volume of these transborder flows is in the range of 400,000 TEUs.

- A global perspective: In 1988 there were 73 million TEU movements world-wide. Some ports accounted for as many as four million (Hong Kong), and ports in the United States accounted for as many as two million (New York/New Jersey) and one million (Seattle, with Portland and Tacoma adding almost another million). Canada's ports handled 1.3 million TEUs in 1988, with another 0.1 to 0.2 million domestic TEUs moved by the railways. From a narrower, North American perspective, total international tonnes of containerized cargo in Canada of 12.6 million tonnes is only 17.5 percent of the 72.0 million tonnes in the United States.

In terms of the characteristics of the freight inside the containers, little data, other than StatsCan's commodity statistics, is available. The most useful here has been obtained from CN Rail which sampled the weight of 40,000 international containers for the year 1989 (Table 2). Many containers are being loaded to less than their

Table 2 CN RAIL CONTAINER TRAFFIC, 1989

Frequency Distribution of Container Gross Weights

Weight (tons)	Import Boxes		Export Boxes	
	20'	40'	20'	40'
0 - 5	4.3%	1.1%	2.6%	0.2%
5 - 10	12.3	15.7	8.7	5.1
10 - 15	9.5	23.7	7.0	7.2
15 - 20	17.2	16.2	9.9	7.9
20 - 25	38.6	19.1	64.6	15.1
25 - 30	16.0	16.7	6.9	28.3
30 - 35	0.6	6.4	0.1	36.0
35 +	1.4	1.1	0.1	0.3

rated weight capacities: for example, 56 percent of the import 40-foot boxes weigh less than 20 tons (18.1 tne) versus the ISO rating of 33.6 Imperial tons (30.48 tne). This suggests that much freight "cubes out," that is, fills the cube of the box before reaching the weight limit. This point is examined in a later Section. Second, many of the outbound boxes are loaded to the their maximum weight capacities. Most of the 20-foot boxes still have the old ISO rating of 44,800 lbs; this can be seen by the fact that 65 percent of the export 20-foot boxes are within the 20 to 25 ton weight category. It can also be seen that the export 40-foot boxes are loaded far heavier than the import ones. Both observations suggest that the freight being used to fill containers leaving Canada is heavy, dense, resource-based commodities. Other information not shown here confirms this.

To summarize, containerization is an important and rapidly growing component of the transportation system. The data suggests that, in the debate of future international container standards, Canada is relatively a small player. It would be difficult for Canada to adopt standards different than those used in other parts of the world, particularly those in the United States. Finally, the data suggests that international container traffic in Canada is characterized by lightly-loaded inbound shipments (consumer goods) and heavily-loaded outbound goods (resource-based goods).

4. POTENTIAL IMPACT OF LARGER OR HEAVIER CONTAINERS

PORTS: (4) In a worst case scenario, the introduction of larger containers would require the replacement of every spreader--the device on a crane or a loader that actually picks up the container--at every terminal in the country, the replacement of every chassis used to move the containers, and the complete rearrangement of the layout of every yard (wider aisles for the straddle cranes). Rough calculations suggest an expenditure of about $15 to $20 million. But this worst case scenario is not likely to happen. First, future containers will almost certainly retain the ISO lifting points meaning that, with some adjustments and perhaps some inconvenience, existing equipment can be used to handle larger containers. Second, given the investment in existing ships and 20 and 40-foot ISO boxes, there is no possibility that the switch to larger containers will occur at such a pace so as to require the complete re-design and re-equipping of a terminal.

A more likely scenario is that, as and when the introduction of larger containers appears imminent, terminals will gradually replace their existing equipment with larger spreaders and longer container chassis, both of which are already on the market. In fact, this "gradual" approach has been a characteristic of the introduction of the new 45-foot containers by American lines. It is true that there will be a necessity to mark off some part of the terminal for the storage and handling of these new containers--the new widths cannot be mixed with the old ISO boxes—and it is also true that the introduction of a new size may impair the productivity of the terminals--handling more sizes with cranes and lifting equipment possibly operating at slower speeds slows things down. But these disadvantages would be not different than those faced by any other terminal in North America. The one

potentially troublesome factor is that smaller terminals (meaning Canadian) are not as capable of spreading the costs of new investment over large volumes of containers.

To summarize, aside from some matters of adjustment, there are no insurmountable, or even really difficult problems that a terminal would face if a new ISO standard for larger containers were adopted. As for heavier 20-foot containers, the assumption is that, as the existing equipment handles 30.48-tonne 40-foot boxes, there would be no problem handling 30-tonne 20-foot boxes.

RAILWAYS Both CN and CP Rail have large intermodal operations as the figures in Table 1 show. The constantly changing regulations governing truck weight and dimension regulations, and now the possible changing standards for containers, create problems for the railways. The most serious one is that railcars are made obsolete before being fully depreciated. This has influenced both company's choices for new intermodal equipment as the cars selected are quite flexible in terms of the box sizes that can be handled.

Of the current CN Rail fleet of 4,090 cars, 270 of those used for piggyback service could be used to handle trailers of up to 53 feet in length (and, obviously, containers on chassis of this length), and 400 of the cars used for containers could be used to handle containers of lengths in the range of 48 to 49 feet. Other equipment could also be used to handle longer trailers and/or containers, but not as efficiently. The most recent equipment, which is just being acquired now, is 100 new 5-paks (ie, five platforms more-or-less permanently attached). The 500 platforms ("wells") on these cars have a length of 49' 3" and, in double-stack use, could carry containers of up to 57 feet in the upper position (no one is actually anticipating such a container). CN plans to introduce its own domestic container service with boxes probably having dimensions of 2.6 by 2.9 by 14.6 metres--slightly wider than 102" and slightly higher than 9.5' and about 48' in length, although the final decision on length may be left open until after an ISO decision is known.

CP Rail developed its own domestic container service in 1979 using containers with a length of 44' 3" and a width of 102 inches. These were optimal for the railcars then in use and for the regulations then governing over-the-road movements. Recently, CP Rail has started a 48-foot domestic container service: they now have 100 such containers and are in the process of acquiring a further 50. All of these retain the ISO lifting points. As a consequence, as long as any new ISO containers also retain the existing lifting points, most of CP Rail's lifting equipment is capable of handling it: 37 of their 46 lifting machines can handle containers longer than 40 feet. Some of the older flatcars could handle new, longer containers, although the expectations are that it would be the new spine cars (five platforms) that would be used. These can handle containers with a length of 14.8 metres (48' 6-7/8") and even containers of up to 49 feet, although they would have to be alternated with shorter containers.

It is evident, then, that while the railways would have to make some adjustments to handle larger international containers, there are no

major barriers standing in the way to their introduction. The possibility of handling heavier 20-foot containers has not been discussed with the railways. It is understood, though, that some of their equipment can handle such containers. (5)

TRUCKERS Trucks can handle any container being contemplated by the ISO or others. Chassis capable of handling any of these containers are available on the market at a cost of $10,000 to $20,000. Some of the chassis can even accommodate a variety of lengths and/or widths. Other than truck weight and dimension regulations, which are considered next, there are no significant impacts on the trucking industry if larger or heavier container standards are adopted.

HIGHWAYS ISO containers can be handled by trucks meeting RTAC weight and dimension regulations as long as the correct equipment is used and as long as the container is placed correctly on the trailer. These two qualifications concerning equipment and placement are important. In terms of weight, the following are representative of typical tractor and trailer tare weights and maximum ISO container weights. The difference between the two 40-foot chassis shown is one axle (ie, a 5-axle versus a 6-axle tractor-semitrailer):

	20-foot container	40-foot container	
tractor-trailer tare weight (kg)	11,492	11,790 -	12,998
ISO container, maximum (kg)	24,000	30,480	30,480
	35,492	42,270	43,478
RTAC tractor-semitrailer maximum GVW (kg) - 5-axle	39,500		
- 6-axle			46,500

One of the advantages a Canadian trucker has over an American is the generally higher axle-loads allowed: the national RTAC standards are 9.1 tonnes on a single axle, 17 tonnes on a tandem, and up to 24 tonnes on a tridem. Some provinces, notably Ontario and Quebec which account for much of the container traffic, allow considerably higher loads than these.

This is not to suggest that hauling containers is without problems. Hauling two heavy 20-foot containers is difficult under RTAC regulations. Two of the heaviest 20-foot containers weigh 48 tonnes, exceeding the capacity of any RTAC configuration and, even, most Ontario configurations given practical front-axle loads. (Ontario regulations allow the highest practical payload capacities for containers.) The proposed 30 tonne 20-foot container could be handled by the RTAC regulations with a tridem-axle chassis having a length of 33 feet. The container, however, has to be placed in the centre of the chassis to achieve the proper axle-load distribution. The RTAC A-train is not feasible because of the 16-tonne cap on the rear pup: the maximum payload is about 12 tonne and there are few 20-foot containers as light as this in Canada. The RTAC C-train, at the proposed 58.5 tonne, can handle two 20-foot containers with a combined weight of 43 tonnes. The RTAC B-train, depending on the specifications, has a

capability of between 41 to 46 tonnes. The problem with it, however, is the difficulty of unloading a container on the lead pup: most of the B-train lead pups cannot be backed up to a dock because of the fifth wheel (there are mechanisms that solve this problem).

Even considering a 24-tonne 20-foot container, it is possible to place such a container on some trailers in such a manner so as to overload an axle group and yet stay within the overall RTAC GVW limit. Another difficulty is the RTAC inter-axle spacing requirements. Current trailers used to handle 20-foot containers are typically in the range of 23 to 27-feet in length. With the shortest of these, there is about 3.35 metres between the last axle of the tractor and the first axle of the semitrailer. RTAC requirements are that there be 5.0 metres between the two sets of tandems. There is no comparable problem with the 40-foot containers in that the chassis used to haul these typically would have more than the 5.5 metres required under the RTAC regulations between the two sets of axle groups (5.0 m is required between two tandem-axle groups, 5.5 m is required between a tandem and a tridem axle group).

In terms of dimensions, the only apparent problem with any of the proposed new containers is any length that exceeds 14.65 metres as this is still the trailer-length limit in some provinces. However, and considering the information shown on Table 3, this does not appear to be a serious problem. There are several methods whereby a

Table 3 SEMITRAILER & CONTAINER LENGTH LIMITS IN CANADA

	14.65 m limit	14.65 m limit, but permits for longer available	14.65 m limit, but overhang provision	greater than 14.65 m
Newfoundland (a)	14.65			
Prince Edward Island		yes		
Nova Scotia		yes		
New Brunswick (b)			yes	
Quebec				15.5
Ontario (c)	14.65			
Manitoba (d)				16.2
Saskatchewan				16.2
Alberta				16.2
British Columbia				16.2
Yukon		yes		
Northwest Territories				no limit

a) Newfoundland is likely to amend its regulation if an ISO container up to 49' came into wide-spread use.
b) Current regulations allow an overhang of up to 1.8 m
c) Ontario intends to adopt the 16.2 m standard.
d) It is not known if 16.2 m is allowed in Winnipeg

container longer than 14.65 metres can be accommodated when the legal semitrailer length is only 14.65 metres: special permitting, that is, obtaining a permit that allows a truck to operate at something other than the standard regulations; and overhanging, that is, a provision in the regulations allowing a load to overhang the trailer. Table 3 shows the situation in all twelve jurisdictions as of November, 1989, taking into account pending changes and some situations where provinces—in their reply to a survey—suggest that a decision on acceptable lengths may be made in the future.

In terms of future containers, then, there is no major problem with either the anticipated maximum weights (30.48 t) or any of the lengths being considered (48' - 50').

5. THE MARKET FOR LARGER OR HEAVIER CONTAINERS

To understand whether or not there is a need for new container standards, three sources of data are examined: freight densities in current ISO containers, port data on tonnes per loaded TEU, and a distribution of the CN Rail container weights.

Current ISO 40-foot boxes cube out when loaded with freight having a density of less than (about) 350 to 400 kg/m^3, depending on the height of the box. General freight is in the range of 160 - 240 kg/m^3 (10 to 15 lbs/ft^3). On this basis alone, then, a case can be made that there is a demand for containers with more cube than the 68.0 - 76.5 cubic metres, depending on the height, available in ISO 40-foot containers. This is borne out by the rapid acceptance of 48-foot (and, presumably soon, 53-foot) semitrailers within the trucking industry—shippers benefit from the increased cubic capacity and the consequent reduction in transportation costs.

Second, consider the data from the three ports shown in Table 4. Although there are gaps, there is enough information to indicate that many ISO boxes are being used at weights below their maximum capacity. The typical ISO container payload capacity is about 21.5 tonnes for a new 20-foot container, about 18.0 tonnes for an old 20-foot container, and about 27.4 tonnes for a 40-foot container (or 13.7 tonnes per TEU). None of the averages on Table 4 approach these numbers.

With a TEU capacity of somewhere between 13.7 and 21.5 tonnes per TEU (depending on the mix of 20 and 40-foot containers), it can be seen that average loads are filling the cube of the box before the weight capacity. It can also be seen that there is a slight trend to lighter loads and more 40-foot boxes in Montreal and there is something approaching a trend in Vancouver to lighter inbound containers. Also, as shown by the data from Vancouver, outbound containers are considerably heavier than inbound ones. The explanation for this last point is simply that the freight used to fill containers out of Canada tends to be the heavier semi-manufactured or raw product versus the light consumer products being shipped into the country.

The third and last piece of data is the CN Rail data on Table 5 (some of the containers shown in the first category may be empty). As

Table 4 CONTAINER CARGO LOAD SIZES

	Halifax	Montreal		Vancouver (a)	
	tonnes per loaded TEU	tonnes per loaded TEU	40ft as % of total	tonnes/loaded TEU inbound	outbound
1975	9.85				
1976	9.76				
1977	9.81				
1978	10.36				
1979	9.50				
1980	9.60				
1981	9.46	11.76	23.8%		
1982	5.62	11.57	27.7		
1983	9.56	11.71	29.2		
1984	9.69	11.64	30.0	9.25	12.83
1985	9.65	11.50	32.5	8.65	12.66
1986	10.16	11.32	34.8	8.47	12.53
1987	9.99	11.27	36.9	8.33	12.60
1988	10.07	11.41	35.8	8.24	12.54

a) Excludes domestic containers; Vancouver is the only port where both tonnes and TEU can be separated on an inbound/outbound basis.

Table 5 CN RAIL CONTAINER WEIGHTS

	import containers		export containers	
	20'	40'	20'	40'
% distribution, weight less than:				
5 tons (4.54 t)	4.3	1.1	2.6	0.2
10 tons (9.07 t)	16.6	16.8	11.3	5.3
15 tons (13.61 t)	26.1	40.5	18.3	12.5
20 tons (18.14 t)	43.3	56.7	28.2	20.4
25 tons (22.68 t)	81.9	75.8	92.8	35.5
Calculated densities, containers with gross load less than: (a)	20' box lbs/ft^3	kg/m^3	40' box lbs/ft^3	kg/m^3
5 tons (4.54 t)	3.9	62.8	1.3	21.4
10 tons (9.07 t)	12.5	200.9	5.5	88.1
15 tons (13.61 t)	21.2	338.9	9.7	154.8
20 tons (18.14 t)	29.8	476.9	13.8	221.5
25 tons (22.68 t)	38.4	615.0	18.0	288.2

a) For a 20' box, calculations assume a tare of 4550 lbs (2.06 t) and a cube of 1160 ft^3 (32.9 m^3); for a 40' box, calculations assume a tare of 6800 lbs (3.08 t) and a cube of 2400 ft^3 (68.0 m^3).

shown, a large number of containers are loaded with freight of very low densities. The first five rows are simply a cumulative frequency distribution of the data from Table 2. The last five rows show calculated freight densities. Using assumptions about the tare weight and height of the containers, both cargo weight and cube can be calculated. For example, it can be shown that a 40-box, with a tare of 3.08 tonnes and a cube of 68.0 m^3, is carrying freight with a density of less than 88.1 kg/m^3 (an extremely low density of 5.5 lbs/ft^3) if it weighs less than 9.07 tonnes (10 tons).

To interpret the information in Table 5 (and using the more familiar Imperial units), consider that about 17 percent of all import containers weigh less than 10 tons; or, stated another way, about 17 percent of the 20-foot containers are moving freight with a density of less than 12.5 lbs/ft^3 and about 17 percent of import 40-foot boxes are moving freight with a density of less than 5.5 lbs/ft^3. To the extent any of these 40-foot boxes are 9.5' high, densities would be even lower than those calculated here. Over 40 percent of the import 40-foot boxes are moving freight with a density of less than 9.7 lbs/ft^3 and almost 57 percent are carrying freight with densities of less than 13.8 lbs/ft^3. There is a clear need for larger containers for freight moving into Canada. The need for these large boxes on outbound movements is less dramatic, but it is still there: 20 percent of the outbound 40-foot boxes are moving freight with densities of less than 13.8 lbs/ft^3.

In terms of the proposed new 30 tonne 20-foot container, the data also supports the contention that some Canadian shippers would benefit from such a box. Specifically, from Table 2 and other evidence that is not presented here, there is clear evidence that export containers—particularly the 20-foot containers—are loaded with commodities such as grains, petrochemical products, and even such things as potash. Some of these are clearly "backhaul" commodities (ie, the carrier is filling them up with anything to avoid an empty move). But the point is that many of these commodities "weigh-out" in the current ISO containers (fill the weight capacity of a container before filling the cube). In fact, if the CN Rail data (Table 2) is compared to the US study on container weights, it becomes clear that Canadian shippers fill export boxes with very heavy commodities. This can be seen in the following figures (the weight breaks used in sources are quite different and prevent precise comparisons):

	Canadian		American	
20' export:	72% over	18.14 tne	32% over	17.23 tne
20' import	57% "	18.14 "	41% "	17.23 "
40' export	65% "	22.68 "	68% "	19.96 "
40' import	24% "	22.68 "	59% "	19.96 "

The greatest difference shows up with the export 20-foot boxes where clearly the Canadian containers are far heavier than American ones.

To summarize, for both cube-out and weigh-out freight there is evidence to indicate that shippers would benefit from either larger or heavier containers. Since most of the costs of handling a container

are on a per-box basis, this makes the economies of handling either more cube or more weight quite attractive.

6. CONCLUDING OBSERVATIONS

Whether or not the ISO makes a decision on standards for large containers, Canada will be affected simply because of the proximity to the United States. Observers suggest that there are now between 16 to 30 thousand 45-foot containers in the United States, between 5 to 10 thousand 48-foot containers, and 600 53-foot containers. This development of large, non-ISO containers (along with other factors such as deregulation) may have the effect of diverting Canadian traffic to the US system, either the long-haul moves of overseas containers or, even, Canadian domestic traffic which is attracted south of the border because of the cheaper rates that have resulted from the use of large containers and double-stack trains. (6) Further, whatever the ISO does, it is clear that Canada will adapt to the use of large containers: both railway are developing their own domestic large container programs.

The future of heavier 20-foot containers is less clear. There does not appear to be any North American pressure for such boxes. Presumably, their introduction to Canada will have to await the decision of the ISO in Seoul in 1991.

The evidence suggests there is a need for both larger and heavier containers. This is particularly true for the import in the current 40-foot boxes of low-density consumer products and the export in current 20-foot boxes of dense resource-based commodities. The rapid development of 48 and 53-foot North American container service speaks to the need for larger containers for domestic freight. Larger or heavier containers will result in lower transportation costs--particularly where freight densities warrant the introduction of double-stack trains or large intermodal terminals (the economies of scale are large). Although the evidence for these economies have not been discussed in this paper, the evidence for them--at least for larger containers--is readily available from analysts of the American transportation system. A subsidiary of APL is now moving 270,000 annual loads of domestic freight in containers in the US Based on first-quarter data complied by the Association of American Railroads, it is anticipated that American railroads will handle in total 5 million TEUs, domestic and international, in 1989. Double-stack cars for containers now represent 25 percent of the total intermodal carrying capacity of US railways. The US representative at the recent meeting of the Inland Transport Committee in Geneva used these figures to describe domestic containerization: "If a full train of double-stack cars is operated, the linehaul costs can be reduced by forty per cent. However, because of the terminal and chassis requirements, total costs may be reduced by only 20 to 25 per cent." (7) **"Only"** a 20 to 25 percent reduction in total door-to-door transportation costs is a significant impact on the transportation system.

Finally, the evidence suggests that the Canadian transportation industry will have few problems adjusting. Container terminals, the

railways, truckers, and the regulations controlling highway weights and dimensions can all accommodate larger or heavier boxes. Admittedly, some equipment may have to be replaced before it is fully depreciated if the switch to large containers or heavier containers is rapid. But, particularly considering international freight, this rapid switch-over is unlikely.

NOTES

1. Nix, F.P., 1990, Potential Impact on Canada of Proposed New ISO Standards for Large International Freight Containers, CIGGT Report No. 89-15, Transport Canada TP #xxxx, TDC, Montreal. The TDC research was limited to the issue of larger containers as this is the subject being investigated by WG #4 of ISO TC 104. The RTAC paper examines the issue of container weights—particularly the proposed 30-tonne 20-foot container—and Canada's truck weight and dimension regulations. A preliminary version, with co-authors John Billing of the Ontario MoT and Al Clayton of the University of Manitoba, was presented at TRB in Washington, D.C., in January, 1990.

2. US Federal Highway Administration, 1989, "Analysis of Port Import/Export Reporting Service (PIERS) Data to Reveal Potentially Overweight Container Movements on America's Highways," Washington, D.C., Table 1-A.

3. Data for 1987 is from F. E. Phillips "Canadian Rails Handle De-regulation With Care," Containerization International, May 1988. Data for 1988 was supplied by the railways. It is possible that the 1987 and 1988 figures for CN Rail are not strictly comparable: the issue is whether the 1987 figures are just international TEUs or whether, as with the 1988 figures, they include domestic TEUs. In the case of CP Rail, domestic container movements are included with "trailers."

4. Information in this section is based on interviews with eight terminal operators and three port corporations conducted in the fall of 1989.

5. CN Rail's newest 5-pak cars can carry 168,000 lbs per well. Two 30-tonne 20-foot containers would have a combined weight of just over 132,000 lbs.

6. MacDonald, J.W., 1989, "Following the Tracks: A Challenge to Canadian Ports and Railways," Portus, pp 28 - 32.

7. "Economic Impact of Large Maritime Containers on the United States Domestic Transportation System," presented at the seminar of the Inland Transport Committee of the UN's Economic Commission for Europe held from Nov. 13-16, 1989 in Geneva.

TRANSPORT DEREGULATION: WHAT ARE THE UNIVERSAL TRUTHS?

Introduction

The past two decades have seen remarkable changes in the way that economic regulation has been viewed - see papers in Button and Swann (1989a). This has been particularly true in the context of transport. The long-standing tradition had been one of market intervention by government to regulate entry and/or price with the intent on the one hand of protecting consumers, third parties and those working in the industry together with, on the other hand, the achievement of social objectives such as service to remote communities and the integration of spatially disparate markets. With one or two notable exceptions (e.g. the deregulation of the UK trucking industry in 1968), the controls which had been built up from the nineteenth century and developed and rationalized in the inter-war period continued to dominate into the 1970s. From the mid-1970s economic liberalization has spread through transport markets with supplying industries being freed from price and entry constraints and privatization taking effect in many sectors.

The objective of this paper is to consider whether our experiences of deregulation reveal any common threads. In particular, whether they reveal any broad, universal indications of how underlying transport markets function; how management responds to new stimuli; the degree to which transport users and third parties really need protecting from the antics of supplying industries; and the nature of transition processes from regulation to liberalization. This is not just an issue of academic interest. Deregulation has been pursued at different rates in different countries and for different modes and there has clearly been something of a bandwagon effect in operation. Indeed, in many instances a demonstration effect is discernible in the debates surrounding reforms. Separation of the general effects from the contextual, therefore, seems important for on-going policy development. Ideally, in this context, one would seek to cover all modes in such an analysis, if for no other reason than that modal substitution can influence the behaviour of a particular sector, but pragmatism leads us to focus primarily on aviation in this short paper.

The paper initially provides a very cursory overview of the background to the regulation debates and the nature of the changes which have taken place. They are well documented elsewhere and are included here merely to set out the historic record of changes across countries and, in the case of the European Communities (EC), economic groupings. We then look at some of the problems of comparing experiences before attempting to tease out any similarities of experience and divergences. Finally, we seek to see exactly what we have learned about the general nature of the aviation market and the ways that actors involved in it perform when confronted with freer market entry and pricing environments.

Background to Aviation Deregulation

Aviation has changed remarkably in the post Second World War era. Technical advances in aircraft design and engines combined with improved navigation and air traffic control systems have expanded the range of services which can be offered, improved safety and reduced costs. In addition to this there have also been

significant changes to the way the sector has been regulated. In particular, the period since the mid-seventies has witnessed considerable liberalization of aviation markets and a reduction in government regulation and public ownership of airlines and associated infrastructure. This trend can be observed in most countries although the nature, speed and commitment to change has varied between them - e.g. see Barone, *et al.* (1986); Gillen *et al.* (1986) and Heaver (1990) for an account of the Canadian changes: Forsyth (1990); and Kirby (1981) for Australia: Button and Swann (1989b); McGowan and Seabright (1989); Pelksman (1986 and 1990); and Sorenson (1990) for European changes: Bailey *et al.* (1985); Keeler (1990); Levine (1987) and Morrison (1989) for US changes: UK Civil Aviation Authority (1988) for UK changes: and Doganis (1989) and Kasper (1988) for changes in the regulation of international aviation.[2]

The situation in the early 1990s is generally viewed as dramatically different to that prevailing only fifteen years earlier. At that time domestic aviation in most industrialized countries was highly regulated and was characterized (in general terms) by constraints on market entry, regulation of fares levels and, in many instances, public ownership of the airlines (e.g. under the 1946 Civil Aviation Act in the UK; the 1928 Civil Aeronautics Act in the USA; the 'Two-Airlines' policy initiated in Australia in the late 1940s; and the 1922 Aeronautics Act in Canada). International aviation was regulated via systems of bilateral agreements between countries established at governmental level. The International Air Transport Association (IATA) acts as a forum and serves a lubricating function in facilitating international agreement. Of course national systems differed, as did the rigidity of specific bilateral international arrangements operational at the time, but as a general observation it would be reasonable to describe aviation as a highly regulated industry. Indeed, Lissitzgen (1968) went as far as to contend that, '...probably no other worldwide economic activity of comparable magnitude is more thoroughly regulated, less free of official restraint and guidance than is world air transport'.

This pattern of regulation was not unique to aviation at that time and extended across most modes of public transport. Entry controls were almost universal in the road freight sector and the bus industry; and railways, with some exceptions such as Canada, were statutory, publicly owned, legal monopolies in most countries (see the case studies in Button and Swann, 1989a). Rate controls were also widespread in both passenger and freight transport and regulations over safety standards and operating practices were virtually universal. Of course, the details of these regulations, their interpretation by administrators and the commitment to their enforcement varied considerably between countries.

Outwardly the rationale for government regulation of transport industries and, at the extreme, the taking of them into public ownership, lay very much in the notion that this the best way to serve the public interest. How the public interest was defined varied both between modes and countries. In Canada, for instance, the regulation of long distance transport (aviation and the railroads) was seen as an essential ingredient of policies to introduce cohesion into a new, large and sparsely populated country (Heaver, 1990). In the UK and the USA regulation of long distance transport was seen as a way of containing potentially damaging levels of competition, in the case of road freight and to a lesser extent aviation, and limiting monopoly, in the case of the railways. Again, motivations were somewhat different in the majority of Continental European countries where transport is treated as an input into a wider social and economic system rather than as in the US and UK (and other countries favouring the so-called 'Anglo-Saxon Philosophy') where transport efficiency is seen more as an objective in its own right. State ownership and the regulated supply of heavily subsidised transport services to achieve regional, industrial and social objectives characterised these former countries.

As one may gather from the comments at the beginning, significant changes have occurred to these regulatory regimes in recent years. Looking at aviation, the

1978 Airline Deregulation Act effectively brought legislative deregulation in the USA, though *de facto* change had been set in motion some two years earlier; *de facto* liberalization began in the UK domestic aviation market in 1980; the Air Canada contract was ended in 1977 although really effective liberalization only came about after the passing of the 1988 National Transportation Act;[3] and the EC began liberalizing intra-member aviation services in the mid-1980s.[4] International aviation has generally become more liberal as the result of freer bilateral agreements - the US 'Open Skies' policy embedded in the International Air Transportation Competition Act 1977 being a cornerstone for this movement.

In part, these changes, and those experienced by other modes, have come about as a process of natural evolution as new modes of transport have emerged. In terms of surface transport, for example, the automobile, has altered the balance of importance between the transport modes. The newer forms of transport are less suited to regulation and, once allowed into the market place, the older established modes are at an inherent disadvantage if they have only limited control over their pricing, service level provision and long-term planning. In part liberalization has also been in response to developments on the demand side as personal travel demands and the demands of industry have changed. Rising incomes, increased leisure and new life-styles have both increased the diversity of the transport services demanded and brought into question the ability of regulators to be flexible enough to meet the fresh challenges. On the freight side, the nature of goods produced and the increased value-to-weight ratio has put a premium on service quality and reliability, rather than haulage costs, and these are more difficult components of the overall freight transport package for administrators to regulate for.

These are developments common to all industrial countries and, hence, it is not surprising that regulatory pressures have transcended national boundaries. In a sense these may be seen as long-term difficulties and frictions which would ultimately have led to some degree of retreat by regulators. Essentially, conditions had changed and the need for regulation had become outweighed by the need for the greater flexibility and dynamism which market forces engender. There has, in fact, however been a little more to it than this.

First, there was increasing evidence that in some sectors regulation, far from protecting the users of transport (or possibly third parties in the case of safety) was actually serving the interests of the transport industries themselves. A degree of 'regulatory capture' was perceived to have occurred - see Keeler (1990) and Morrison (1989) on US aviation. While in some instances this may have come about once regulation had been initiated, especially in circumstances where the supplying transport firms were the main source of data upon which regulators made on-going administrative decisions concerning fare levels, capacity provision, etc., if one looks back to the actual time much of the legislation was framed one can often observe a heavy involvement of incumbent transport undertakings implicitly, and in some cases openly, influencing the way controls were defined.[5]

Second, in some instances, liberalization came about as part of wider macroeconomic strategies. In the USA, for example, it occurred at a time of high inflation and the withdrawal of 'big government' was seen as a way of reducing the cost-push element in this process. In Canada, there were general knock-on effects from the liberalization of markets in the US leading to general measures of reform, of which those in transport were but an element, to stimulate the economy. In Europe, the move towards a 'Single European Market' by 1993 (European Communities Commission, 1985) as part of a wider economic integration process has called forth changes in transport policy especially with respect to trucking and aviation.

Finally, one might point to the intellectual changes which have occurred in economic and political thinking. As John Maynard Keynes once said, 'Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist... I am sure that the power of vested

interest is vastly exaggerated compared with the gradual encroachment of ideas'. In fact, the actual impact of such changes in thought can sometimes be equally exaggerated but they have, nevertheless, been important. In the context of reforms in UK transport policy and to a lesser extent the EC (Tucci, 1985), for instance, the notion of creating contestable markets, or at least markets approaching a contestable state, has been relevant although, as Kahn (1988) points out, such theoretical developments had little to do with changes in US domestic aviation policy.

The Transferability of Lessons - Relevance of the US Experience

Much has been written on the impact of transport, and in particular aviation, deregulation in the USA. This literature has formed a cornerstone of debate about both the desirability and nature of reforms which might be enacted elsewhere. It is, therefore, a useful bench-mark. It cannot but have affected, for instance, the attitudes of policy makers in Canada. It had an important impact in Australia and the decision to end the two airline policy. (Forsyth, 1990). There are, also, strong pressures for liberalizing European aviation, and supportive evidence from the experiences of the USA has been drawn upon to argue that, on balance, a liberalized market may prove more efficient. Since the latter is an on-going issue it is perhaps interesting to see just how the European aviation market differs from that of the US domestic market and how this may influence the outcome of regulatory change in the former - see also Pryke (1988 and 1990); Pelksman (1990); Button and Swann (1990); and Sawer (1987). These differences tend to indicate that liberalization in Europe may not produce an identical result to that experienced across the Atlantic and that simple emulation may be inappropriate. For example one can point to:-

- *Domestic/International Traffic Split.* The deregulated US market is domestic whereas that within Europe is predominantly international - some 80 per cent of European flights are cross-border. This means that the majority of European carriers are essentially international airlines. Aviation activities between states is, therefore, subject to bilateral agreements which are often of forms not found in the US prior to deregulation. Revenue pooling agreements have been, for example, quite usual on the major routes.

The creation of a Single Market within the EC by 1993 will still leave many European nations outside of the liberalization process[6] and even within the EC not all constraints are likely to be removed given the variety of economic, social and political objectives which underline nations' aviation policy. The changes in the US were sudden and uniform, those taking place in Europe are gradual and, to some extent, variable. For example, even before the recent developments within the EC there were piecemeal liberalizations of some bilateral agreements. Table 1, for instance, shows the situation with regard to the UK and other European states.

- *The Non-scheduled Market.* The internal structure of the European market differs significantly from that of the USA. Europe has a substantial charter market which did not exist on the same scale in the US prior to deregulation. Further, not only have non-scheduled operators the scope for relatively easy market entry, albeit with conditions attached, but many of them have relatively new fleets and have an established market image. Unlike the situation prevailing in the US until the mid-1970s, this means there are powerful countervailing forces in some markets already restraining the actions of scheduled operations. Indeed, McGowan and Seabright (1989) note the more 'innovative' pricing strategies of scheduled operators on routes where they co-exist with charter carriers. But there is also another way of looking at this. Charter services, although cheap, are less flexible and hence less useful for business travellers. Where markets are mainly for leisure travel these are dominated by charter carriers and in many cases no scheduled services are offered.[7] Deregulation here could permit a more efficient traffic mix to develop with lower costs and less stringent discount conditions. This could generate benefits of a type

not found in many US markets. One might add to this, that the existence of a pool of experienced airline operators, albeit in the charter market, may combat the advantages of 'economies of experience' enjoyed by incumbent scheduled airlines which seem to have limited effective market penetration in the USA (Baker and Platt, 1989).

Table 1 Liberalised UK bilaterals with other European countries

Country	*Liberalization of:-*		
	Route Access	*Capacity Constraint*	*Tariff Constraint*
Netherlands (1964)	Yes	Yes	No
Netherlands (1985)	Yes	Yes	Yes
Fed. Rep. of Germany	Yes	Yes	Limited
Luxembourg	Yes	Yes	Yes
Belgium	Yes	Yes	Yes
Switzerland	Yes	Yes	Limited
France	Limited	Limited	No
Spain	Limited	Limited	No
Italy	Limited	Limited	No

- *Market Size.* The size of the European market is significantly smaller than the domestic US market. The average route length in Europe is some 750 kilometres whereas in the USA it is 1300 kilometres. Taking the top 75 routes in Europe only 17 have a flight time of two hours or more and for ten of these the flight time is between two and two and a half hours (Pryke, 1988). US flights tend to be much longer and this is important. If flights are short then there is much less scope for hubbing because any time spent changing plane during a trip takes up a relatively large part of the overall journey time. In terms of market competition, it means that indirect flights in Europe, even if fares are lower, are seldom going to offer effective competition to direct services as has occurred in the US. Pryke (1988), for example, deploying a set of assumptions regarding levels of hubbing and demand, finds that while liberalization in Europe is likely to reduce the degree of monopolistic power over many routes (e.g. on short haul routes while single carrier supply will remain at about 48 per cent of services, the number of two carrier routes will fall from 32 per cent to about 25 per cent as multiple supply expands), the eventual outcome will fall short of the US situation (where only 38 per cent of routes have one supplier and 25 per cent have two suppliers).

The relative size of the European market is also reflected in the size of the European Communities' airlines. The merger of British Airways (doing 46.3 billion scheduled passenger-kilometres) and British Caledonian (doing 8.8 billion) in 1987 made it the largest European carrier in terms of passenger-kilometres done at the time and yet this must be set against the 106.7 billion passenger-kilometres of United Airlines and 91.3 billion of American Airlines not to mention the 213.3 billion of Aeroflot.

- *Production Costs.* Production costs are different in Europe to those which prevail in the US. While it is difficult to make direct comparisons, there is some general evidence (see Table 2) that scheduled airline costs are higher in Europe than in the USA - Barrett (1987); McGowan and Seabright (1989); Sawyers (1986). European airlines are confronted with some costs which are outside of their control and are higher than those encountered by their US counterparts. For example, IATA has estimated that landing fees in the US represent between 10 per cent and 30 per cent of the European level. But even allowing for this, some of the higher costs stem

from lower productivity rather than generally higher unit input prices. While deregulation in the US resulted in substantial reductions in labour costs (Morrison, 1989) and enhanced productivity, mainly brought about by wage reductions, labour shedding, changes in working practices, etc., it seems unlikely that the somewhat different attitude towards labour relations prevailing in most European countries would permit the same thing to happen there - or, at least, not so rapidly and dramatically.

• *Computer Reservation Systems.* The CRS systems in the USA are owned by the largest airlines (e.g. United with Apollo and American with Sabre) while in Europe each is owned by a consortium of airlines (e.g. Galileo is owned by British Airways, KLM and seven other airlines). They are, therefore, unlikely to be open to quite the same degree of potential exploitation as was found to have occurred after deregulation in the US (Levine, 1987). In particular, US owners are able to access to rivals' data bases while the European systems are designed to prevent such 'keyhole' activities. Recent moves by both the EC and ECAC have also resulted in legal codes of practice designed to prevent deliberate massaging of the information presented on the screen.

Table 2 Airline labour costs and productivity *(average per employee, 1987)*

	Labour costs ($'000)			
	Pilots/ co-pilots	*Other cockpit staff*	*Cabin crew*	*Productivity**
Eight US majors	92	40	28	1.6
BA/BCal (Britain)	65	48	19	1.1
Lufthansa (W Germany)	na	130	40	0.8
SAS (Scandinavia)	na	103	41	0.6
UTA (France)	164	119	45	0.8
Alitalia (Italy)	na	93	59	0.7
Iberia (Spain)	109	80	37	0.7

* Revenue passenger kilometres,millions
Source: McGowan and Seabright (1989)

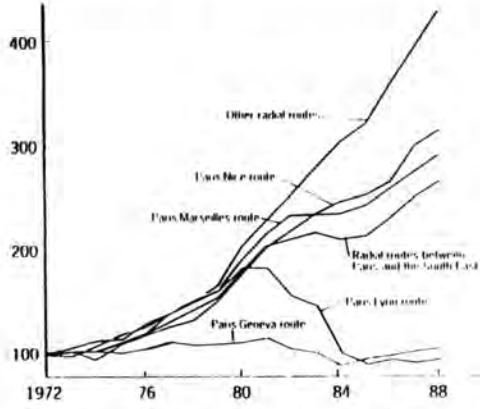
• *Ownership of Airlines.* While the US aviation industry is entirely in private hands, there is substantial, although very slowly contracting, public sector participation in the ownership of European airlines. For example, Air France, the largest European airline is 100 per cent government owned, as is Olympic, TAP, Aer Lingus, Iberia, Luxair, etc. with many other airlines having majority government holdings in them - e.g. Lufthansa (74 per cent), Alitalia (67 per cent) and KLM (37 per cent). In many countries there is a 'preferred vehicle', namely a dominant airline which is normally either partly or entirely publicly owned and is seen as the instrument for advancing national aviation policy. While several US carriers have gone bankrupt, public sector involvement inevitably affects the way an airline is treated and it is difficult to conceive of a government owned carrier being allowed to go bankrupt in a competitive European aviation market.

• *Inter-modal Competition.* There is substantial inter-modal competition in Europe over medium distances, especially from high-speed train services such as the French TGV system. The US rail system, save for some services on the North-East corridor, is essentially a freight system - less than 0.05 per cent of US passenger traffic is by rail. The situation is different in Europe. Some 13 per cent of passenger-kilometres done in the EC are by rail. This is because rail is heavily subsidized in many countries and, in addition, in many instances rail services can

compete with air on the basis of door-to-door journey time for trips up to 500 kilometres. The expansion of the high-speed rail network in Europe, the completion of the Channel Tunnel, etc. (Button, 1989) suggests that this competition will expand to more routes over the next decade. There is already evidence that the development of such services can affect air travel demand. The ability of high-speed trains to attract air passengers has been proven first in Japan at 240km/h then in France at 270km/h. In the latter case, for instance, Figure 1 shows the growth in demand for air travel on the main French domestic routes. The opening of the TGV rail service between Paris and Lyon has clearly contained air traffic growth on this route as has the Paris-Geneva service.

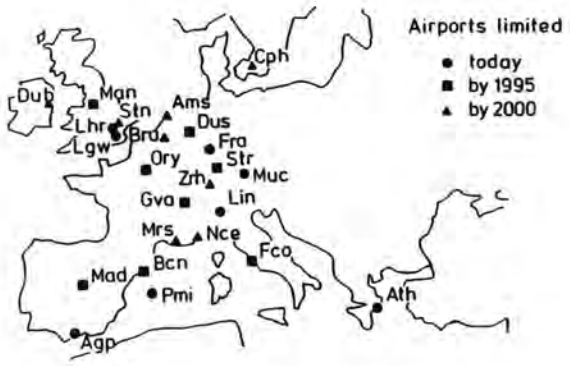
High quality roads in Europe, especially coupled with faster permitted driving speeds in many countries, also means that road passenger transport competes rather more effectively on some corridors than would be the case on comparable routes in the US. The gradual evolution of an EC infrastructure fund coupled with national investment programmes (albeit differing in scale between EC members) also means that the European road network will continue to develop in the future. This contrasts with the relatively small US road building programme.

Figure 1 **Air Travel on the Main French Routes (Index with 1972=100)**



• *Infrastructure Availability.* There were a number of major bottlenecks in the US air infrastructure system at the time of deregulation and the period immediately after it. These were associated mainly with airport capacity and the air traffic control system. As liberalization proceeds within Europe, however, the scales of the infrastructure constraints are more substantial and the mechanisms for dealing with them are more cumbersome. Capacity has already been reached at 10 of the largest 46 airports (see Figure 2) and being approached rapidly at another 16. The air traffic control system in Europe, unlike that for domestic US aviation, has traditionally been a national concern and is frequently heavily congested. There is co-ordination between the various Air Traffic Flow Management Units but many of the links are not direct and rely on telephone contact and the electronic systems used to monitor air traffic differ between countries. Additionally, the flight paths for air traffic in Europe, including those over the most densely trafficked areas, are constrained by the demands of military aviation. Since the quality of infrastructure is essentially only as good as its worst link, and there is no overall mechanism for automatically investing in new systems, it seems probable that Europe will suffer somewhat more from capacity constraints than has the USA.

Figure 2 **Airports at or Reaching Capacity in Europe**



• *The Advantage of Hindsight.* European policy makers already have the US experience to guide them and they are, therefore, likely to react against some of the perceived difficulties which have been encountered in the US. The Directorate General for Competition of the EC, for example, would seem to be fully aware of the potential problems airline mergers may cause under a more liberal regime and the latent market power which exists through flight code sharing and domination of CRS systems (Argyris, 1989). The implementation of policies to counter potential problems, however, will itself cause reaction amongst operators as they naturally seek some degree of shelter within the more competitive environment. Given the different institutional constraints confronting them, however the airlines may well behave differently to their US counterparts.

Some Comments on the Outcomes of Deregulation

While there are, therefore, a number of significant differences between the US and European situation from a policy perspective, the real question is whether these are important enough to mean that adoption of US style liberalization would result in an outcome for Europe which would be markedly different to that on the other side of the Atlantic. Since there has already been gradual reform of sorts in Europe, with further liberalization planned before 1993 (Button and Swann, 1990),[8] and the airlines are themselves seemingly anticipating freer markets in the 1990s,[9] one can glean some information about just how general the US outcome is.

If one looks at the US experience, then in the jargon of welfare economics there has been a noticeable improvement if measured by the Kaldor compensation criteria. The overall picture indicating that while there have been losers - especially in terms of business travellers seeking direct flights (Keeler, 1990) - these are more than offset by the benefits to those who have gained. Fares have fallen, flight choices have risen and safety standards do not seem to have diminished. While changes have been slower in Europe, the liberalization of bilateral agreements which have taken place to date have produced fare reductions and deeper discounting (McGowan and Seabright, 1989).

What is also apparent from the experiences of the US, Europe and, in an extreme way, Canada, is that in a liberalized aviation market there is a tendency for

airline ownership to become highly concentrated. In a sense this may be seen as a device to develop and subsequently protect market power. In the USA, for example, there was a period when the number of airlines grew quite rapidly peaking at 123 in 1984. Subsequently we have moved towards the era of, what Frank Lorenzo has termed, 'The Megaline Phase', as successive mergers and takeovers have reduced the number of truly independent carriers to 27.[10] A more extreme picture has emerged in Canada where there is effectively a duopoly.

Mergers in Europe have also taken place although, given the more extensive involvement of governments coupled with a degree of uncertainty about the attitude of the EC Competition Directorate, these have been less dramatic (IFAPA, 1988). Domestically, looking at major mergers, British Airways has taken over British Caledonian and more recently Air France has bought UTA and with it gained a majority share-holding in Air Inter to make it Europe's largest carrier (see Table 3). At the international level within Europe, the Netherlands' carrier KLM teamed up with British Airways to acquire a 20 per cent each stake in the Belgium carrier KLM. KLM also has a 14.9 per cent stake in Air UK. Air France and Lufthansa have operational agreements which include the formation of a joint East-West German carrier. More broadly, the Scandinavian carrier SAS has moved outside of Europe to acquire a 10 per cent equity holding in Texas Air and has made alliances with All Nipon Airways, Thai International, Lan-Chile and CAI. At a slightly different level, British Airways made an aborted attempt to purchase United Airlines but still has an integrated flight schedule with it.

Scale itself has not been seen as the primary motive for mergers and alliances in US aviation but rather scale tends to coincide with the ability of airlines to exploit fully economies of scope and density especially if it results in market domination of key hubs. Indeed, the increased hubbing which has occurred since 1978 in the USA is generally recognised, along with reduced labour costs, as one of the main contributors towards the real fare decrease from 4.4 cents per mile to 3.2 cents between 1976 and 1987 (Keeler, 1990). The long term danger that goes with this is that hub dominance can also lead to carriers exploiting their market position at such hubs.[11] In Europe hub dominance already exists (British Airways position at Heathrow, where there is an exclusion rule, and its control of Terminal 4 is a case in point) and allocation of slots etc. is based upon grandfather rights. The lack of market mechanisms to allocate slots at European airports gives incumbent carriers a natural advantage. Mergers, however, are less likely to be for reasons of acquiring airport control in Europe than in the US quite simply because both the EC Commission and most national governments tend to be stricter in their approach to hub domination.[12]

Table 3 Scheduled passengers carried by Western Europe's airlines (1988)

	Share of West European market '000s	%
Air France (with Air Inter)	**28,519**	**13**
British Airways	22,516	11
Lufthansa	17,791	8
Iberia	15,109	7
Alitalia	14,602	7
SAS	13,320	6
Swiss Air	7,087	3
Olympic Airways	6,660	3
KLM	6,219	3

Sources: ICAO, *Air Transport World*, *Economist* estimates.

While one can point to this similarity between the European situation and that in North America one or two caveats should be added. First, while the Department of Transportation (which was given responsibility to approve mergers after the enactment of the 1978 Airline Deregulation Act) has been rather passive until recently in terms of restraining airline merger activity,[13] the EC is particular has developed a more aggressive attitude towards takeovers and mergers. While in the past the system has essentially involved retrospective actions to force divestiture if mergers were felt to be leading to excessive market dominance, more recent actions have initiated proactive measures with potential mergers between large undertakings being brought before the Commission.[14] Further, at the national level some countries, such as the UK, have developed policies designed to prevent predatory behaviour within their domestic markets. The mergers which are taking place in Europe may, in consequence, result in higher levels of efficiency rather than market exploitation.

Second, aviation is an international industry and, as pointed out above, the European airlines are relatively small players. Linked with this, improvements in the productivity of European airlines has tended to lag behind that of deregulated US carriers (see Table 4). The result of this is concern that a more liberal international aviation market may become dominated by US airlines, indeed US airlines are already trying to develop international networks to maximize the economies of density and scope they can reap from their mainland hubs. Mergers may, therefore, be seen as important in developing genuinely global European carriers to compete with US airlines on an equal footing.

Finally, mergers within Europe may in the long-term help to erode the notion of national carriers and permit a more natural internal aviation market to develop initially within the EC but ultimately across the whole of Europe.

In other areas some of the experiences of the US are not so clearly visible in Europe. Frequent flyer programmes are, for example, extremely rare although some of the international carriers do have agreements to tie-in with North American airlines' schemes. One could explain this lack of intra-European programmes in terms of the possible actions of the EC Commission if a major carrier did try to initiate such a programme, especially given the differential tax regimes within the Communities whereby some countries would tax frequent flyer credits gained on business trips and others would not. Issues of national discrimination could arise in such circumstances. But equally, it could be added that the major European airlines have observed overseas experiences in these matters and seem to have reached a mutual conclusion that frequent flyer programmes essentially constitute a 'zero-sum game' and that the risks of entering are not worth the potential, and ultimately small, gains in market share.

Table 4 **Average annual percentage decline in unit costs and sources of unit costs for US and non-US carriers, pre- and post-deregulation**

	Pre-deregulation (1970-1975)		*Post-deregulation (1975-1983)*	
Sources	*USA*	*Non-USA*	*USA*	*Non-USA*
Productive efficiency				
Operating characteristics	1.6	3.3	2.2	2.4
Technical efficiency	1.4	1.2	1.1	0.4
Total productive efficiency	**3.0**	**4.5**	**3.3**	**2.8**

Source: Caves, D.W. *et al.* (1987).

Market Structures

Although we now have considerable experience of deregulated aviation markets in the USA there is still no real consensus on the natural market form for the sector. The development of contestability theory in the 1970s led many to believe - e.g. see Bailey and Panzar (1981) - that once entry to and exit from aviation markets was made ultra free then, because of the ease with which airlines can reallocate aircraft and adjust services at nominal cost, the full benefits of contestability could be reaped. Subsequent, retrospective, studies in the USA have thrown up rather conflicting stories of just how valid this perception has been - see Sinha (1986).[15] Certainly, the notion that one can make the aviation market perfectly contestable at a stroke now seem to have evaporated. Indeed, rather than looking at some utopian vision of how aviation might be supplied at maximum efficiency, the focus has switched first to whether deregulation has led to an improvement in the efficiency in the sector and second to whether there might be additional ways of tinkering with the system to improve things further.[16]

Notions of contestability were certainly influential in the early thinking about both the need for and, subsequently, the form liberalization in Europe should take. As a modelling framework for developing policies, however, the nature of the European market, with its national interests, airport capacity and air traffic constraints, and legacy of established routes and networks suggests that incumbents will ensure that free entry and exit is not possible. It also seems that workable competition, at least as defined by Keeler (1990) - viz that 'level of performance (which) can practically (be) achieved by the marketplace' - is a difficult bench-mark to work with given the problems of specifying the relevant counterfactuals needed before one can decide if a particular set of market institutions represents the best practical arrangement possible.

What does seem clear from what has happened in North America, and is gradually occurring in Europe and Australia, is that incumbent airlines naturally seek to manipulate whichever type of regulatory regime confronts them. By gaining control of complementary inputs (e.g. airports slots, CRS systems, etc.), acquiring competitors, forming alliances and constructing barriers to entry (e.g. frequent flier programmes) they seek to limit the powers of both actual and potential competition. Consequently, the deregulated aviation market behaves rather more like an oligopoly than any other market form. In these circumstances the issue becomes one of containing oligopoly power while at the same time ensuring that the maximum possible economies of scale, scope and density are enjoyed. In terms of overall resources allocation, which brings in all forms of economic activity including that outside of the transport sector, there is much to be said for uniformity of control and regulation. The development and implementation of common anti-trust and mergers policies are, therefore, a more rational way of dealing with the general problems of market exploitation than is the use of specific aviation based regulation. The difficulty encountered, and still to be resolved in doing this, is the criteria upon which to refer company actions or mergers for assessment - predatory pricing being a particularly difficult practice to clearly define in this context.

One can perhaps see here one of the major advantages of recent EC policy which has, in part for practical reasons, only slowly unwound. It has enabled the legislators to review what has happened elsewhere where there have been almost revolutionary changes in policy, and to seek general policy solutions covering both air transport specific issues (such as the EC code of conduct with regard to CRS displays) and broader industrial matters (such as the criteria upon which mergers are evaluated).

Conclusions

There are clearly and discernible cycles (or some might say 'fashions') with regard to the way transport regulation is viewed. Bandwagon effects are pronounced. The issue then is really one of deciding how sensible it is for everyone to follow these cycles and to what extent there is a need for local variation and adaption. While economic theory provides useful guidelines, the theory is itself based upon assumptions regarding behaviour and constraints which in reality may differ with circumstance. In the case of regulating transport the issue then becomes one of deciding to what degree the outcome of change in one country is of general applicability and to what extent is it peculiar.

It seems unlikely that the recent spate of market liberalization of transport supply will be reversed in the near future - indeed at the international level the trend is a continuing one. What we observe from our experience to date is that there are certain underlying features of transport markets - or at least aviation markets - but that these must be tempered both by the geographical and other technical influences on supply and demand, and by the ultimate set of institutional constraints which control the market. On this latter point, while one frequently uses the term 'deregulated' markets such markets never exist. All transport markets are subjected to a variety of regulations, be they of a social kind, over land use matters, or as part of general industrial policy. The important issue is, therefore, the nature and intensity of the regulations which fit into these portfolios of policy instruments. It would seem that it is important that a degree of fine tuning is necessary to meet the needs of local conditions and aspirations.

Endnotes

1 We tend to use the terms 'deregulation', 'liberalization' and 'regulatory reform' interchangeably. In fact, the European convention is to speak in terms of regulatory reform, since in many instances social regulations have often been reinforced as economic regulations have been relaxed and also, in some case, privatization has been accompanied by new economic regulations. The North American convention seems to be to talk of deregulation even if some regulations still remain.

2 A useful bibliography of the literature on airline regulation and deregulation is contained in Stanbury and Tretheway (1986).

3 Although services in the northern part of the country remain regulated.

4 Interestingly, much of the change has been forced on the governments of member states by actions of outside parties (especially the Nouvelles Frontieres Case) and by the Communities' civil service (see Button and Swann, 1989 and 1990).

5 For instance the Salter Conference which drew up the proposals leading to the regulation of entry to the UK trucking industry was composed of railwaymen and incumbent,trucking operators.

6 There are, for example, current 12 members of the EC but there are 22 members of the European Civil Aviation Commission (ECAC).

7 Of the 51 most significant city-pair routes on which there was charter traffic from the UK in 1987, 23 had no scheduled traffic. On the remaining 28 routes only 23 per cent of traffic was scheduled.

8 Changes in EC aviation policy have in effect progressed to allow automatic freedom rights within the Communities, removal of national discrimination in allocating licences, the banning of capacity sharing agreements, and the phased introduction of fare setting freedom, providing both countries do not object, but controls over cabotage, pilots qualifications, etc. remain (see Button and Swann, 1990).

9 The situation in Canada and Australia may be thought to be somewhat different because of the geographical nature of the markets involved. In particular, the linear market in southern Canada and the population distribution along it may have contributed to the duopoly which has emerged (Heaver, 1990).

10 This concentration should, however, be compared with the pre-deregulation situation. In 1972 the top four carriers accounted for about 60 per cent of the revenue passenger-kilometres and the top eight for about 85 per cent. The associated Herfindahl-Hirschman Index (H-HI) was 1205. In 1988, the H-HI was 1120 with the top for carriers accounting for about 58 per cent of the passenger-kilometres and the top eight for 88 per cent (see Breyer's discussion in McGowan and Seabright, 1989). However, if one looks at the welfare effects of the particular mergers which have occurred in the USA the evidence seems to suggest that about half of them increased welfare and the remainder decreased it (Morrison and Winston, 1989). No comparable studies have yet been attempted for Europe.

11 It has been estimated, for example, by Bailey *et al.* (1985), that an airline with 50 per cent of the departures from a hub can charge 7 per cent higher fares than one with only 25 per cent of the departures. But as Borenstein (1989), in his study of hub dominance, points out, 'Though the link between airport dominance and high fares seems clear, a welfare analysis of increased airport concentration must also include the benefits that may accrue from hub operations'.

12 For example, British Airways was forced to surrender some of its slots at Gatwick Airport as a condition of merging with British Caledonian.

13 Responsibility for acquisition policy passed from the CAB to the DOT for a transition period until 1989 when the Department of Justice took over responsibility. There has been a general disquiet in the US about the way the DOT approached issues of airline merger - see Hawk (1989).

14 In 1989 it was agreed that all mergers involving worldwide turnover of ECU 5 billion, falling to ECU 2 billion in 1992 would be examined. The takeover of UTA by Air France, for instance, was referred to the EC authorities in early 1990.

15 Indeed some of the early advocates of attempting to make aviation markets contestable seem to have subsequently revised their positions, e.g. 'We now believe that transportation by trucks, barges and even buses may be more contestable than air transportation...' (Baumol and Willig, 1986).

16 This, at the theoretical level, leads on to issues of whether and to what extent the market is imperfectly contestable (Morrison and Winston, 1987) or to the degree to which it might be deemed workably competitive (Keeler, 1990).

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A Comparative Analysis of the Economic Impact Studies at Canadian Airports

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1.0 Introduction

Airports generate substantial impacts, in terms of value added activity and employment for local and regional economies. In the past five years, Transport Canada has commissioned a series of studies to quantify these impacts at federally owned airports across Canada. Standard terms of reference were given to private consultants and university researchers to measure the beneficial effects of individual airports to the local and provincial economy. Now that a significant number of these studies have been completed there is an opportunity to undertake a cross sectional analysis of Canadian airports.

1.1 Purpose of Study

In 1987, the Government of Canada introduced a new policy to guide the operation and ownership of federal airports. These policy guidelines encourage "commercial orientation, potential contribution to economic development and responsiveness to local interests and concerns" for the administration of federal airports (Transport Canada, TP 8353). Transport Canada's economic impact studies are part of this effort to foster community appreciation of the airport's contribution to the local economy.

Economic impact studies, which are based on a single year, become quickly dated. Although each study includes a projection of future impacts, based on forecast passenger numbers, this provides only a crude guide for updating the impacts of the airports economic activities. Moreover, airports are likely subject to economies of size that may preclude simple linear extrapolations of their growth. This study investigates the feasibility of using regression analysis to estimate subsequent revisions and updates of the original base studies.

A secondary purpose of this paper is to examine some issues in the methodology of airport economic impact analysis and to test the consistency of the research studies that have been undertaken by different private contractors.

1.2 Study Objectives

This paper compares the economic activity and employment associated with 22 Canadian airports. In addition, exploratory research is undertaken to develop a regression equation to estimate the economic impacts of the airports. This equation tests the relationship between airport impacts and other readily available indicators of airport activity, such as passenger traffic, population, and community income.

2.0 Comparative Analysis of Economic Impact Studies

The economic impact studies carried out at Canadian airports have used a methodology similar to that described in Mazarolle and Bisson (1989). Primary data are collected through personal interviews and by surveys of airport-related organizations. These data are used to measure the significance of the airport in terms of employment, expenditure, revenues and capital investment effects.

Most studies report estimates for direct and total economic impacts. The direct economic impact refers to economic activities that depend on the airport for the majority of their revenues. These activities can be further grouped into primary and secondary economic activities related to the airport. The former are generally aviation-related and are located either on-site, or in the immediate vicinity of the airport. Primary linkage organizations include air carriers, general aviation, air support services and airport operation and administration.

Secondary linkage organizations are generally not aviation-related, but their business is derived primarily from airport-related activities. Organizations in this group include commercial, on-site retail establishments and ground transport companies. Some studies also include an estimate for the airport-related revenues of the tourist and hotel industries.

In addition to the direct economic impacts of the airport, indirect and induced impacts occur as a result of subsequent rounds of economic activity by airport-related firms and their employees. Indirect and induced economic impacts are measured by applying an appropriate multiplier to the direct economic impacts. The sum of the direct (primary and secondary), indirect and induced impacts is reported as the total economic impact.

A comparison of completed airport impact studies reveals some differences in the scope of economic activity that has been reported. Most studies provide direct and total measures of employment and revenues/expenditures on goods and services. Other measures that are reported include value-added, labour income and contributions to the local tax base. A

comparison of economic impacts among the specified airports, in terms of direct and total employment and revenue impacts is presented in Table 1.

The airports listed in Table 1 vary in size from Canada's largest international airport (Toronto) to the small regional airports in the Northwest Territories. Atlantic Canada and Quebec are under-represented in this sample, while western Canada is over-represented. Nevertheless, the wide selection of international, national and regional airports does provide a reasonable sample for the preliminary nature of this analysis.

A comparative analysis of the total impacts of economic activity at Canadian airports is difficult because the studies have not used economic multipliers that are derived from a common source. Comparisons of the direct employment and direct revenue impacts are found to be the more consistent measures of economic impacts in the studies. The only significant problem with the direct impacts is that some studies rely on a relatively small sample. Hence, there may be greater variance in estimates of direct impacts, but they are based on a consistent method of calculation. Consequently, the direct employment and revenue impacts are the principal focus of this analysis.

TABLE 1: SUMMARY OF AIRPORT ECONOMIC IMPACTS

Airports	Code	Direct Employment without Hotels	Direct Employment with Hotels	Total[1] Employment	Revenues Direct	Revenues Total
		(.....person years.....)			($ millions)	
Toronto	TO	29836	33785	55994	3855.3	NA
Vancouver	VA	11115	12615	28687	1312.0	2423.0
Calgary	CA	4840	NA	12366	580.8	681.9
Winnipeg	WI	4058	4993	9238[2]	406.9	NA
Edmonton	ED	1707	NA	6973	602.7	1600.0
Quebec City	QU	778	NA	1461	12.2	31.3
Thunder Bay	TB	480	887	1811	82.3	172.2
Prince George	PG	549	972	1376	30.9	57.0
London	LN	472	1051	2668	32.5	105.8
Yellowknife	YE	159	NA	273	33.0	87.6
Sydney	SY	143	NA	290	10.4	23.6
Kamloops	KA	150	NA	460	26.0	48.0
Fort St. John	FJ	124	NA	179	11.4	20.9
Whitehorse	WH	218	NA	314	23.7	43.4
Lethbridge	LE	111	261	549	36.7	104.1
Thompson	TH	282	374	733	24.6	NA
Grande Prairie	GP	125	NA	223	9.5	25.6
Fort McMurray	FM	179	NA	316	20.4	52.7
Inuvik	IN	71	NA	128	15.3	40.5
Churchill	CH	100	NA	326	6.9	17.1
Norman Wells	NW	46	NA	82	9.0	23.7
Fort Nelson	FN	44	NA	69	4.0	7.4

1 Includes indirect and induced impacts.

2 Includes CFB Winnipeg facilities located at the Winnipeg International Airport

2.1 Employment Impacts

Employment is defined in total person years of employment. Direct employment is reported as a sum of the full-time and full-time equivalents of part-time employment. Direct employment (excluding hotel employees), and total employment impacts as a ratio of annual passenger traffic are graphed for each airport in Figure 1. Differences between the direct and total employment impacts at these airports suggest two possible hypothesis. One hypothesis is

that the background economic activities vary greatly from airport to airport. Undoubtedly, variation in background activity could explain some differences in the ratio of direct to total employment impacts. The differences in Figure 1, however, appear excessive. For example, Calgary and Edmonton have similar economic environments, but great differences in the ratio of direct to total employment. Whereas Calgary has a greater direct employment than Edmonton, the total employment impacts per passenger are in the reverse order. The alternative hypothesis is that these differences illustrate the inaccuracies inherent in using economic multipliers to calculate "total" impacts.[1] Economic logic favours the alternative hypothesis.

Differences between airports in the direct employment per passenger suggest that airport operations experience economies of size. The airports in Figure 1 are arranged in order of passenger traffic. As the volume of traffic decreases, there is a general increase in the ratio of direct airport employment to annual passenger traffic. Toronto's Pearson International Airport has the greatest total direct employment, but one of the lowest ratios of employment per passenger. This may be explained by the need for a core of management and support services that is not directly related to airport size, and by the ability of larger airports to handle bigger aircraft.

Clearly, the economies of size are more complex than a simple ratio of passenger numbers. Some smaller regional airports, such as Sydney, have less direct employment per passenger than the international airports. Part of the explanation may be the location of non-passenger related activities, such as air freight operations, air line maintenance facilities and the flight crew bases that are stationed at the large international airports.

Air transport plays a vital role to link the remote communities. In Figure 2, the ratio of air passengers to local population is presented, with the airports arranged in order of decreasing passenger traffic. Some of the northern airports, such as Churchill, Yellowknife, Inuvik and Norman Wells serve as transportation hubs for passengers in their region. For example, passengers to and from Keewatin account for one-third of the Churchill's passenger traffic (Sypher-Mueller, 1989).

The annual number of air passengers per local population also reflects the competition that some airports experience from other nearby airports. London airport, which is described as living in the "shadow of the Toronto International" (Acres, 1988), has less than one air passenger per year for every citizen living in the City of London. In contrast, the Thunder Bay airport, which is remote from other major airports, has five air passengers per year for every person living in the community.



Figure 1

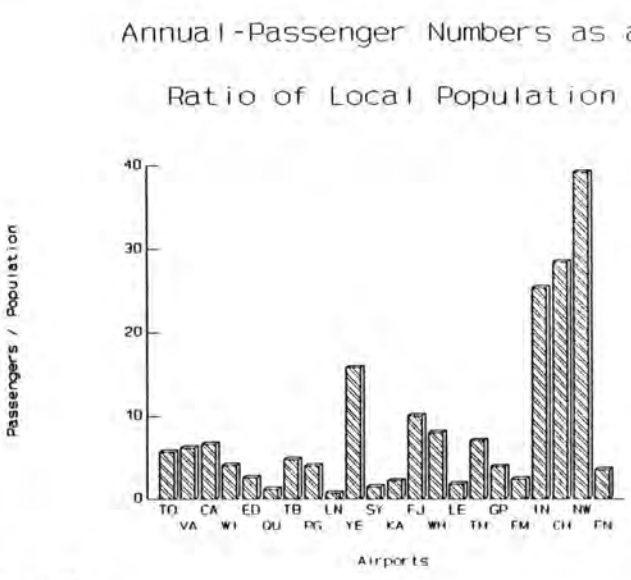


Figure 2

2.2 Revenue Impacts

Another measure of economic activity is the impact of the airport as a generator of revenues. The economic output or net revenues are determined by the total gross revenue from all airport related activity less any intermediate products. The values of the intermediate products are already implicitly included in the prices of the final goods. For example, fuel sales to the airlines are not usually included as an economic impact.

The value of the output from government organizations cannot be determined in the same manner as the output of commercial organizations. Government organizations such as Agriculture Canada, do not earn revenues from the services they provide (inspection of plants and animals at the international airports), but an economic output (incomes of the inspectors) does occur. Thus, the value of output of public organizations is assumed to equal their operating budgets. These amounts indicate, at market prices, the cost of the goods and services that they offer.

The total revenue impacts are not reported in some studies.[2] In view of this, only direct revenue impacts are used in this analysis.

2.3 Differences in Comparative Studies

A comparison of the economic impacts of the airports is constrained by problems of data inconsistency. The first problem is the lack of an identical time-frame for the data collection. More often than not, the availability of funds determined when the economic impact studies were undertaken. As a result, the data for the airport studies refer to different years, within a four year period.[3]

The second problem is the heterogenous methods of data reporting. Although the airport economic impact studies followed a standard general methodology, different measures of economic activity were used. For example, Toronto's Lester B. Pearson International Airport Study reports personal income, while most other studies use labour income as a measure of the income impact.

The third problem is the "discretionary" areas of economic impacts. The economic impact of the hotel sector is one of these 'grey' areas, that may be excluded at the discretion of the authors (Derek DeBiasio, 1989). Only seven of the 22 studies included hotels as part of the secondary economic impacts. As a result, however, the total impacts of these two groups (with hotels and without hotels) are not comparable because the economic multipliers are applied to different levels of activity.

Inconsistency in the use of economic multipliers to derive indirect and induced impacts is a fourth problem. It is unclear whether the economic impacts of an airport should be related solely to the community or region served by the airport, or whether a "provincial" impact is the appropriate measure.[4] Most studies actually calculate a provincial impact of their airports, while some studies developed their own "regional" multipliers (Jankowski, 1989). Consequently, the total employment and revenues are often not directly comparable among the studies even if they use the same definitions for economic activity (i.e., with or without hotels).

Differences in the approach and methodology limit the scope for incorporation of the data into a cross-sectional analysis. The problems with the "economic multipliers" make comparisons of the total impacts too suspect for serious analysis. The lack of uniformity in the definitions of income also eliminates this measure. What is left is the direct employment (excluding hotels) and direct revenue impacts, which are the focus of the next section.

3.0 Econometric Cross-Sectional Analysis of Airport Activity

In order to facilitate the updating of economic impacts, economic indicators were chosen that are readily available, such as the number of passengers that use the airport each year. The effort to test the relationship between the economic impacts measured by the individual studies and observable indicators has at least three uses. First, it provides an objective means of testing the accuracy of the economic studies and/or the methodology employed. If the results of an "outlier" cannot be explained by other economic considerations, there is a high probability that the problem lies with the methodology of the consulting study.

If an econometric equation can be developed that estimates impacts from observable data, it would be useful for updating the results of these airport studies during the 1990s. By the end of the decade, however, structural changes at the airports would likely require a new series of in-depth analyses to be commissioned.

A third use for an econometric estimate of economic impacts would be to facilitate planning. For example, an equation linked to passenger forecasting models, could assist the airport's to plan for such requirements as airport usage, commercial services, and to estimate airport payrolls.

3.1 Choice of Variables in the Equation

The direct economic impact of the airport is hypothesized to depend upon the level of passenger traffic at the airport, the city's economic "well-being", the location of airline maintenance bases, the size of the accommodation industry, and the competition from nearby airports. This information is displayed in Table 2.

The airport economic impact is expected to increase with passenger traffic. However, increased numbers of connecting passengers may not add significantly to the economic impact of the airport, because most of these passengers are merely transferring between air carriers at the airport. As a result, economies of size between passenger traffic, T, and direct employment (without hotels), DE, is likely to be a positive, but non-linear relationship.

TABLE 2: OBSERVABLE INDICATORS OF AIRPORT ACTIVITY

Airports	Code	Passenger Traffic	Population	House Prices	Hotel Rooms
Toronto	TO	20,267,400	3,537,000	247,961	23,440
Vancouver	VA	8,840,100	1,425,700	166,126	10,308
Calgary	CA	4,549,800	677,300	104,489	8,171
Winnipeg	WI	2,459,800	598,500	79,950	5,918
Edmonton	ED	2,072,400	784,500	83,325	8,362
Quebec City	QU	727,800	603,300	75,798	7,515
Thunder Bay	TB	591,900	122,400	83,284	1,867
Prince George	PG	275,400	67,600	58,101	1,331
London	LN	255,600	351,300	138,146	2,306
Yellowknife	YE	186,300	11,800	50,599	472
Sydney	SY	182,400	123,000	47,070	983
Kamloops	KA	138,400	61,700	65,287	1,794
Fort St. John	FJ	137,000	13,600	75,575	670
Whitehorse	WH	123,600	15,200	50,599	300
Lethbridge	LE	110,700	60,000	71,285	941
Thompson	TH	105,200	14,700	65,135	189
Grande Prairie	GP	103,300	26,000	60,706	1,029
Fort McMurray	FM	90,100	36,800	70,853	696
Inuvik	IN	76,100	3,000	50,599	188
Churchill	CH	34,100	1,200	65,135	125
Norman Wells	NW	27,400	700	50,599	56
Fort Nelson	FN	14,200	4,000	75,575	427

It is hypothesized that economic activity at the airport depends on the economic "well-being" of the city. Economic activity should be positively related to changes in the level of commerce and employment incomes. Statistics on Gross Domestic Product are only available on a provincial basis, and cannot be used in this study. As a proxy for economic "well-being", the average house price variable, G, is used. The average house price should rise/fall with the economic fortunes of the city because the benefits of locating in a particular city become capitalized into house prices.

Business activities and tourism are two prime reasons for air travel. Many of these air travellers will stay overnight in a hotel room, prior to making a return flight. Consequently, the number of hotel rooms in the city, H, should vary with the economic impact of the airport. This variable should have a positive coefficient.

Competition from other neighbouring airports is likely to be important when travellers are within reasonable driving distance. For the purposes of this analysis, a 150-mile radius was selected to be the relevant distance between airports. Competition is measured as the sum of passenger traffic at competing airports divided by the square of the distance that separates the two airports. The variable C is the sum of all competition from all neighbouring airports within reasonable driving distance (150 miles). The coefficient of this competition term is expected to be negative.

In order to account for the different characteristics of the individual airports, a dummy variable, D, is used to distinguish the airports with major airline maintenance bases. These airports are Toronto, Vancouver, Calgary, Winnipeg and Thompson[5], which will take the value of one, and D = 0 for all other airports.

For purposes of estimating the parameters of the model, a random disturbance term, e, is assumed to be normally distributed with mean 0, constant variance and be independent across all observations.

3.2 Description of Data

The majority of the economic impact studies were completed in 1989. Consequently, 1988 data were collected for the independent variables.

Annual enplaned and deplaned passenger traffic for individual airports were obtained from the air traffic forecasting division of Transport Canada. The average resale house prices were obtained from the annual statistical survey of the Canadian Real Estate Association (1989). The number of hotel rooms

were taken directly from the Accommodation and Tourism Guides for the individual cities.

The mix of airports in this sample may differ because of location as well as size. A second dummy variable was proposed that distinguishes airports located in the north (e.g. Churchill). The dummy variable takes the value of 0 for northern airports and 1 for all other airports.

3.3 Empirical Results

The estimating equation in terms of a direct employment used the data obtained from the twenty-two airport studies. The relationship is specified as:

$$DE = f \{ T , G , H , C , D1 , D2 , e \}$$

where DE is expressed in terms of person years of direct employment (without the hotel sector); T is passenger movements measured in millions of passengers; G is the average resale house price measured in thousands of dollars; H is the number of hotel rooms for each city; C is an index for competition from other airports; D1 is the dummy variable depicting the major airports with maintenance bases; D2 is the northern airport dummy; and finally, e is a random disturbance term.

The equation is estimated by ordinary least squares regression. Several functional forms of the model were tested (for example, semi-log, double-log and linear specification). The best fit was obtained with the double-log specification of the equation.[6]

The competition variable and the northern airport dummy were not statistically significant. This suggests that other variables, such as passenger numbers, sufficiently account for the effects of location on the direct employment at the airports. These variables were dropped from subsequent forms of the equation.

The results of the regression analysis is presented in Table 3.

TABLE 3: REGRESSION RESULTS: CROSS-SECTIONAL ANALYSIS OF ECONOMIC IMPACTS IN 22 CANADIAN AIRPORTS

	Employment		Revenue	Hotels
EQUATION:	(1)	(2)	(3)	(4)
DEPENDENT VARIABLE:	LEMP (Ln DE)	LEMP	LREV (Ln R)	LHOTEL (Ln H)
Constant	-9.541 [-5.8]*	-9.853 [-6.10]*	-10.830 [-4.02]*	-2.457 [2.27]*
Passenger Traffic (Ln T)	0.703 [10.04]*	0.724 [16.78]*	0.762 [5.46]*	0.760 [9.62]*
Wealth (Ln G)	0.564 [2.91]*	0.585 [3.26]*	0.436 [1.40]	--- [-]
Hotel Rooms (Ln H)	0.026 [0.32]	--- [-]	--- [-]	--- [-]
Dummy Variable (D1)	0.685 [4.55]*	0.656 [5.56]*	0.605 [1.32]	--- [-]
Adjusted R-SQUARED	0.968	0.970	0.878	0.795
Durbin-Watson	2.6	2.7	2.8	2.2
F-Statistic	159.9	225.1	51.3	82.5

Note: The t-values are reported in the square brackets. The robust correction procedures in TSP were used to correct the standard errors for heteroscedasticity. The t-values that are significant at the 95 percent level have an asterisk (*).

Equation 1 in Table 3 indicates that the coefficients of passenger traffic, wealth and the dummy variable are highly significant, but the hotel variable is not significant. The signs of the coefficients agree with our expectation given by economic theory. The variable for hotels is not significantly significant because of multicollinearity (the variable for passenger traffic).[7] Consequently, this variable was dropped in the estimation of Equation 2.

The standard errors of all the explanatory variables decreased considerably with the deletion of the hotel variable. All these variables

improved in statistical significance without much change in the coefficients of the variables from Equation 1. Consequently, the coefficients in Equation 2 are stable, which increases confidence in the estimates. The coefficients for passengers and wealth can be interpreted as long run elasticities. For a sustained one percent increase in passenger traffic, direct employment increases 0.72 percent. Similarly, a one percent increase in house prices (deflated to the 1988 base year) would lead to 0.86 percent increase in direct employment (excluding the hotel sector)

The actual and predicted direct employment based on Equation 2 are illustrated in Figure 3. This graph illustrates the closeness of the regression fit to the actual employment data.



Equation 3 in Table 3 is used to estimate direct revenues, with the same independent variables as in Equation 2. The only statistically significant variable is passenger traffic. The disappointing results obtained in this regression analysis may be explained in part by the ambiguity in defining direct revenue impacts that are exaggerated by the inclusion of airline ticket receipts.

Whalen and Roach (1989) note the problem associated with airline tickets, which make up a significant proportion of the total revenue impact at the airports.

> "Airline revenues which are available for a particular airport represent the revenue for the sale of tickets originating at the site, to their destination or point of transfer. It is not reasonable to assume that all this revenue is attributable to the point of origin. The airline is selling a service, transportation from origin to destination. What portion is attributable to the origin and what is attributable to the destinations? No easy solution exists" (Whalen and Roach, p.15).

The lack of a direct relationship between airline revenues and the economic impact of the airport can be illustrated by an example. The revenues that an airline would receive from a Winnipeg-London (England) ticket could be four times the revenues of a Winnipeg-London (Ontario) ticket, while the economic activity generated at the Winnipeg airport might be identical. Only the locally purchased inputs, such as the flight kitchens, fuel and travel agent commissions would have a direct impact on the local economy. Ironically, the economic impacts of these variables were explicitly excluded in virtually all studies in order to avoid "double-counting", that would exaggerate direct revenues. Clearly, the incorporation of air ticket sales as a revenue impact is conceptually flawed and results in a gross inflation of the actual economic impacts at the airport.

The fourth regression equation in Table 3 was used to test the relationship between hotel numbers and air passengers. The results of this equation indicate that the number of hotel rooms is affected significantly by the volume of air passengers.

While not iron-clad proof (both passengers and hotels could be simply a function of city size), it helps to clear away doubts about the incorporation of the hotel sector in the analysis. The above relationship suggests that, in order to estimate the economic activity of the airport, a portion of the accommodation-related employment and revenues from the airport-dependent hotels should be included. Futz et al (1989) present a methodology for including hotels as a secondary linkage of the direct impacts.

4.0 Conclusion

The series of economic impact studies that have been undertaken at federally-owned airports across Canada are a first attempt to obtain a comprehensive picture of the economic contribution that these "businesses"

make to Canadian society. Undoubtedly, these studies will be subject to mixed reviews. The lack of consistency in methodology and reporting make comparisons difficult. Moreover, many studies will likely be judged to have given an inflated estimate of the economic impacts, particulary of the "total" impacts.

Harsh criticism must be tempered, however, by the realities of conducting these studies. Much of the inconsistency is due to the "grey" areas and lack of consensus on what constitutes an impact and how some activities should be measured. It is also worth noting that the bias towards inflating the "economic impact" of an airport, is not inconsistent with the desires of the local community leaders. Civic pride has no doubt played a role in exaggerating the "total" impacts at some airports.

While many measures of "the economic impact" must be viewed as suspect, this study has found considerable consistency in the measures of direct employment. A cross-sectional econometric analysis of direct employment (without hotels) resulted in an estimating equation that is statistically significant.

The regression equation (Equation 2), which expresses economic impact in terms of direct employment (without hotels), provides a convenient means to predict the economic impacts for individual airports. Given that the information on the airport's passenger traffic levels and housing prices are readily available, this equation can help airport managers to update the economic activity at their airports during the 1990s.

This study also suggests two refinements in the methodology for future economic impact studies. By testing the relationship between hotels and passenger traffic, the question about the hotel sector as a 'grey' area have been cleared. The significant relationship between hotel numbers and passengers, suggests that hotel numbers should be included in the methodology used to quantify airport economic impacts.

The analysis of the revenue impact, on the other hand, suggests that the use of airline ticket sales as an economic impact at the airports is without logical foundation. The methodology of airport economic impact studies should be refined to exclude these revenues from the "local" impact, and instead, include all the intermediate purchases that are made by the airlines locally at the airport.

It appears that airport operations may be characterized by significant economies of size. This is an important finding that could shed light on the prospects for privatization that the Federal government has been considering. Complete privatization may be feasible for some larger airports, but is not likely to be an option for the smallest airports. Further research on the economies

of size may suggest an alternative policy that would link public support to passenger numbers at smaller airports. Such a policy might entail the partial privatization of the airport based on a continuing government grant that is inversely related to passenger traffic.

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1. Note for example, the relative direct and total impacts of the Toronto and London airports. This estimate of London airport's total impacts reflects only the impact on the surrounding region. These differences would have been twice as large if London airport's "total" impact on the Ontario economy had been used. Although it is possible that Toronto airport's total impact has been underestimated, it is more likely that the total impacts of the London airport have been grossly inflated by the consulting firm that undertook the study.

2. In the case of the Winnipeg and Thompson studies, the total value added contribution to the provincial GDP is used as a measure of the total impact of those airports.

3. The Vancouver International Airport Economic Impact Study was done in 1986, while most of the other studies were completed in 1989.

4. Mazarolle and Bisson imply the "local" impact is for municipalities bordering the airport, but provide no guide to "regional" impacts. None of the studies reviewed provide a justification for their definitions of the appropriate local or regional impact areas.

5. The maintenance and overhaul facilities of Calm Air are located at Thompson airport.

6. Using the logarithmic transformation of the data also helped to minimize the problem of heteroscedasticity which is inherent in most cross-sectional regression analysis.

7. When the variable for passenger traffic is dropped, hotel rooms becomes highly significant and has the correct sign. From a theoretical basis, however, the causal relationship between airport-related employment and passenger traffic is more acceptable.

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ESTIMATION OF OPTIMUM PRESSURE PATTERN (OPP) ROUTE SAVINGS RESULTING FROM THE IMPLEMENTATION OF THE CANADIAN AUTOMATED AIR TRAFFIC SYSTEM (CAATS)

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Introduction

The most efficient routing of aircraft is achieved through the use of **Optimum Pressure Pattern** (OPP) routes[1]. OPPs are random track routings that represent the most efficient combination of route, altitude and speed for winds and temperature conditions, load and other operational factors such that fuel will be efficiently used.

The existing Air Traffic Control (ATC) system is limited in its capabilities to permit aircraft to fly OPPs. The present flight data processing[2] infrastructure relies heavily on people preparing and distributing information physically. The primary means of controlling air traffic is with manual coordination, manual flight plan processing and the use of preset procedures and flight routes to minimize coordination requests. As a result, there is limited capability to allow flexibility in route selection, route amendment and altitude changes in flight.

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[1] It is recognized that commercial air carriers and private aircraft operators may not always use the same techniques to select flight plan routes; other variables which might be considered are the use of 'least-time tracks' (LTTs) and the difference in fuel prices between origin and destination.

[2] Activities involved in the acquisition, manipulation, display and distribution of all data pertaining to a flight in order to provide controllers with a strategic and tactical overview of the projected air traffic situation are known collectively as flight data processing. These tasks are performed by an infrastructure composed of personnel, rules and procedures, surveillance, communications and aeronautical information systems and subsystems.

Furthermore, the potential for improvement of the existing ATC system is limited. Although the implementation of the Radar Modernization Project will improve the efficiency of the system to a degree, it will not, for example, cater to aircraft outside radar coverage. Also, while the use of Area Navigation (RNAV) routes has increased over the past few years, their use is restricted in terms of altitude, hours of day, etc. Without the introduction of automated flight data processing capabilities the potential gains to be derived are minimal.

The existing flight data processing infrastructure will be fully modernized with the implementation of the Canadian Automated Air Traffic System (CAATS). CAATS will integrate all, and automate most, flight data processing and associated activities and systems. With CAATS, the ATC system has the potential to change from one based on an airway structure to one based on random routings.

With the introduction of CAATS, substantial benefits will result in the form of cost reductions and time savings to users through the use of OPPs[3], which are also referred to as random routes or user preferred trajectories.

This paper illustrates the methodology used to estimate OPP route savings and provides an estimate of the dollar value of such savings as compared to the costs of CAATS.

Methodology

OPP route savings are forecast over a 20 year period beginning in 1996 with the implementation of CAATS. The forecast of OPP route savings takes into account projected traffic growth, advancements in navigation, surveillance and communications technology as well as various other factors that were determined to influence the outcome of the analysis.

Briefly, the analysis undertaken represents a simulation of aircraft routings under two scenarios:

1) the continued use of the existing ATC system; and

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[3] It should be noted that OPP route savings are only one of the expected benefits of CAATS. Other user benefits include savings from the reduction in delays caused by existing sector capacity constraints. There are also significant efficiency improvements that will accrue to Transport Canada and other government departments with the implementation of CAATS.

2) the CAATS environment[4].

Under each scenario, estimates of fuel consumption, distance flown and time in flight were derived for a representative sample of flights. The difference in the fuel and time estimates between the "as flown" routes and the OPP routes constitutes the maximum savings that CAATS could generate.

The benefits to be derived from OPP route savings were based on this simulation exercise. They consist of fuel cost savings, other aircraft operating cost savings and passenger time savings.

All flights that cross Canadian controlled airspace[5], whether departing, arriving or simply transiting it, can potentially benefit from OPPs with the implementation of CAATS. However, the analysis is restricted to aircraft operating under Instrument Flight Rules (IFR) and excludes Transborder (Canada-U.S.) flights because of the short time during which they remain within Canadian controlled airspace.

The estimation of OPP benefits is based on a stratified random sample of flights. The sample was chosen using strata representative of all possible flying conditions within controlled airspace. Care also was taken to ensure that all classes of users were properly represented in the sample. In order to ensure this, separate samples were drawn for domestic commercial carrier operations, for general aviation users, and for international flights within Canadian controlled airspace (including flights arriving/departing in Canada as well as those overflying Canada).

Domestic commercial operations were estimated to comprise the largest - 53% - percentage of flights operated within IFR controlled airspace. Given this percentage, a significant effort has gone into the identification of characteristics which best differentiate flights within this user group.

Three key factors were chosen to stratify the domestic commercial sample:

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[4] The methodology used represents an approach that is similar to the one used by The Mitre Corporation to estimate user preferred trajectory (UPT) benefits for the U.S.'s Advanced Automation System (AAS). (see References)

[5] Includes domestic airspace as well as traffic controlled in the North Atlantic Oceanic Control Area.

1) stage length;

2) airspace complexity; and

3) terminal area complexity.

The use of stage length is important for two reasons. First, the potential for a direct route is greater the longer the flight, as are the resulting savings. Second, the required navigation equipment for the use of direct routes will vary with the length of haul; for example, on short-haul routes existing VOR/DME equipment may be sufficient.

The second factor, airspace complexity, is considered as the controllers' ability to grant OPPs would be affected by traffic and airspace complexity. Established routes have been created partly to assist controllers in routing complex traffic flows safely and efficiently. OPPs often consist of direct, off-airway routes. Such direct routes put aircraft in places where controllers may be unaccustomed to seeing them.

The third factor used to stratify airspace is terminal area complexity. Flights to/from the larger, more heavily used terminal areas can generally be expected to use ATC preferred routes to allow controllers to manage the heavier traffic flows safely.

A fourth factor, aircraft type, was also taken into account in the analysis as it will impact on both fuel consumption and aircraft speed.

International flights, including overflights but excluding transborder flights, were estimated to represent 12% of total IFR flights in Canadian controlled airspace and were classified according to eight streams of traffic found in the Official Airline Guide (OAG).

General Aviation traffic was estimated to comprise approximately 16% of total IFR flights within Canadian controlled airspace. General Aviation flights were represented in the sample as a number of randomly chosen flights from each flight information region.

Simulation Model

Distance, flight times and fuel consumed for each flight within the sample were estimated under two scenarios:

1) actual route flown; and

2) OPP routing possible under CAATS.

For the purpose of the simulation exercise, Lockheed Dataplan's Jetplan program was used. Jetplan is a computerized flight planning service used by over 600 U.S. domestic and foreign government agencies (including Transport Canada), a number of commercial airlines such as American Airlines, Japan Airlines, and over 300 corporate flight departments and most airplane manufacturers.

The inputs for the simulation of the sampled flights were taken from flight strips. The information required included the aircraft type, the speed, the origin and destination airport, the proposed departure time (or time entering/leaving Canadian airspace), the requested altitude and the routing. Aircraft weights were approximated using data from the flight strips and other relevant information.

All the inputs were then fed into Jetplan which simulated flights as they were flown and calculated the flight duration, the fuel consumed and the distance flown based on weather conditions of the sample day.

The program was then re-run to simulate the OPP route for each of the flights. It is important to note that the JETPLAN model is widely used today to plan actual flights. It therefore takes into account real aircraft performance specifications and right-way altitudes as conventionally used.

Estimates of fuel consumption, distance flown and time in flight for the actual routes flown represent the use of the actual ATC system. Estimates of fuel consumption, distance flown and time in flight for OPPs represent the optimized routings that would be available with CAATS. The differences between the "as flown" route and the OPP route in terms of fuel, distance or time constitute the maximum savings that CAATS could generate.

OPP benefits only apply to the enroute phase of flight. As such, fuel consumed, distance and time flown in the departure and approach phases were not considered as relevant to this estimation.

Estimates of Fuel and Time Savings

Fuel and time savings were derived from the results of the simulation exercise. **Figures 1** and **2** present the relative savings in fuel and time with the use of OPPs for the sampled flights. Around 50% of the sampled flights saved from 1% to 5% of fuel and time. Only 10.2% of flights had fuel savings greater than 5% and only 7.5% of the flights had time savings greater than 5%; savings of greater than 10% comprised slightly more than half of these totals.

FIGURE 1

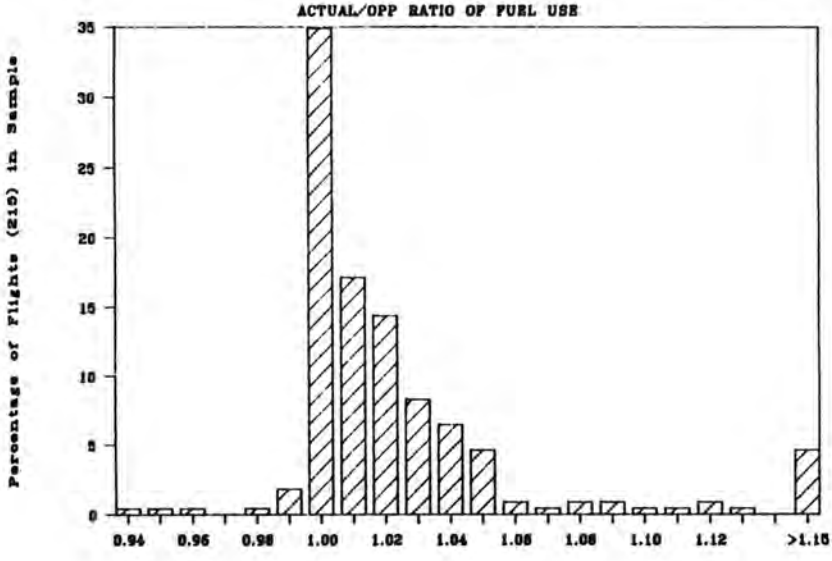


FIGURE 2

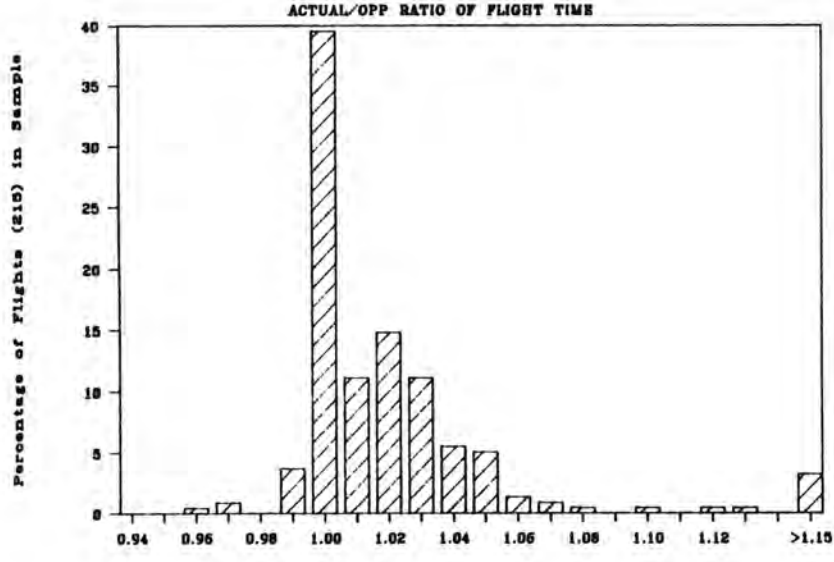


Table 1 shows the resulting fuel saving in percentage and time saving in minutes per flight that were subsequently extended to the relevant population. The results indicate, for example, that 2.31% of all fuel consumed in Canadian airspace on domestic commercial flights could be saved if all benefits from flying OPPs could be realized. Similarly, 1.64 minutes per flight of aircraft operating costs, other than fuel, and 1.64 minutes of passenger's time could be saved on all domestic commercial flights, and so on[6].

TABLE 1

SAVINGS PER FLIGHT FROM OPP ROUTES

	Fuel	Time (min.)
Domestic Commercial	2.31%	1.64
International	1.34%	5.48
General Aviation	2.42%	2.02

The percentage saving in fuel and time thus calculated are viewed as a maximum potential savings for the use of OPPs. However, various factors will affect the realization of such savings.

Factors Affecting the Use of OPP Routes

Notwithstanding the capabilities of CAATS, aircraft taking advantage of OPP routes will be limited to those which are equipped to accurately navigate along the desired flight paths within the coverage area of station-referenced navigation aids or within the limits of capability of self-contained navigation aids.

For short distances between adequately equipped ground locations, this would include almost all aircraft presently equipped to fly IFR, which includes all aircraft of the sample. For medium-and long-haul distances this would require more sophisticated avionics.

In the existing ATC system, a structured route system and large separation minima are required in areas where radar does not exist, position reports are infrequent and communications are indirect (Oceanic, Arctic and Northern control areas). To allow the use of random tracks, frequent

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[6] Domestic commercial results represent a weighted average, using distance flown figures, of all sample strata. International and General Aviation results are simple averages of all records in each category.

positional updates automatically displayed to the controllers and direct communications are required. This could be provided by an Automatic Dependent Surveillance (ADS) system coupled with satellite digital data link where no air-ground data link or terrestrial network exists. The ground deployment of ADS in Canada is expected to follow CAATS implementation in 1996.

Given these factors it was necessary to derive an equipage forecast to apply to the results of the simulation exercises to provide a realistic estimate of OPP savings. The following table summarizes the forecast percentage of flights expected to be able to take advantage of OPPs over the time frame of the analysis.

TABLE 2

PERCENTAGE OF FLIGHTS CAPABLE OF FLYING OPPs

	Domestic Commercial	International	General Aviation
1997	88%	15%*	72%
2006	92%	97%	80%
2016	100%	97%	98%

*Reflects the expected implementation of ADS, which is expected in the 1997-2000 period.

Just as potential OPP savings need to be adjusted to take into account the navigation environment, OPP savings should also be adjusted to account for limitations of the ATC system that would exist even with an automated system such as CAATS, i.e. the percent of fuel and time savings that CAATS can deliver.

In a similar study of the introduction of the AAS in the U.S., the Mitre Corporation reduced random routes savings by 40%. Considering the differences between the volume of traffic controlled in Canadian and U.S. airspace and the more limited use of OPPs possible within the Canadian system (already accounted for in equipage forecasts) it was decided to reduce OPP savings by a factor of 20%.

Deterioration of the Existing Flight Data Processing System

The existing ATC system will have to increasingly rely on procedural restrictions to permit controllers to handle safely and efficiently higher volumes of traffic in the future. More standard routes will be established and existing ones extended; more enroute restrictions also will be required to reduce coordination between controllers and to increase sector throughput. These effects were

considered inevitable without improved automation as traffic increases to the levels predicted in 2016 (a doubling of traffic).

OPP routes are compared with the "as flown" routes to determine OPP savings. As the existing ATC system deteriorates over the time span of this analysis "as flown" time in-flight and fuel burned can be expected to increase, thus making the OPP savings incrementally larger. Thus, "as flown" fuel and time estimates were increased beginning in 1989 at a linear rate to a maximum of 40% in 2016.

Valuation of OPP Routes Savings

Savings calculated for OPPs begin to accrue in 1996/97, with the implementation of Phase II of CAATS. Those user benefits gained by flying OPPs fall into three categories: fuel savings, other direct aircraft operating costs savings and passenger time savings.

Benefits are calculated independently for each of the three user groups: domestic commercial, international and general aviation.

Computations were based on fuel and time savings figures obtained for each user group in the sample and on movement, passenger and fuel use forecasts[7]. For all international flights, including overflights, only 50% of savings was attributed to CAATS, as only a percentage of the route would be flown in Canadian airspace. As noted earlier, all transborder flights were excluded from the analysis.

Of direct aircraft operating costs, only aircraft maintenance (material and supplies) costs have been included in this analysis since savings resulting from OPPs are insufficient to justify changes in labour schedules, reduce insurance fees, etc.

The time saved by flying OPP routes is also a benefit for the passengers of the aircraft. Each passenger was given a time saving equal to the average number of minutes saved per flight in the appropriate category. Time savings were valued using a figure of $20.00 per hour for passenger time, a figure based on average gross wage rates.

Table 3 provides detailed savings estimates in present value dollars for each cost category and each user group. These values take into account the factors previously outlined,

[7] Fuel forecasts were developed for this analysis. Movement and passenger forecasts were supplied by the Statistics and Forecasts (Air) Directorate of Transport Canada.

such as equipage forecasts, factors impinging upon the granting of OPP routes, and the deterioration of the existing system. All savings are shown in 1988 present value dollars using a 10% real social discount rate.

TABLE 3

USER BENEFITS DERIVED FROM OPPs
(1988 present value dollars-million)

User Group	Passenger Time	Fuel Costs	Aircraft Op. Costs	Total Savings
Domestic Comm.	63.9 (21.4%)	84.3 (28.2%)	9.4 (3.1%)	157.6 (52.8%)
Inter-national	94.1 (31.5%)	39.0 (13.1%)	3.7 (1.2%)	136.7 (45.8%)
General Aviation	1.3 (0.4%)	1.9 (0.6%)	1.0 (0.3%)	4.2 (1.4%)
Total	159.3 (53.3%)	125.2 (41.9%)	14.1 (4.7%)	298.6 (100%)

* Percentage of total benefits are shown in brackets. Totals may not add due to rounding.

The total estimated benefits derived from the use of OPPs amounts to $298.6 million (1988 present value dollars)[8]. Most of the benefits, $157.6-million, are generated by commercial domestic users. International flights benefit by $136.7 million and General Aviation by $4.2 million. Of the

[8] As noted in the introduction, the Radar Modernization Project will improve the efficiency of the ATC system to a degree in that it will permit the use of LTTs. The benefit-cost analysis for the Radar Modernization Project claimed benefits of $41.6-million (1988 present value dollars). This sum was subsequently subtracted from the value of CAATS OPP benefits cited in this report.

total, 53.3% are from passenger time savings, 41.9% are from fuel savings and 4.7% are from aircraft operating costs.

Sensitivity Analysis

In calculating the benefits from OPP routes, a number of assumptions had to be made. The results are also dependent upon traffic forecasts. A sensitivity analysis on all the key assumptions and forecasts was undertaken to evaluate the impact of a potential change of such factors on the benefits derived for OPP route savings. The Net Present Value (NPV) of OPP savings was found to vary between $138.9-million and $708.4-million (1988 present value dollars). A summary of results is presented in Table 4.

Although key variables/inputs were examined one at a time in the previous sensitivity analyses, they are not necessarily expected to vary independently of one another. Rather, groups of them should take alternative values to reflect particular events or phenomena. To test the robustness of obtained results, a variety of scenarios negatively affecting OPP benefits were analyzed.

If, for example, economic growth predictions underlying the various forecasts used in the analysis were proven to be overly optimistic, OPP savings would be best estimated using revised inputs; in this case, lower forecasts for traffic and aircraft equipage and higher ones for aviation fuel prices. Such a scenario would have yielded a NPV of $145.8-million (1988 present value dollars), a decrease of 51.2% when compared to the best estimate.

Taking a highly conservative approach to the computation of benefits (e.g. excluding overflights and time savings of less than 5 minutes, reducing the value of passenger time) would have lowered the NPV to $142.6-million (1988 present value dollars), a decrease of 52.2% from the best estimate.

While the impact of these scenarios, and others that were examined, reduces the NPV of OPP savings up to sixty percent, the figures remain significantly above zero.

Summary

The best estimate of OPP route savings resulting the implementation of CAATS is $298.6-million (1988 present value dollars). A detailed sensitivity analysis indicates that the results are very robust, and that in all circumstances analyzed OPP savings would be substantial.

The present value of OPP route savings equals approximately 75% of the incremental costs of CAATS. When these results are combined with other user benefits, efficiency improvements to Transport Canada and compared to the

TABLE 4

SUMMARY OF SENSITIVITY ANALYSIS RESULTS
(1988 present value dollars-million)

Best Estimate: 298.6

Positive Impact	NPV	% Change
Time and Fuel Saved: Upper Limit of Sample Mean	342.4	+14.7
High Traffic Forecasts	379.1	+27.0
5% Discount Rate	708.4	+137.2
$25 Value of Passenger Time	338.4	+13.3
Optimistic Aircraft Equipage Scenario	337.4	+13.0
Use of All Direct Operating Costs	380.0	+27.3
High Fuel Price Forecasts	327.6	+9.7
Negative Impact		
Time and Fuel Saved: Lower Limit of Sample Mean	254.8	-14.7
Low Traffic Forecasts	220.9	-26.0
15% Discount Rate	138.9	-53.5
$15 Value of Passenger Time	258.8	-13.3
Excluding Time Savings of Less than 5 Minutes	226.5	-24.1
Pessimistic Aircraft Equipage Scenario	179.2	-40.0
Low Fuel Price Forecasts	275.1	-7.9
Lower Fuel Consumption Due to Improved Aircraft Efficiency	289.7	-3.0

incremental costs of the project, it is evident that implementation of CAATS will result in a more efficient air transportation system.

While the beneficiaries of OPP route savings were identified as commercial air carriers, private aircraft operators and the travelling public, it should be noted that these users are not necessarily the final beneficiaries of the project; the value attached to the estimated OPP savings can also be seen as a measure of productivity increases in the Canadian economy as a whole.

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NORTHWESTERN ONTARIO LOG HAULING

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The forest industry is an important sector of Northern Ontario's economy. Transportation of raw material from the forests to processing mills is a vital link in this industry.

In 1988 the Ontario Ministry of Transportation conducted a study that examined the transportation of logs by owner operators to the various forest product companies located in Northwestern Ontario. This paper describes the study methodology, outlines operating conditions, analyzes owner operators' financial results, and examines the various factors which determine the financial success or failure of an owner operator's log hauling operation.

1. STUDY METHODOLOGY

1.a Sources of Information

The findings of the study were the result of a wide range of information sources.

To determine the commercial relationships which exist between the companies and the owner operators, and to obtain information with respect to loading and unloading procedures, rates and method of payment, interviews were conducted with representatives from the nine principal mills in Northwestern Ontario.

To gain first-hand knowledge of the physical operations that are directly related to log hauling, on site observations of various loading, load fastening, load checking, hauling, and unloading operations were made.

To verify reported equipment cost information, two tractor retailers and two trailer manufacturers were interviewed. Similarly, to verify reported variable cost information, Trimac Consulting Services was employed to develop a series of standard costs based on various operating scenarios.

* The views expressed are those of the authors and not necessarily those of the Ministry.

To ascertain the revenues that log haulers generate and to determine the costs associated with owning and operating a log hauling vehicle over various distances and terrains, interviews were conducted with 68 Northwestern Ontario owner operators whose primary business is log hauling. Interviews were conducted between January 1988 and June 1988. For thoroughness and consistency purposes, an eight page questionnaire was developed and completed by the interviewer during each interview. This procedure was deemed necessary because of the wide variety of ways in which owner operators interpret costs and maintain records.

Of the 68 interviews, only 54 yielded results which were usable. The remaining 14 were disregarded because the responses therein were either incomplete or distorted.

Despite the foregoing, the confidence level in the interview results remains very high because it was estimated that the 54 interviews represented over 10 percent of the owner operators in Northwestern Ontario.

Initially, it was intended that a significantly larger percentage of the carriers would be interviewed. However, even before the first series of interviews at the first location were completed, it became evident that the intended sample size was too large. This was evidenced by the fact that the responses to the questions became highly repetitive.

The ultimate result of this discovery was that interviews at each location were conducted only until a desired confidence level in data consistency was achieved. The number of interviews at each location is therefore not proportional to the volumes handled by the individual mills.

1.b. Confidentiality of Data

In order to protect the proprietary nature of the information presented in this report, the individual mills have been designated as Mills "A" through "H".

Furthermore, the letter designations were assigned randomly throughout the study. Therefore, Mill A on Table 1 may be Mill C on Table 2, Mill H on Figure 2, Mill G on Figure 4 and so on.

The provision of information in this manner accomplishes two objectives. First, it does protect Mill confidentiality, however, just as importantly, it facilitates not only the analysis of overall averages, but also the analysis of the range of results by individual mill.

1.c. Log Hauling Costing Model

With close to a hundred different sources of information, the interview stage of the study yielded voluminous amounts of data. To systematically process all of this data, a micro-computer costing model was developed. The major elements of the model are described in detail in the section of the paper dealing with financial results.

2. OPERATING CONDITIONS

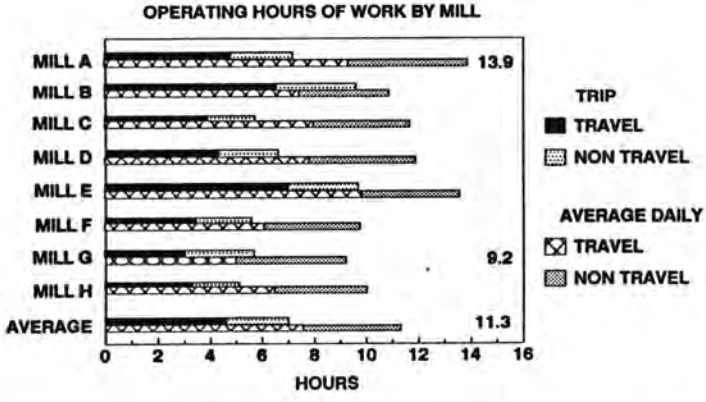
2.a. Hours of Work

Figure 1 illustrates owner operators' hours of work on both a trip and average daily basis broken down between travel and non-travel time.

The average round trip took 7.0 hours to complete and the average owner operator made 1.6 trips per day. The result was an average working day of 11.25 hours.

On an individual mill basis, the average daily hours of work ranged from a low of 9.2 hours to a high of 13.9 hours.

FIGURE 1



For purposes of this study, travel time is defined as the time owner operators spent driving their vehicles. In this study, the stated travel times are calculated functions of distances, road type and predetermined standard speeds for each road type. These calculated travel times were subsequently compared to the reported travel times and, in a vast majority of the cases, the calculated results very closely paralleled those reported by the owner operators.

With respect to non-travel time, the stated results are those reported by the individual owner operators. Non-travel time is defined as the time spent on inherent log hauling functions such as load fastening, load checking, loading, unloading, as well as loading delays and unloading delays.

These latter two "non-productive" functions were a very contentious issue with a significant number of owner operators in Northwestern Ontario. In some cases, owner operators indicated that they were routinely required to wait up to 3 hours a day to be unloaded. In others, they claimed that loading delays of 2 to 3 hours were not uncommon. In virtually all cases, the owner operators stated that they were not directly compensated for the delays.

Table 1 below reflects days and hours of work on an annual basis. Also shown are "reported" and "estimated" maintenance hours. Of the total time, maintenance made up 16.2% if "reported" hours were taken into consideration and 8.3% if "estimated" hours were used.

TABLE 1
ANNUAL HOURS OF WORK

Average Daily Trips	1.60
Average Annual Days Worked	198.8
Annual Operating Hours	2237
Annual Reported Maintenance Hours	433
Annual Estimated Maintenance Hours	203

The reason for the distinction between "reported" and "estimated" hours is the fact that owner operators do not keep maintenance hours of work records. Consequently, many simply guessed when asked how many hours per year they spent on maintaining their equipment.

"Estimated" maintenance hours in this study are an informal function of some of the more carefully thought out responses and of the standards that were provided by the consulting firm employed by the Ministry. In any case, owner operators put in a long day when one considers that the time spent on maintenance is over and above the time spent operating the equipment.

2.b. Kilometers Driven

Table 2 reflects the reported average number of kilometers that owner operators travel over various types of roads on a trip and daily basis.

TABLE 2
AVERAGE KMS DRIVEN

Road Type	Trip Kms	Aver. Daily Kms	Percent
Block	5.9	9.4	2.1%
Gravel	88.6	141.8	31.5%
Highway	179.6	287.6	63.7%
Urban	7.5	12.0	2.7%
Total	281.6	450.8	100.0%
Range	96.6 to 643.7	146.5 to 698.5	

All of the foregoing terms are more or less self explanatory except for the work "Block". "Block" is a word used in this study to define the last few kilometers of road into the bush. This is normally the worst section of road and one where the vehicles are likely to be driven in low gear. Depending on the owner operator and the company for which he hauls, this last stretch of road could also be referred to as a Branch Road, a Strip Road, Loop Road or quite simply a Bush Road.

Approximately one third of the total kilometers are driven over block and gravel roads. This is significant because these tertiary road conditions not only increase the variable costs associated with operating a vehicle but they also reduced speeds and thereby contribute to the formation of the owner operator's extended working day.

The average owner operator's speed was 60.6 kilometers per hour. Individually, average speeds ranged from a low of 40.9 kilometers per hour to a high of 73.9 kilometers per hour.

2.c. Reported Overloads

During the interview process, owner operators were asked to state how much wood they were currently hauling per trip and how much they would haul if standard highway weight limits were stringently enforced.

Although the overall average reported overload was 6.0%, on an individual mill basis, it ranged from a low of 2.2% to a high of 9.0%.

Individually, owner operators reported overloads of up to 26.8%. Ninety four percent of the owner operators interviewed "volunteered" to provide information with respect to load sizes. Of these, 78% implied that they routinely overloaded their vehicles.

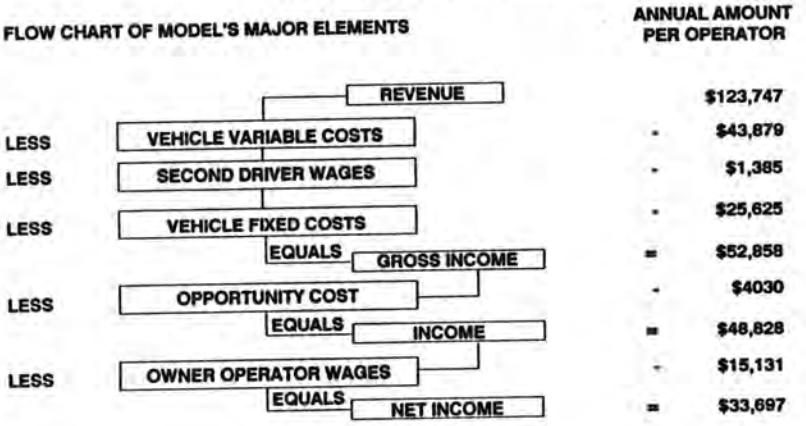
It is difficult to substantiate the accuracy of the foregoing statistics because in answering questions pertaining to load sizes, the owner operators were putting themselves into a perceived conflict of interest situation.

3. FINANCIAL RESULTS

Figure 2 below illustrates the major elements from within the model that were computed with respect to each individual owner operator. The "annual amounts per operator" shown in the right hand column are the average results of the 54 owner operators that were ultimately considered in this study.

FIGURE 2

LOG HAULING COSTING MODEL



3.1 Annual Revenue

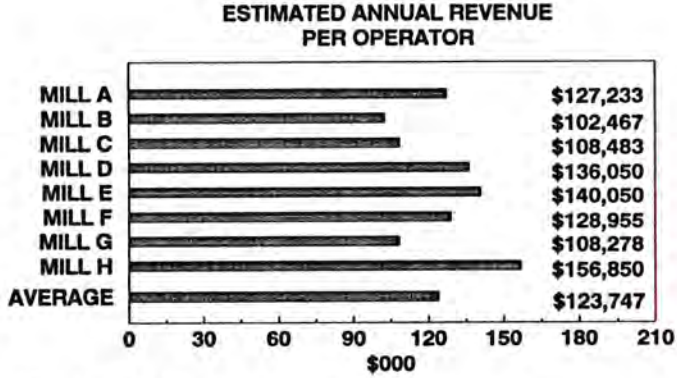
Annual revenue was calculated for each owner operator. This was accomplished by multiplying each reported legal payload by the rate paid for each specific trip. The results were subsequently multiplied by the reported number of trips that each operator made on an annual basis.

The foregoing procedure yielded annual revenue at reported legal weights. To arrive at actual annual revenues, the revenues at legal weights were adjusted upward by the percentage that each owner operator reportedly overloaded his vehicle.

The actual overall revenues calculated by the model in the foregoing manner were only 1.5 percent higher than the average revenues which were reported by the individual owner operators. This comparison serves to confirm that the revenues generated by the model were reasonably accurate.

Figure 3 illustrates these calculated annual revenues on a mill by mill basis. According to the model, the average owner operator in Northwestern Ontario generates $123,747 in annual revenue. Individually, annual revenues ranged from a low of $51,979 to a high of $192,096.

FIGURE 3



3.2 Variable Costs

With only a few minor exceptions, the variable costs used in the model were those which were derived from the owner operator-supplied information.

The average variable cost per kilometer is shown in Table 3. Fuel costs per kilometer were determined by calculating the function of the reported fuel consumption rate and the reported price of fuel per liter. Maintenance and tire costs on the other hand were determined by dividing the reported annual costs for each by the number of kilometers that the vehicles reportedly travelled each year.

TABLE 3
VEHICLE VARIABLE COST

Fuel	$0.251 per km
Maintenance	0.136
Tires	0.103
Total	0.490

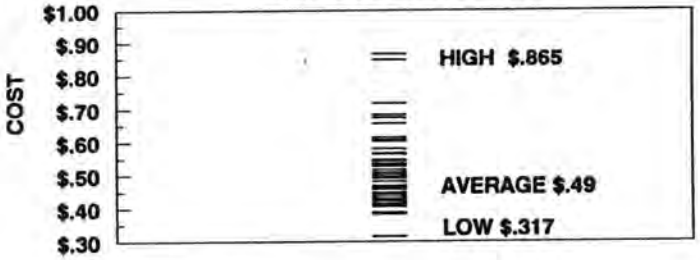
To determine variable costs on an annual basis, the owner operators' respective variable costs per kilometer were multiplied by the round trip distance between the mill and owner operators predominant point of origin and the number of trips the owner operator reportedly made per year. It should be noted if the predominant point of origin is used to calculate annual kms driven, it results in a figure 5.5% lower than the actual annual kms driven as reported by the owner operators.

Average reported variable costs fell within the high and low ranges of standard costs that were developed by Trimac. This is a firm indication that the average variable costs used in the analysis are reasonably accurate.

There was, however, quite a range in reported variable costs. In Figure 4, it can be seen that although the majority of the reported costs per km are around the average of $0.49 per km, the reported costs range from $0.317 to a high of $0.865. The extent to which owner operator costs are above or below the average will have a significant impact on earnings.

FIGURE 4

DISTRIBUTION OF REPORTED VARIABLE COST PER KM



3.3 Second Driver Wages

If a second driver was employed by an owner operator during the course of the year, the second driver's wages were deducted from the revenue that the vehicle generated. This was done in order to ensure that the gross income generated by the model represented the gross income for only one operator.

Second driver wages were not a significant cost factor, averaging only $1,385 per operator per year. A second driver was employed on a part-time basis, in 7.4% of the cases. In one instance, a second driver was employed on a full-time basis.

3.4 Fixed Costs

Fixed costs varied widely among owner operators. This was largely attributed to wide variations in the age of the equipment being operated and consequently to wide variations in its current and future value.

Table 4 reflects the averages as well as the individual fixed cost highs and lows that were encountered.

TABLE 4
ANNUAL VEHICLE FIXED COSTS PER OPERATOR

	Low	High	Average
Depreciation	$ 3,250	$22,150	$12,674
Interest	--	7,406	3,294
Licence	2,227	2,882	2,709
Insurance	1,352	6,500	3,550
Other	1,000	10,000	3,398
Total	$12,780	$41,619	$25,625*

* Average of Total

"Depreciation" was calculated on a straight line basis based upon the owner operator's reported equipment purchase price, his stated expectations with respect to equipment life and his estimated salvage value.

"Interest" costs were based upon the owner operator's stated loan amounts, the loan period and the reported interest rate.

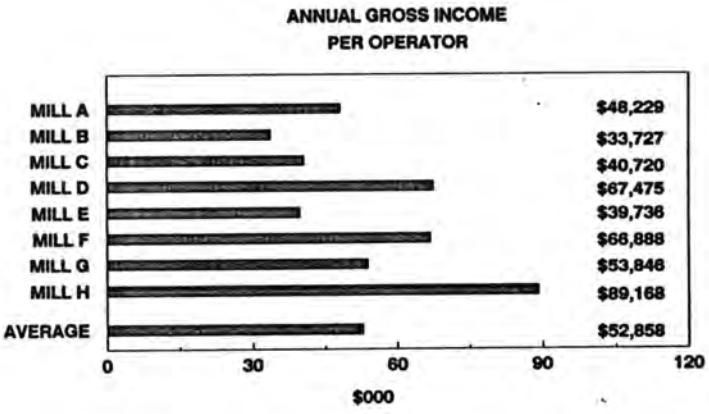
"Licence", "Insurance", and "Other" costs are those which were directly reported by the individual owner operators. Included in "Other" costs are items such as equipment cleaning, accounting expenses, tools, facility operating and facility depreciation costs.

3.5 GROSS INCOME

Gross income, as calculated by the model, probably best reflects what the individual owner operators would consider to be earnings.

Average annual gross income per operator, segregated by mill is reflected in Figure 5.

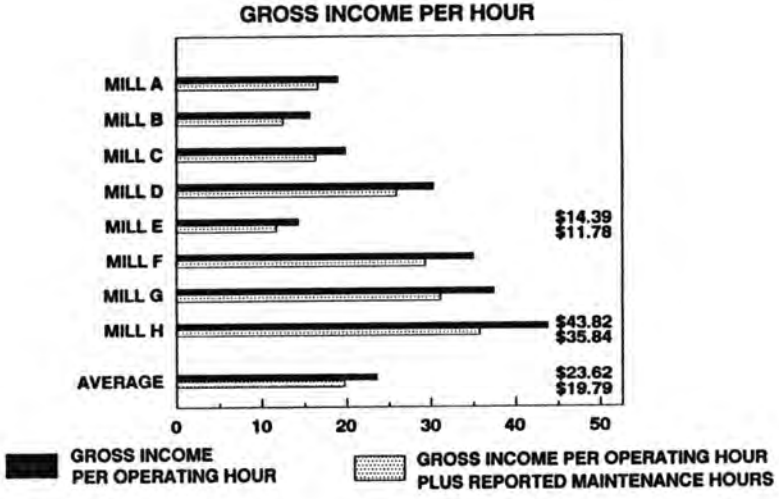
FIGURE 5



The average annual gross income was $52,858. When segregated by mill however, annual gross income varies considerably, ranging from a high of $89,168 to a low of only $33,727.

Figure 6 below reflects the models calculation of average gross income per operating and reported maintenance hour.

FIGURE 6



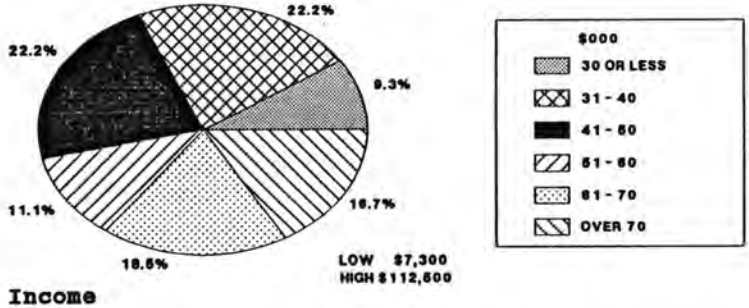
As shown in Figure 6, when operating time and reported maintenance time were taken into consideration, average owner operator earnings were $19.79 per hour. Again however, these results are tempered by the fact that there were wide variations in the hourly earnings, ranging from a high of $35.84 to a low of $11.78 per hour.

To obtain a clearer understanding of the overall gross income status of the owner operators in Northwestern Ontario, they were segregated into a number of individual gross income categories.

Figure 7 below graphically depicts the results and shows that over 90% of the owner operators who were interviewed generate a gross income that was in excess of $30,000 per year. Individually however, annual gross income ranged from a high of $112,541 to a low of only $7,324.

FIGURE 7

NUMBER OF OWNER OPERATORS SEGREGATED BY GROSS INCOME



3.6 Income

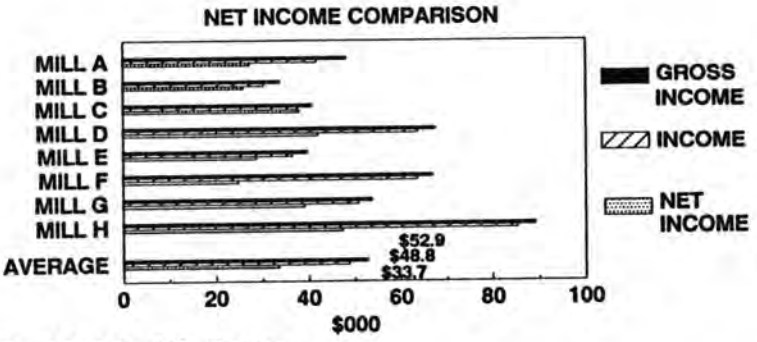
For lack of a more descriptive term, INCOME was selected to describe owner operator earnings after the deduction of opportunity costs. Although few if any owner operators actually take opportunity costs into consideration, they were taken into consideration in this study to facilitate a fair comparison of income. Thus, owner operators who paid cash or made large down payments on their equipment could be compared fairly to those who borrowed all their money or made only minimal down payments.

Opportunity costs were calculated by applying a 10% interest rate to the amounts of money that the owner operators made as down payments on their equipment.

Opportunity costs with respect to the owner operators who were interviewed for this study, ranged from a high of $13,400 to a low of $0.00. The average opportunity costs were $4,030.

Income segregated by mill is graphically depicted in Figure 8.

FIGURE 8



3.7 Annual Net Income

Annual net income describes the owner operator's income (prior to the deduction of income taxes,) but after the deduction of direct owner operator wages. Annual net income is graphically depicted in Figure 8 which shows that the annual average gross income of $52,858 drops to $48,828 when opportunity costs are taken into consideration and down to $33,697 when the owner operator's direct wages are considered.

Annual net income on an individual basis ranged from a loss of $9,259 to a high of $81,977.

Annual net income however, does not necessarily reflect an owner operators' take home earnings because in some cases, (43% of the time) owner operators are actually paid a wage by the mill. The mill deducts this expense from the revenue generated by the movement of the load and the owner operator (for accounting purposes) deducts this as an expense in his calculation of net income.

Nevertheless, calculation of annual net income was useful because it provided another test of the costing models accuracy. Only 26 owner operators specifically reported net income. For those who did, the costing model produced results that averaged $4,343 per year higher than those which were reported. This was a variance of 15.7 percent indicating that the model is over-estimating net earnings. This apparent overstatement of calculated earnings should be tempered with the knowledge that some owner operators provided less reliable information than others. Thus the overstatement of earnings may not be as significant as the analysis appears to indicate.

3.8 Owner Operator Company Driver Comparison

When a company driver's direct earnings were compared to an owner operator's direct earnings, it was found that earnings are generally comparable, provided that work schedules are alike, and an allowance is made for owner operators' investment risks. However, in some cases, owner operators are required to pay for their own fringe benefits. When this occurs, and the owner operator is responsible for vacation pay, statutory holidays, workmen's compensation, dental plans, health insurance, life insurance, long term disability etc. the owner operator will have a considerably lower disposable income than the company employee.

4. FACTORS AFFECTING GROSS INCOME

4.1 Impact of Weight Regulations

The often advanced theory that overloads are a direct result of depressed rate levels, quite simply cannot be substantiated. There is an incentive for owner operators to overload their vehicles regardless of the level of rates that are being paid. As a matter of fact, the higher the rate level is, the greater is the incremental incentive to overload.

Table 5 below, reflects the impact of overloading on owner operators' gross annual income.

INCOME OF OVERLOADING ON OWNER OPERATORS' ESTIMATED GROSS ANNUAL INCOME

LOCATION	AT LEGAL WEIGHT	6 % OVER-WEIGHT	10% OVER-WEIGHT
MILL A	$39,510	$48,229	$51,361
MILL B	24,773	33,727	34,125
MILL C	37,448	40,720	47,969
MILL D	58,530	67,475	71,241
MILL E	30,811	39,736	43,994
MILL F	60,781	66,888	73,067
MILL G	51,183	53,846	61,745
MILL H	81,645	89,168	96,577
AVERAGE	45,854	52,858	57,528

Average gross income increased from $45,854 per year at legal weight to $52,858 per year at 6% overweight and to $57,528 per year at 10% overweight. These were increases of 15.3% and 25.5% respectively.

It is important, however, to point out that increased wear and tear on equipment was not taken into consideration in the foregoing analysis.

To further illustrate the incentive that exists for owner operators to overload their vehicles, the incremental incentives for each overload percentage point were calculated. Figure 9 shows that for each percentage point that the owner operators overloaded their vehicles, they earned an additional $1,167 in net income per year. Again, the figures exclude incremental wear and tear on the vehicles.

FIGURE 9

ESTIMATED ANNUAL GROSS INCOME FOR EACH PERCENT OVERWEIGHT

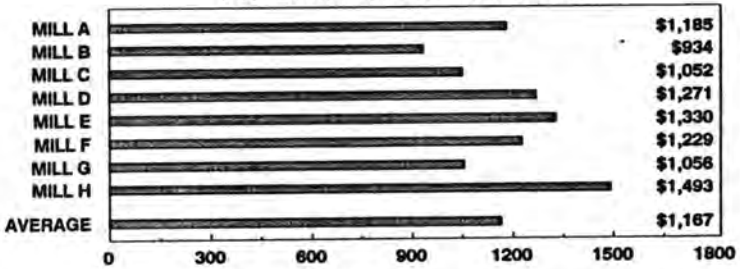
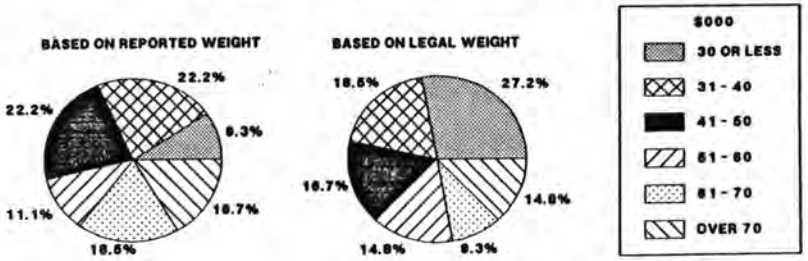


Figure 10 illustrates that a significant number of owner operators would earn less money if they were required to operate at legal weights. For example, based on reported payloads, 9.3% of the owner operators who were interviewed would have earned less than $30,000. That percentage would increase to 27.2% if they were forced to abandon overloading.

FIGURE 10

NUMBER OF OWNER OPERATORS SEGREGATED BY GROSS INCOME



4.2 Variations in Costs

To test the significance of the variations in reported costs, annual gross income was recalculated for each owner operator. It was assumed that:

- each owner operator performed the same work and was paid the same money,
- each owner operator incurred his own reported fixed costs,
- each owner operator incurred his reported variable cost per km multiplied by an average distance of 89,628 kms per year.

The revised estimates of annual gross income are shown for each owner operator in Figure 11.

FIGURE 11



Figure 11 illustrates that gross income varies considerably between owner operators due to a variance in individual owner operator costs. There is a differential of $42,408 or 152% between the lowest-cost and highest-cost owner operator.

If the 15% lowest cost owner operators and the 15% highest-cost owner operators are excluded, the annual gross income varies by $19,462 or 48%.

Compared to the estimated 15.3% reduction in gross income that results from enforced weigh regulations, it can be seen that the effective management of costs plays a more important role in owner operators' profitability than does overloading.

4.3 Variations in Time Worked

Similarly, variations in the number of days worked can have a significant impact on an owner operator's earnings. Obviously, the fewer days per year an owner operator works the less money he will have to cover fixed costs.

For example, if an owner operator's work year is reduced by 20 days, his gross income will drop by $8,035 or 15.2% per year. Similarly, if an owner operator runs 5 trips per week rather than 8 trips, gross income will decrease by $29,983 or 56.7%.

5.0 SUMMARY

The following are the main points which emanated from the study:

1. Operating practices such as hours of work, length of trip, trips per day, and types of roads travelled varied widely not only among companies but among individual owner operators as well.

2. Although most log haulers are not able to work a full year, when working, they generally work long hours each day, either driving or maintaining their equipment.

3. Log hauling is unlike other trucking operations because about one third of the total kilometers driven is on bush or gravel roads resulting in higher operating costs.

4. Gross income, which probably best reflects what the individual owner operators consider as earnings, varied considerably. Average gross income was found to be generally comparable to a company driver's earnings provided that the work schedules were alike. However, in those cases where the mills did not cover the fringe benefits for the owner operator, the company driver had a significant advantage.

5. In the short term, overloading increases operating costs only marginally, but it increases annual earnings significantly. On average, for each percentage point that the owner operators overloaded their vehicles, they earned an additional $1,167 per year.

6. Although overloading will have a significant impact on owner operator earnings, other factors such as management of costs and amount of time worked have as much or more impact on earnings.

General Freight Service to Rural Manitoba: The Pivotal Role of Beer

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Throughout the twentieth century, governments have intervened to influence the provision of goods and services to rural communities. Financial assistance has been provided to extend power (electrification), communications (telephone) and transportation (roads), from urban to rural populations. In addition, governments have used their regulatory powers to affect the prices and quality of services received in rural areas. One of the most highly regulated of these services is the for-hire general freight trucking industry.

Economic regulation has played a dominant role in the history of Manitoba's intra-provincial freight market. The Government of Manitoba has used economic regulation to control the number of Public Service Vehicle (PSV) carriers serving each rural community, and to specify the schedule of freight tariffs. Ostensibly, the purpose of this regulation is to influence the level of service that the PSV carriers provide to rural areas.

Restricted entry limits competition and promotes stability in the industry for the established carriers. Freight rate controls aim to provide remunerative charges for most transportation services, and in some cases cross-subsidization for selected freight categories, while limiting the market power that is accorded by state regulation. Such controls however, do not guarantee the existence of the necessary volume of traffic to support the industry. Moreover, regulatory controls may limit the ability of the industry to adjust to changing economic circumstances, or the challenges created by new commercial innovations. This is important because economic regulation which attempts to set prices above what would prevail in the open market, usually creates incentives for individuals to search for alternatives that circumvent the system.

Strict regulation of rural PSV carriers has not prevented the attrition of their numbers during the past two decades. A productivity study of the rural general freight industry in 1972 identified 153 carriers that were active in the intra-provincial market (House, 1974). Ten years later, a Task Force Report of the Department of Highways and Transportation (Manitoba, 1984a) identified only 129 such carriers. By 1988, the number of active rural general freight carriers had decreased to 84 (Prentice et al, 1989). This represents a 45

percent reduction in the number of rural general freight carriers in the past 15 years.

Despite this significant reduction in the number of rural carriers, the process of rationalization is far from complete. Operating profits in the industry are low, and some owners claim that they could make better incomes as drivers for other companies. Industry opinions on the number of PSV carriers that can remain viable are generally pessimistic. Estimates of the number of carriers that are likely to constitute the industry vary from a high of 25, to as low as 12.

Regulation of Rural Freight Services

Regulation of rural trucking was introduced initially in 1912 to ensure "local control over local enterprise" (Manitoba, 1984a). In the same year, the **Motor Vehicle Act** was amended to authorize municipalities to "make rules and regulations for controlling such business [i.e., hiring motor vehicles] or occupation". In the depression of the 1930s, there was concern that excess carriers in the transport industry could result in "cut throat" competition, driving down rates and creating instability by forcing carriers to leave the industry. It was widely held by those in the transport industry, that open entry and no price regulation could lead to a process of "destructive competition", which would end in monopoly pricing of service to rural communities (Manitoba, 1984b).

The regulation of rural trucking was justified by the perceived need to provide reliable service to rural communities and to promote economic development. An associated reason for economic regulation during this period was the perception that truck competition might exert a detrimental influence on railway branch lines and reduce service to rural communities.

In 1930, the **Highway Traffic Act** made the Municipal and Public Utilities Board (MPUB), responsible for the regulation of all public service vehicles (PSV), buses and trucks. It was also given authority to set maximum or minimum rates. The MPUB stipulated that anyone intending to operate a public service vehicle required an operating certificate. These were issued to potential entrants only if the existing service was not considered adequate. In this way, the MPUB could control entry and exit and thereby stabilize the industry.

The construction of the Trans-Canada Highway, following the Korean War, opened up extra-provincial transport between Eastern and Western Canada. Although provincial governments have always regulated intra-provincial trucking, they did not have the constitutional authority to control the activities of inter-provincial trucking. With the passing of the **Motor Vehicle Transport Act** (1954), the federal government delegated this authority to the

provinces. Under the Act, the Manitoba Motor Transport Board (MTB) was authorized to grant licences for extra-provincial traffic into, or through the province, on like terms and conditions as similar intra-provincial traffic.

Although the Motor Vehicle Transport Act (1987) does not pertain to intra-provincial regulation, the review process did stimulate some modifications that affected intra-provincial trucking. The principal regulatory changes are presented below.

- An extension of the designated/exempt commodities list (March 1986) which expanded the number of goods that carriers can easily obtain operating authorities to carry to all points in Manitoba.

- The regulated freight rates for intra-provincial carriage were converted from statutory rates to a standard tariff of maximum tolls (February 1987). Under the new rules, carriers can charge less than the regulated rates without having to file for a tariff that would be made available to all similar shippers.

- Regulations were set out under which private shippers could utilize a "single-source" for truck leasing and driver pool operations (May 1987).

In addition, other minor regulatory changes were made concerning minimum insurance requirements, tacking of authorities, operating authority transfers and entry rules.

Rationale for Regulation

Blanchard (1985) suggests that the current rationale underlying the support for regulation of rural carriers has at least five basic assumptions:

1. the cost of serving small, or remote communities, is higher than other highly populated centres;

2. carriers do not make sufficient profits in serving smaller communities;

3. carriers will only provide an adequate level of service to these communities (which based on assumption 2, are deemed "unprofitable"), if coerced, or cross-subsidized, or both;

4. the costs of enforcement/cross-subsidization are less than the benefits; and,

5. regulations governing rural service "obligations" are practical and feasible to enforce.

The literature on the provision of freight service to small communities does not support assumptions 2, 3 or 5. First, there is the problem of defining what is an "adequate" level of for-hire truck service for rural communities. Second, no mechanism exists to ensure that any cross-subsidies will be applied to the intended beneficiaries. Finally, there is no evidence that either coercive regulations, or cross-subsidies, have been successful in creating a level of for-hire truck service to rural communities that was "better" than would have occurred because of market forces (Ontario, 1983; Pustay, 1983).

These views on the irrelevance of regulation are strongly supported by research studies of service to small communities following deregulation in the United States (Freedman and Beilock, 1984, 1985). In no jurisdiction was the level of service to small communities judged to have been altered significantly by regulatory change (Kidder, 1983, 1984).

Prentice, et al (1989) also find no evidence to support the assumptions that rural service obligations are either practical or feasible to enforce. The lack of enforcement is identified as one of the key problems experienced by the PSV carriers in Manitoba. The ability of non-PSV trucks to carry freight, legally, or quasi-legally, is one of the main reasons for the decline of the PSV general freight carriers. This suggests that the Government of Manitoba implicitly rejected Assumption 4 (that the benefits of regulation exceed its costs of enforcement).

Ineffectual enforcement of regulations cannot be credited, however, with the extended process of rationalization that has occurred in Manitoba. Clearly other economic forces have been at work that would have caused a rationalization regardless of the regulatory system. Changes in the composition of the rural population and the decline of small communities has had a negative impact on the demand for the services of rural general freight carriers. In addition, technological changes and commercial innovations have altered the costs and supply of freight services that compete with PSV trucks. These economic forces are described in the following section.

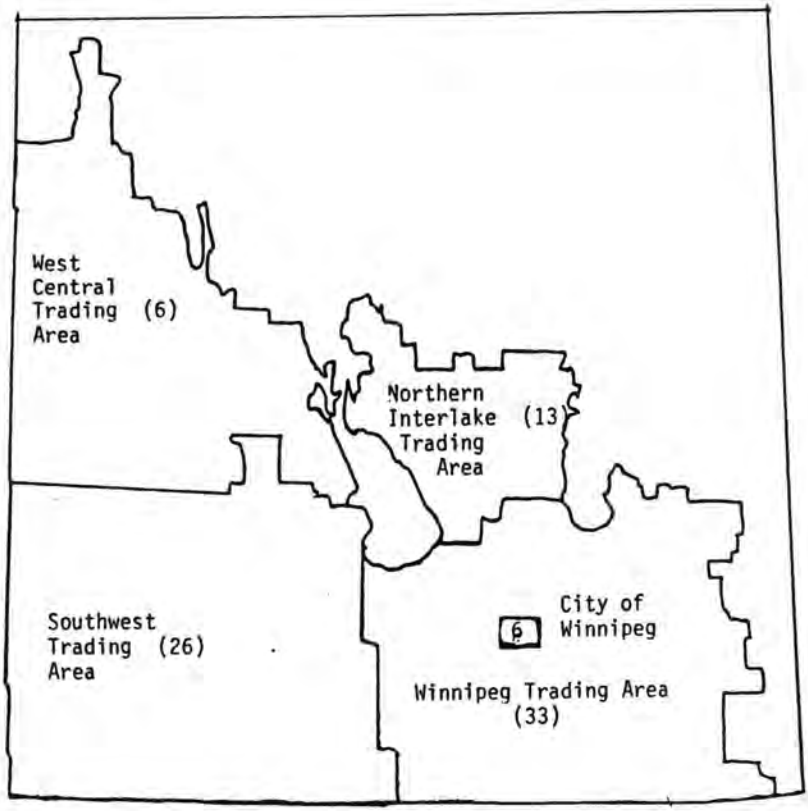
Dynamics of the Rural Freight Market

Although Manitoba has approximately one million inhabitants, most of the province is sparsely populated. Winnipeg, the capital and major urban centre, contains almost 60 percent of the population while the combined population of the next two largest cities, Brandon and Portage la Prairie, is only 5 percent of the total. The remaining population is located mainly in towns, small villages, and rural areas in the southern half of the province. As a result, most of the freight movements consist of less-than-truckload (LTL) shipments from

distribution warehouses in Winnipeg to the rural communities, with little, or no freight, available for the return trip.

Figure 1 illustrates the distribution of the PSV carriers that have intra-provincial operating authorities to carry general freight in Manitoba. With the exception of the six larger PSV carriers located in Winnipeg, most of these carriers have operating authorities to move freight between Winnipeg and a few communities in the proximity of their base location.

Figure 1 Base Locations of Rural PSV Carriers in Manitoba's Economic Trading Zones



The map in Figure 1 is divided into economic trading areas that were used by Tully (1984) to project population changes to the year 2001. In all areas, the population aged 65 and over is expected to increase. With the exception of the Winnipeg Trading Area, however, the population aged less than 65 is projected to decrease by approximately 25 percent. Consequently, in most parts of rural Manitoba, PSV carriers are serving a market that is shrinking in absolute numbers, while the remaining individuals are likely to demand fewer freight services.

The market for rural PSV services has been eroded further by the competition between urban "shopping centres" and the retail sectors in small towns. As new shopping malls have opened in relatively larger centres, such as Brandon, Steinbach and Portage la Prairie, people living in rural areas have been driving their cars to these locations to shop for groceries and other products where they are offered a wider selection and opportunities for lower prices. When the retailers in rural areas lose business to larger centres, their demand for transportation services also declines.

Private trucking has had the greatest detrimental effect on the rural PSV carriers. For many large shippers, the advent of truck leasing made private trucking more economical than the use of PSV trucks that had a fixed tariff of tolls which overpriced truck load shipments. The demand for greater reliability and more specialized service have also encourage the switch to private carriage. For many PSV carriers, it is desirable to delay departure for rural areas by half a day, or overnight, until the truck has enough freight to justify the trip.[1] In addition, most of the smaller PSV carriers do not have refrigerated trucks. As a result, shippers of perishable food products, which were a mainstay of the PSV industry, have switched the bulk of their freight to private carriage.

PSV carriers have also been confronted with increased competition from farm trucks. Livestock is one of few types of "backhaul" freight available to many rural general freight carriers. After dropping off their load of cattle or hogs, however, the trailers must be thoroughly cleaned before they can be used for general freight. Consequently, the profitability of hauling livestock has been questionable for many years (House, 1974).

As the weight and dimensions of trucks have increased, farmers and some non-general freight PSV carriers with specialized livestock tractor-trailers have become active in hauling livestock.[2] Farmers, who have access to tax reduced "purple gas" and lower costs for insurance and licence plate registration fees, are permitted to haul their "neighbours" livestock (up to 13,500 kg gross) and receive compensation for "out of pocket" expenses. The problems associated with identifying and proving the abuse of these limits on farm trucks has made it increasingly difficult for PSV carriers to compete.

Structure of the Rural General Freight Industry

A total of 51 trucking firms participated in a survey from April to July, 1988. Although not a complete census, this sample includes about 60 percent of the firms in the industry, and is evenly drawn from all regions of the province. Only 45 of the questionnaires were adequately completed and relevant to the study.

Table 1 displays the number of firms in the survey by five separate revenue categories and eight employee categories. These data illustrate the great diversity that characterizes the rural general freight industry. While firms with four or less employees make up almost half the total number of respondents, no revenue category represents more than 27 percent of the sample, or less than 18 percent. It is also evident that most trucking firms are limited to a narrow scope of operations. Over half of these carriers depend on less than five rural communities to generate their freight.

Table 1 Structural Characteristics of Manitoba's Rural General Freight Industry: Number of Employees and Communities Served

	Firm Size in terms of Total Revenues ('000)					
	Less than $75	$75-$149	$150-$249	$250-$500	$500 or more	Number of Firms
Employees						
1	3	1	1	0	0	5
2 - 44	7	5	1	0	17	
5 - 90	0	2	5	1	8	
10 - 14	1	1	0	1	2	5
15 - 20	0	0	0	0	3	3
21 - 25	0	0	1	0	4	5
over 25	0	0	0	0	2	2
Communities Served						
5 or less	7	4	6	4	5	26
6 to 10	1	3	2	2	3	11
11 to 15	0	1	1	1	2	5
16 to 20	0	0	0	0	0	0
21 to 30	0	0	0	0	1	1
30 or more	0	1	0	0	1	2
Number of Respondents	8	9	9	7	12	45

Table 2 displays the net profit of firms in the different regions. Incomes are very low; 38 percent of the firms had less than $10,000 net profit, about two-thirds of all firms in the sample had profits of $25,000 or less.

When the earnings of firms in different regions are compared, it is obvious that there are many firms in Southwest and West Central Manitoba with relatively low net profits. Only 16 percent of firms from these two regions earned over $25,000, and none earned over $50,000. This can be compared to firms in the Winnipeg Trading Area, who generally fared better. In this region, about 44 percent had an income of $25,000 or more, and 28 percent earned $50,000 or more.

Table 2 Net Profits of Rural General Freight Carriers by Location

	Trading Area				
	Winnipeg	Southwest	West	Interlake	Total
$10,000 or less	6	6	3	1	16
$10,000-25,000	4	5	2	1	12
$25,000-35,000	1	1	1	2	5
$35,000-50,000	2	1	0	0	3
$50,000-100,000	4	0	0	1	5
$100,000 or more	1	0	0	0	1
Number of Respondents	18	13	6	5	42

Level of Service Provided

The frequency of service rural carriers provide is presented in Table 3. Only 60 percent of the carriers provide "daily" serve to their communities. The larger carriers are generally able to provide more frequent service than smaller carriers. Over half of the largest carriers (with revenues of $500,000 or more) serve their largest communities more than five times a week. Only four other carriers (with less revenues) were able to provide similar service.

Table 3 Frequency of Service by Firm Size (Total Revenues)

Trips per Week	Total Revenues ('000) Less than $75	$75-150	$150-250	$250-500	$500 or more	Total
Six times	1	0	3	0	7	11
Five times	2	4	4	3	3	16
Four times	2	0	0	2	0	4
Three times	0	1	0	1	1	3
Two times	1	1	2	1	1	6
Once or less	1	2	0	0	0	3
Total Respondents	7	8	9	7	12	43

The frequency of service that carriers provide depends on the amount of freight available for their trips to Winnipeg and back. If there is only enough freight going to the communities listed in the carrier's operating authority to warrant three trips a week, the carrier may lose money by offering four trips per week. The carriers' length of haul also determines, to a great extent, the frequency of service they are able to provide.

The relationship between firm location and frequency of service is presented in Table 4.

Table 4 Base Location of PSV Carrier and Frequency of Service

	Trading Area Winnipeg	Southwest	West	Interlake	Total
Trips per Week					
Six times	5	3	1	2	11
Five times	13	2	1	0	16
Four times	2	2	0	0	4
Three times	0	0	2	1	3
Two times	0	3	1	2	6
Once, or less	0	2	1	0	3

The location of firms appears to be a good indicator of the frequency of service provided. All truckers in the Winnipeg Trading Area, the region closest to Winnipeg, serve their communities at least four times a week. On the other hand, only two of the firms in the West Central Manitoba region serve their communities more than three times weekly. Some of the larger firms in Southwest Manitoba also provide frequent service, but many communities in this area have to be content with service once or twice a week.

Modal Choice of Rural-Based Shippers

Rural-based manufacturers are one of the few types of businesses located in the rural areas that have significant demands for both inbound and outbound transportation services. In addition, transportation has been singled out in previous analysis, as a major impediment to the development of industry in rural areas (Manitoba,1969). The following analysis is based on a questionnaire that was sent to over 200 rural-based manufacturers, of which 83 usable responses were received.

Rural-based manufacturers were asked to indicate the modes of transportation that are available for their use, and the proportions of their inbound and outbound freight that are carried by each type of transport. Their responses, which are presented in Table 6, show that private truck, for-hire truck, courier and bus services are available to approximately two-thirds of the rural manufacturers that replied to the survey. These data imply that rural shippers have an adequate choice of various shipping methods, with the exception of rail (only 30 percent indicate that rail shipment is available).

Table 6 Availability and Forms of Transport Services used for Inbound and Outbound Shipments

Type of Transport	Proportion of Service	Availability of Shipments Inbound	Outbound
		..... percent	
Own truck	70%	26%	38%
Supplier's/Customer's Truck	70%	14%	14%
Full load for-hire Truck	65%	21%	11%
Partial load for-hire Truck	72%	21%	16%
Courier	68%	4%	4%
Bus	71%	5%	6%
Rail	30%	4%	4%

The high degree of availability of "own trucks" and "suppliers' or customers' own trucks" is noteworthy, especially in view of the volume of freight moved by private carriage. Shippers were asked to estimate the approximate percentage of various transport services used, in terms of the amount of weight shipped. Private trucks are used for approximately one-quarter of rural manufacturer's inbound shipments and for over one third of their outbound shipments. In comparison, part-load and full-load for-hire trucks carry about 42 percent of inbound shipments, but only 27 percent of outbound shipments.

It is clear that the use of private trucking is wide-spread among the rural manufacturers that replied to the survey. To the extent that about 40 percent of the inbound freight, which could be hauled by for-hire truckers, is subject to private carriage, the headhaul (Winnipeg to the rural areas) volumes of the PSV carriers are reduced. Perhaps more important from a profit perspective, however, over half the freight generated by these rural manufacturers, that could supply needed back-haul (rural areas to Winnipeg) loads for for-hire truckers, is being lost to private carriage.

Freight Composition of Rural Carriers

General freight carriers were asked to identify the three most important classes of freight carried on their headhaul and the backhaul. These data are presented in Table 7. Based on this information a general profile of the industry emerges. Although there are some exceptions, a typical rural trucker generally transports groceries and beer to rural areas from Winnipeg and returns to Winnipeg with beer empties, livestock, or an empty vehicle.

Table 7 Rankings of the Top "Headhaul" and "Backhaul" Commodities by 45 Rural PSV Carriers

"Headhaul" Freight: from Winnipeg to the rural areas

Commodities	Most Important	Second Most Important	Third Most Important
Groceries	17	6	1
Beer	10	10	4
General Freight (Miscellaneous)	6	4	6
Liquor	3	2	0
Feed	2	3	1

"Backhaul" Freight: from the rural areas to Winnipeg

Commodities	Most Important	Second Most Important	Third Most Important
Livestock	15	2	2
Beer Empties/ Return Bottles	8	8	3
Misc. General Freight	4	2	9
Grain	2	2	1
Feed/Feed Products	1	3	0

The Pivotal Role of Beer

The importance of beer and liquor in the composition of rural carriers' freight is not simply a quirk of the market. An implicit policy has been followed by the Government of Manitoba to use the carriage of beer and liquor to "support" the rural PSV general freight industry. The purpose behind this policy was rural development: the legitimate desire to assist the delivery of general freight to the rural communities.

The rural development policy has been effected by a very subtle form of cross-subsidization. The urban consumers of beer and liquor have helped to pay the "extra cost" of ensuring service to the rural communities. The policy has been effected through two regulatory bodies: the Manitoba Liquor Control Commission (MLCC) and the Motor Transport Board (MTB).

Like all Canadian provinces, Manitoba operates a government monopoly on the distribution of alcoholic drinks. The MLCC undertakes the distribution

and retail marketing of imported beer and liquor, but licences the distribution of domestic beer. In addition, the MLCC sets the retail prices for all beer and liquor. Through these powers, the MLCC has the ability to exert direct influence on the carriage of imported beer and liquor and indirect influence on domestic beer distribution. In fact, these controls have been used in such a discriminatory manner that Canadian liquor distribution is a significant international trade issue (Menzie and Prentice,1988).

The physical distribution of all domestic beers in Manitoba is undertaken by one logistics firm, Associated Beer Distributors (ABD), which is jointly owned by the breweries. Within the City of Winnipeg, ABD uses private carriage, while in the rest of the province, the services of about 69 rural PSV carriers are used.

Beer has attributes that make it "prime freight" for the rural PSV carriers It is dense, consistent (shipments 52 weeks a year), has low claims, and includes a backhaul (empty beer bottles). Until 1988, ABD was paying the same rates as shippers with other types of freight. ABD concluded that the rates they were charged were too high, considering the desirability of the freight, and that they were subsidizing other shippers' freight.

On the basis of a consulting study, which ABD commissioned, their benefits from switching to private carriage in the rural areas, was estimated to equal $500,000 annually.

ABD applied to the MTB to use private carriage to deliver beer to all points in Manitoba. The PSV carriers protested the application, which would have a detrimental effect on their business. ABD decided to withdraw their application, and negotiated a new agreement with the Manitoba Trucking Association which set maximum rates and conditions under which beer and empties would be moved by PSV carriers in Manitoba. This initial agreement was set for the duration of three years.

The agreement has lower overall rates, and also has some rate improvements for small shipments and demurrage penalties for delays caused by ABD. Nevertheless, two thirds of the PSV carriers surveyed by Prentice et al. (1989), expected their revenues to decline as a result of the new beer tariff. For many carriers however, the new rate agreement with ABD may be irrelevant. The forces of international competition now present a greater threat to their survival.

The provincial regulations governing the distribution of beer were excluded from the negotiations of the Canada-U.S Free Trade Agreement (CUSTA). Shortly after the signing of CUSTA in December 1988 however, a panel of the General Agreement on Tariffs and Trade (GATT) ruled that

provincial liquor distribution regulations were a non-tariff barrier to trade. In keeping with Canada's GATT obligations discriminatory practices in the distribution of beer are now being eliminated.

Under prior provincial liquor regulations, the Canadian brewers have been required to locate a brewery in each province in order to obtain access to the preferential distribution system. As a result, Canada has a large number of small scale plants. The breweries in Manitoba use only returnable bottles and import all canned beer from their larger plants in either Alberta or Ontario. This is mainly because of the cost of transporting empty cans and the expense of operating bottling and canning lines simultaneously. There are agglomeration economies in the production of canned beer. If the scale of operation can justify the establishment of a can factory beside the brewery, cans are competitive with the cost of re-cycling (washing, inspection, etc.) returnable bottles and can achieve higher levels of productivity (because of the faster filling rates).

In the United States, between 65 to 80 percent of the beer is sold in cans. This differs considerably from Manitoba, where 90 percent of the beer is sold in returnable bottles. In part this is cultural; Canadians are very good beer bottle re-cyclers (over 95 percent annually). In Manitoba, about 90 percent of domestic beer is sold in returnable bottles.

Manitoba beer drinkers' proclivity for "bottled beer" may also be price influenced. As of March 1, 1990, 24 bottles of domestic beer cost $25.80, including $2.40 refundable bottle deposit, for a net cost of $23.40. In cans, the equivalent 24 units of beer cost $26.70, including a refundable deposit of $1.20 on the cans, for a net cost of $25.50. Consequently, there is a disincentive of $2.10 per case of 24 cans ($0.09 per can) built into the current pricing system. It is worth noting that in other parts of Canada, such as neighbouring Saskatchewan and Alberta, where these sorts of price differences do not exist, canned beer has captured a much larger share of the market.

The Canned Beer Problem

The importance of canned beer may not be apparently obvious, but it does pose a serious problem for the PSV carriers. If returnable bottles are replaced by aluminum cans the carriers could have a significant drop in revenues. One dozen cans of beer weigh 10 1/4 pounds, while a dozen bottles of beer with the same quantity of liquid weigh 16 pounds. Thus, the use of more cans would reduce the tonnage shipped from Winnipeg to rural Manitoba by 38 percent and, in turn, the revenues of the carriers would decline.

A switch from bottled to canned beer would have further negative impacts on the profitability of the rural general freight carriers. Whereas 24 empty

beer bottles provide 7 pounds of freight for the backhaul, 24 empty cans only weigh 1.1 pounds. As a result, the switch from bottles to cans would reduce headhaul freight about one third, and backhaul freight to one seventh of its current volume (if all cans are re-cycled).

The Manitoba Government has been adjusting its policies to comply with the GATT ruling, but the actions of the MLCC appear to respect the letter, rather than the spirit of non-discrimination. Foreign beers are not readily available at all locations where domestic beers are sold. Although the MLCC retail price of U.S. beers includes a $.05 per can "environmental protection" tax equal to the Manitoba deposit on cans of domestic beer, the tax on foreign beer cans is non-refundable, whereas consumers can recoup their deposit on Canadian beer cans. Despite this non-refundable "environmental protection" tax, a six-pack of American beer can still be purchased for $.30 less than six Canadian canned beer.

Although Canadians do not generally prefer U.S. brewed beers, in other provinces (Alberta and Ontario) where lower priced American beer has been widely available, it has captured a significant share of these markets. In fact, the competition from cheap U.S. beer and liquor has already had an indirect impact on the rural freight market. The Manitoba Hotel Association (MHA) reports a marked increase in the closures of rural hotels[3]. In 1988, 14 hotels were subject to foreclosure, or simply ceased operation, while 16 hotels went out of business in 1989. All but one of these hotels were located in rural Manitoba.

Two reasons for the loss of these hotels have been identified by the MHA. First, the de-population of the rural areas and the aging composition of the population have reduced demand. Second, increasing volumes of U.S. beer and spirits are being imported directly by rural residents. Because of high Canadian taxes, and the low cost of U.S. beer, it is less expensive to cross the border and pay the duty/taxes to import American beer than to buy domestic products.

American beer is likely to capture a larger share of Manitoba's beer market. The U.S. breweries will demand and eventually receive equal distribution opportunities in the Canadian market. When this happens, the entire distribution by the rural PSV carriers could be in jeopardy. Under the MVTA (1987) Manitoba would have to grant an extra-provincial operating authority to a U.S. carrier for the delivery of American beer to all points in Manitoba. This would open the door for any of the U.S. breweries to establish a milkrun for substantial deliveries of beer directly to rural hotels and MLCC retail outlets in Manitoba. In order to match this competition, the Canadian breweries would have to respond with a cheaper private carrier operation of their own.

Discussion

Beer and beer-empties constitute the largest single freight contribution to the rural PSV carriers in Manitoba. The loss of this freight would have severe negative impacts on virtually every carrier. In turn, the pace of rationalization that has affected the rural PSV carriers during the past 15 years would be accelerated.

Despite the considerable number of carriers that have exited from the industry, excess capacity continues to plague the rural PSV carriers. The combined effect of declining rural population, and increased competition from other forms of transport, have reduced the total freight market available to rural carriers. This has created a high cost industry, because of unnecessary duplication of service, and low returns. For many carriers, their operating authorities are too restrictive to generate sufficient freight to earn a reasonable return on their investment and labour. Over 38 percent of the rural PSV carriers, surveyed by Prentice et al. (1989), declared net profits of less than $10,000 in 1987, while two-thirds earned less than $25,000.

From a public policy perspective however, the important question is what are the likely economic impacts on the rural communities?

Undoubtedly there will be some negative economic impacts, to the extent that some rural towns will lose the jobs that the economic activity of the PSV carriers provided. Whether the level of service received by rural communities in Manitoba will be negatively affected is more contentious. There is strong evidence that trucking services to rural communities are a function of market forces, and have little to do with current regulations. The service that rural carriers now provide is not uniform across the province. Instead they appear to respond to market forces by limiting the frequency of service they offer to the demand that is present in their communities.

The de-population of rural Manitoba is a concern for those who care about its economic and social development. Whether the strict regulation of the intra-provincial general freight industry serves to foster rural development is open to debate. While it is extremely difficult to prove, there is evidence to suggest that the higher costs and restrictive nature of trucking regulations may have had an opposite effect. Instead of fostering development, these regulations may have discouraged the location of manufacturing jobs in rural areas, which is the real key to maintaining their population.

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Endnotes

1. PSV carriers have lost the majority of their time-sensitive small package freight to courier services and the bus lines.

2. This loss of freight to specialized carriers has an precedent. Prior to the introduction of bulk milk trucks, milk cans were the most important "backhaul" commodity of the general freight carriers.

3. Manitoba Hotel Association, President, personal communication.

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THE IMPACT OF DEREGULATION ON THE QUÉBEC TRUCKING INDUSTRY: A PRELIMINARY ASSESSMENT

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1. Introduction

The Québec trucking industry has been deregulated since January 1988, when the National Assembly passed a new transportation law, la "Loi sur le camionnage" (L.R.Q., c.C.-5.1). However, the real cause of changes in the Québec legislation comes initially from the Motor Carrier Act of 1980, enacted by the American Congress. By relying on market forces to determine the conduct of the motor carrier industry, the American legislation has undoubtedly had repercussions on the Canadian trucking industry through various channels. Because the Canadian institutional framework differs from the American arrangement in that there is no Pan-Canadian regulation as such, the federal government had to pass new transportation legislation, namely the Motor Vehicle Transport Act (S.C. 1987, C.35), to initiate such a move. In short, the federal governement took the initiative in this matter. It may have come as a surprise, because the Canadian Parliament had delegated its legislative authority to regulate interprovincial and international public trucking activity to each respective province as far back as 1953.

The purpose of this paper is to assess, on a preliminary basis, the main effects of this new policy whose objective is to promote competition in an industry which was formally regulated over the last 37 years. The following approach has been used: Section 2 briefly describes what the prevailing situation was in this Québec industry before the new Trucking Act of 1988. A number of studies of American trucking deregulation are analyzed in Section 3 to see if transitional and/or long run events which occur there may also take place in Québec, mutatis mutandis. Section 4 presents and assesses the changes which have taken place since this deregulation. However, before examining their impacts, this paper will also describe how the American deregulation has indirectly influenced the Canadian context, leading to successive new federal and provincial Transportation legislation. Finally, I shall attempt to relate those modifications to the deregulation phenomenon and its ultimate effects on the expectations of the people involved in the industry (truckers and shippers, as well as politicians).

2. The Québec Trucking Regulation Before 1988: An Overview

The main elements describing the Québec regulatory regime are the barriers to entry, explicitly incorporated in the public necessity and convenience test, and the price regulation exerted by the Board. Having

established the scope of the economic regulation, the second part includes an evaluation of the actual importance of these regulatory measures and thus the extent of the leakages that erode the formal constraints introduced by the Commission. The third section briefly attempts to identify the consequences on the industry's economic performance[1].

2.1 The Québec Regulatory Regime: Main Characteristics

As in the case of other Canadian quasi-judicial agencies, the procedures of the Québec Transport Commission for the granting of permit authorities focus on requirements pertaining to the "public interest". Although this concept is not specifically mentioned in the founding act, continuous jurisprudence has established an obligation to give fundamental consideration to "public interest" when making a decision. The Québec Transport Commission is the sole judge of this concept, given that there is no precise definition of this term; thus, the basis for interpreting it is subjective and depends on the particular circumstances of each situation. This is not to say that the agency operates in a purely arbitrary fashion, but rather that the Commission members have a certain degree of latitude and flexibility in their interpretation[2]. In the absence of such a formal definition, the study of a sampling of the Board's decisions will clarify the interpretation given by Commission members to this concept.

From this systematic review of decisions, it may be advanced that a general permit for a given coveted market will not be requested when all applicants know perfectly well that strong opposition from firms within this coveted segment will surely and systematically induce the Board to deny the request. On the other hand, a restricted permit will be granted more easily than in the previous case because of its inherent restrictions; opposition will be less intense because the stakes are generally perceived as modest by established firms. Particular circumstances, favorable to such a request, occur generally when a shipper develops a need that existing carriers are not able to satisfy, when the new authorized service does not divert customers away from established carriers and when the new restricted permit increases the share of the for-hire trucking industry in the overall transportation of goods. Consequently, new restricted permits or permit clauses requested (and eventually granted) will contain many restrictions regarding the commodities carried, the route to be used and the shippers to be served, since this is the only means for any carrier to overcome the full range of obstacles[3]. The general rule prevailing in the Québec trucking industry is to seek a general trucking permit when a firm wants to expand its activities in a new market and to request a restricted permit from the regulatory agency when only a marginal incursion in a new market is considered.

Until 1982, it was left to the Commission to establish all the rates and tariffs governing carriers or their representatives, mainly the Québec Tariff Bureau Inc. The Commission analyzed and set rates and tariffs to make them "just and reasonable" as required by the Trucking Act. Therefore, no carrier was able to charge rates other than those in effect. It must be said, however, that the agency formally set up the price structure and it approved nearly all applications for rate amendments submitted later. Although the board has powers to alter the submitted rates, it has done so only infrequently. In March 1982, a rates and tariffs filling procedure was introduced, but with a fairly high

number of exceptions. In 1986, a general rate filing procedure was implemented.

The Québec Tariff Bureau Inc. is the other institution which plays an important role in the determination of rates in Québec. As it collectively sets rates based on average cost characteristics for groups of firms, rather than the costs of individual firms, those regulated prices may not entirely eliminate competition, but may instead channel it in directions other than prices. Moreover, not only is its membership not mandatory, but this private organization cannot prevent dissident action by a member who wants his rates to be set up by the board.

2.2 The Actual Extent of the Economic Regulation

Many factors strongly suggest that the protection offered by the legal system of entry control is not as tight as the formal description would seem to imply. If this is added to the inherent climate of tolerance and prevailing weak incentives for applying published rates and tariffs, then the formal constraints are greatly reduced.

There exist various agents and mechanisms, internal as well as external to the industry, that are designed to act as a release valve and thus diminish the effectiveness of the Commission's protectionist measures. However, inter-modal substitutes, like private carriers and railways, are deliberately not discussed here because both modes require shippers having a relatively high volume of shipments on a regular basis. Only "illegal trucking", leasing or pseudo-leasing firms, freight brokers and/or freight forwarders are briefly analyzed as substitutes endogeneous to the trucking industry.

"Illegal trucking" takes place when a carrier does not hold a valid permit or chooses to operate beyond the clauses of all his permit authorities. A trucking firm will offer this type of illegal service if the probabilities of getting caught and of being fined are low and if the fine per offense is small in relation to the expected profits derived from this illegal activity. Many of the available indicators clearly suggest that the probability of getting caught is relatively low: the shortage of surveillance officers and the complexity of permit authorities makes it nearly impossible to decide on the legality of given operation. Even if a carrier is caught, there exist long delays between the date of the violation and the date of sentencing by Québec court judges. In 1982, the fine for first offence was set up to $100, being previously at $50. However, each complaint is considered as an isolated occurrence, since the Québec Department of Transport does not make a note of repeat infractions. Finally, the regulatory agency has rarely withdrawn or suspended the permit authority of a carrier convicted of illegal trucking activities.

The freight broker and/or freight forwarder, in the strict sense of the term, is not regulated by the Commission. These intermediaries offer the same services as a general carrier does, namely the pick-up and the delivery of less-than-truckload (LTL) shipments. Some of them may own some permit authorities and in this specific case, those brokerage and/or forwarding services are a natural extent of their actual activities, although they are performed by circumventing the regulation. Others generally rely on regulated carriers to move their truckload (TL) shipments to their regular points of service.

Leasing (or pseudo-leasing) firms lease the services of a truck and/or a driver rather than supply their own transport service as most common carriers do. Since they are not subject to the Commission's regulation, their services cost less than those of public carriers, mainly because these firms have no territorial constraints. Therefore, the leasing firm gains some advantages in terms of quality of services because it can ship everywhere without the interchange or transhipment of merchandise, which considerably reduces transit time and possible damages to the cargo. It is not unusual, however, to find a public carrier which also owns a leasing firm.

Enforcement of the official rates is definitely lax, and the by-laws are violated, although no one dares measure the real extent of these violations. The rate and tariff structure is quite complex and surveillance officers, now with the help of the Sureté du Québec, investigate only following a public complaint. Of course, these complaints are primarily made by competing carriers. However, they are very rare; only two or three infractions per year are registered. It is not surprising that the Québec Department of Transport, the Québec Transport Commission and the Québec Tariff Bureau Inc. always conclude, on the basis of their respective research or decisions, that rates and tariffs are negociable and must reflect the market conditions.

2.3 The impacts of regulation on the industry

We will now determine whether the set of constraints imposed by the Commission's regulation is as ineffective as the description of the "leakages" implies.

First of all, the reported sales of permit authorities or particular clauses of a permit do not reach the level found by Moore, Breen and Frew in their study of the American regulated carriers[4]. As a matter of fact, condensed financial statements of 97 firms published by the Québec Tariff Inc. for 1983 and 1984 reveal that the relative share of intangible assets to operating revenues is respectively 2.81% and 2.74% which is far lower than the ratio of 15% obtained by American economists[5]. It should be pointed out that American studies consider only the market value of operating certificates and do not take goodwill into account at all, whereas Québec data include both of them.

Many comparative studies have tested the hypothesis that regulation could explain the price differences observed between public carriers located in various provinces, trucking regulation being a provincial matter. The main conclusion of those empirical papers generally agree that regulation does not constitute a statistically significant variable in the determination of rates and tariffs in Québec[6].

The trucking industry, broadly defined, operates in an unofficial competitive environment. However, evidence of inefficiency has been detected, creating in the short run a burden that Quebec trucking firms must necessarily bear by obtaining a lower rate of return on their capital[7]. In the long run, its alternatives are therefore the following: either let the non regulated part of the industry expand its activities marginally as it does for the last fifteen years or support a deregulatory process and at least regain, if not increase, its share in the motor carrier industry broadly defined.

3. Lessons from the American Experience of Deregulation

The American trucking industry is still in a period of transition toward a new unregulated long run equilibrium. Although it may be difficult to evaluate, the movement since deregulation has been and still is in the direction of an unregulated equilibrium. Our brief survey focuses only on the effect of regulation on the following indicia of firm and/or market behavior or performance, namely the structure of the industry, the rate structure and service quality and the production function and costs.[8]

Different segments of the motor carrier industry have been differently affected by deregulation. Most of the new applicants are heavily concentrated in the truckload segment of the industry where fixed starting costs are relatively lower. These TL carriers small as well as large generally operate either with owner-operators or non-union drivers. Very few newcomers come in the LTL segment because of the current excess capacity resulting from the previous strict regulation. The regional LTL carriers have tried to expand their territories by adding new operating permit authorities rather than by mergers and takeovers, leading to an effective increase in the number of large carriers offering service to shippers at any place. The expected fear that the industry would be divided into two separate and different groups, namely a small number of large LTL carriers and a large number of small LTL carriers has not occured yet. Finally, the number of common carriers increased by more than one quarter between 1980 and 1982 and by one half between 1980 and 1984 to 25 000[9].

The effect of deregulation on rate structures has taken the form of discounts from listed prices rather than changes in the posted prices themselves[10]. All studies of trucking deregulation have discovered the presence of such flexible pricing. The quantity-tied discounts tend to vary among shippers (large and small, urban and rural) and, as those discounts from posted prices are directly related to the quantity of freight offered by the shipper, few small and rural shippers complain. Published tariffs no longer constitute a reliable guide to the actual prices being paid because discounting is so widespread. Finally, very few academic and/or econometric studies have confirmed the hypothesis that deregulation has depressed rates for motor carrier services. A comparative time-series study of Florida trucking rates suggests that intrastate deregulation reduced rates by roughly 14 percent[11], whereas another study reports evidence of price declines coincident with deregulation, although no attempt was made to allow for for changing economic conditions[12].

The most noticeable change was an increase in the service options available to shippers[13]. Now carriers may offer guaranteed delivery times or just-in-time service, pick-up and delivery at night and on weekends, shipment tracing, computerized record-keeping and multiple tender discount. A final remark: there exists no evidence that service quality has dropped following deregulation.

The cost effects of deregulation confirm what widespread agreement had already found, namely that the ICC regulation led to considerable inefficiency[14]. Because common carriers are no longer bound by route and commodity restrictions, they reduce their level of empty backhauls and partial loads relative to the regulation level. Moreover, route mileage decreases when

carriers are no longer prohibited from travelling via the most direct route, circuitous route authorities and gateway restrictions being abandoned. Contract carriers can also expand their activities, because they are not limited to serving a maximum of eight shippers. Private carriers and exempt agricultural product carriers now tend to have more balanced loads, being authorized to haul regulated commodities on their return trips. Added to this reduction in operating costs is the impact of newcomers in this industry. As a matter of fact, extensive low-wage, non-union entry, combined naturally with the 1981-1982 recession squeezed existing carriers, especially in the regional truckload market. This led to substantial unemployment for union drivers and ultimately resulted in considerable contract concessions by the Teamsters Union[15], namely lower wage rates and more flexible working conditions. Finally, owner-operators are no longer limited to exempt commodities, neither are they required to sign long-term contracts with regulated carriers. They are now authorized to offer or lease their services to private carriers.

A final point regarding the effect of deregulation on production costs is related to the production fonction used by trucking firms. Before 1980, the production function was generally the same for all firms since they jointly produced LTL shipments and TL shipments, whatever the distance. However, econometric studies clearly demonstrated that there were no more economies of scope realized by large carriers and that only regulation could be responsible for that persistent inefficiency[16]. As carriers optimize their routes, free from ICC certificate restrictions, there have been dramatic changes in trucking route structures (hub and spoke), truck utilization and labour productivity. More specifically, American carriers have achieved higher utilization equipment from better adaptation of equipment to individual markets and restructuring of the transport networks, regardless of the scale (size and extent) of their operations. They firmly believe in the advantage of networks (large and small) and as such they expect to benefit from the economies of network utilization as well as those of network configuration related to such a system of production[17]. This emphasis on the concept of networks has led to the creation of a new specialized trucking firm, namely one carrying only LTL shipments on long distance (1,000 miles and over) which operate across the United States by using the hub and spoke system. The actual image of the trucking industry is composed of three national large LTL carriers, Consolidated Freightways, Roadway and Yellow, as well as thousands of regional and local trucking firms which use a joint production function (TL and LTL shipments) on various distances and finally, thousands of specialized TL carriers which haul shipments on their territories defined by market forces.

In conclusion, the effect of deregulation has been to de-homogenize service and price offerings within and across markets. Carriers are now free to offer different services in different markets, to move prices closer to the true costs of serving a market, to provide innovative service offerings where customers are willing to pay for them. Moreover, deregulation has modified the structure of the trucking industry. Market forces induced carriers to restucture their networks and the latter have done this primarily by invading the territories of competing carriers. Finally, the most noticeable change in production costs has been cost savings in labour and it has been obtained by union concesssions and the entrance of non-union carriers.

4. The Québec Deregulation Process

From an analytical viewpoint, the 1980 trucking deregulation must be considered as an American collective good whose production causes externalities to the Canadian trucking industry because of international relations between the two countries. This slow and indirect, but real and effective spread of American deregulation is obtained by two precise and different elements, the pricing system for hauling goods across the frontier and the presence of American carriers on Canadian territory[18].

Briefly, the core of the argument for the first element is the following: American carriers hauling transborder shipments will export the American pricing structure to Canada. If a Canadian firm deserving the same market resists to the competitive forces initiated in the United States, its relative share of this international market will shrink to the benefits of those that adapt.[19] The second element of the spread of deregulation is the existence of American trucking firms operating in Canadian soil. American firms import all the new operation techniques based on the concept of transport networks and they actually achieve a higher equipment utilization and present a wider menu of price/service offerings. Consequently, they produce at lower costs and obtain an higher rate of return than Canadian firms.

Having reviewed the way in which Québec and other Canadian provinces have been urged to adopt more competitive practices, even before Québec deregulation became official, I now intend to describe and analyze the impact that this new competitive regime has on the efficiency of the trucking industry.

4.1 The Content of the New Trucking Law

The new Trucking Law completely changes the procedure of granting a permit authority. The onus of proving the "public interest" test no longer rests on the newcomer when requesting a permit authority, but on the opposing firms. This reverse onus "public interest" procedure makes it very hard and expensive for existing firms to oppose an applicant in a public hearing because they have to prove, beyond any doubt, how the incoming firm can be destructive to a competitive regime. Three 1988 decisive cases firmly establish the content of what should be the new reverse onus "public interest" test and therefore clearly open the road to competition[20]. Since then, there has not been any systematic opposition to a request for a general permit authority. More and more trucking firms therefore request a general permit authority rather than a restricted permit as was the case before these three decisions by The Québec Transport Commission. The only required condition to be met when requesting a permit authority is a two-part mandatory "fitness" entry test; the first is a good knowledge of the safety conditions contained in the various trucking regulations and by-laws and in the National Safety Code; the second is to own a general insurance policy which covers cargo and personal liabilities.

The second element which promotes competition in this industry is the repeal of the rate filing procedure. Presently, all rates and tariffs result from a mutual negotiation by both parties and therefore they remain confidential.

4.2 The Consequences of the New Trucking Law

As expected, the abolition of the legal barriers to entry induces many newcomers to move in. A large majority of requests for permit authorities comes from local or regional trucking firms which finally have the opportunity to build transport networks which correspond to their own choices. In other words, the supply of trucking services is directly determined by market forces. Besides these already established firms, newcomers are from those previously described as intra-modal substitutes, namely leasing firms, freight brokers and/or forwarders, owner-operators and common carriers operating outside Québec. In the first year of the new trucking law, 70% of interprovincial and international permit authorities and 96% of intraprovincial permit authorities requested have been awarded to Québec carriers.[21]

The structure of the industry slowly changed since deregulation because mergers, acquisitions, expansions and takeovers actually took place many years prior to the formal enactment of deregulation. By the way, this was also the case in other Canadian provinces[22]. In other words, many trucking firms anticipated the deregulatory process as described by Freedom to Move and made the right move earlier, thus buying some time to consolidate their position and adjust to a more competitive regime. As a matter of fact, these mergers led them to achieve greater network density whereas a greater diversity of shippers also led them to a more intensive use of labour and terminals. As the Québec LTL market had less excess capacity than those in the United States, where regulation is stricter, few shakeouts through mergers and additional bankruptcies are likely. Additional competition come from established regional carriers which expand their routes and services in territories of competing firms. Finally, more newcomers go into the TL market which has a relatively low entry capital requirement. The latter do not compete only with TL established regional carriers, but also with LTL carriers which rely on truckloads for backhaul trips. Many of those local entrants offer just-in-time service for TL shipments.

The level of rates and tariffs is influenced, in a given market, by the number of new entering firms which naturally add competition to the established regional carriers. The impact of deregulation is more perceptible on the truckload rates as new entrants, which had inherent comparative advantages in their low fixed costs, were able to exert downward pressures. These competitive prices therefore force established carriers to adjust their rates and increase cost controls to retain their respective market share. Concerning the evolution of LTL rates, some indicators suggest that rate increases are in general slight because new entrants in a coveted market segment usually introduce discounting to attract new shippers.

Finally, service options to shippers are on the increase. As more firms consolidate their activities and change their route structures, up to the network perspective, they allow for broader provisions of single line service. Secondly, as more carriers, whatever their size, are in competition to haul various loads from shippers, they are induced to offer different price/service ratios. The emphasis is put on reducing transit time and shipment tracing.

Although all Québec firms continue to jointly produce TL and LTL shipments on various distances, they tend to support the concept of transport

networks in order to rationalize their operations. A prerequisite to that adoption is the implementation of market-segment costing systems to ensure some financial success. In other words, rough indicators of costs as distance are no longer viable instruments of profits in a competitive regime.

5. Concluding Remarks

Labour unions and trucking firms were always firmly opposed to the deregulation movement started by Freedom to Move. They argued, at the time, that a dislocation of the Canadian industry would occur, namely that the trucking industry would soon become the end of the spoke of the American trucking networks.[23] In actual fact, the results are really quite different from those which were expected. Many changes took place gradually over the years. At the outset, mergers by Québec firms operating on the same market increase traffic density and thus obtain higher degree of network density. These substantial cost advantages are indirectly related to the overall size of a firm and are directly associated with the firm's market share. Secondly, the increase in competition coming from outsiders'entrance and established firms expanding in new coveted markets leads carriers to adopt new techniques of production, namely the reliance on transport networks. Trucking firms now must know their true costs on each particular segment of their network in order to survive in a competitive environment. Therefore, new price/service ratios are offered to shippers up to their requirements, new ways of balancing trips, such as triangulation and so on, are implemented, particular niches are discovered and increased emphasis is placed on marketing.

The fundamental reason which explains why major changes, such as those which occurred in the American trucking industry in the last decade, did not take place in the Québec industry, is the openness of the Québec economy. The latter is not able to export the social costs of its protectionist policies, whatever they may be, because this economy does not really have any influence on North American rates and tariffs. Consequently, if changes in another country, such as the American deregulation, increase the trucking elasticity of supply, there exists a clear tendency for the smaller country or province to adapt as quickly as possible to maintain its industry in good financial health.

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LE TRANSPORT ROUTIER DES MARCHANDISES DANS UN NOUVEAU CONTEXTE: UN ETAT DE LA SITUATION

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1. **INTRODUCTION** Dans ce texte, nous dressons l'état de la situation du transport routier des marchandises dans son nouvel environnement plus dynamique et concurrentiel. Après un bref rappel historique de l'évolution du contexte réglementaire, nous allons tout d'abord analyser l'impact de la déréglementation sur la structure de l'industrie. En particulier, nous examinons les conséquences de ces changements sur les segments des charges complètes (TL) et partielles (LTL) du point de vue des nouveaux entrants, des tarifs et du service.

Dans la section 4, nous constatons l'émergence d'une nouvelle relation entre expéditeurs et transporteurs. Nous examinons en quoi la déréglementation a modifié le processus de décision traditionnel de l'expéditeur. En effet avant 1980, la décision d'achat de services de transport se prenait de façon routinière et comportait peu de risque. Depuis la déréglementation, cette décision est considérée comme plus complexe et plus risquée. Le décideur doit donc s'impliquer davantage et il participe souvent à la formation de stratégies en transport. Les expéditeurs s'intéressent maintenant davantage aux politiques de transport et de gestion des stocks dans le but d'améliorer l'efficacité de la distribution physique de leurs produits. Ce nouvel intérêt des expéditeurs pour les activités logistiques pourrait entraîner une révision en profondeur des modes de distribution et façons de faire actuelles qui, à leur tour, pourraient affecter le rôle et l'avenir des transporteurs routiers de marchandises.

Dans la section 5, nous cherchons à découvrir comment les transporteurs peuvent s'adapter aux nouvelles règles du jeu. Nous nous intéressons plus particulièrement au changement d'orientation stratégique que la déréglementation a provoqué et à l'importance accrue que revêtent maintenant le marketing et la stratégie pour les transporteurs. Nous constatons l'émergence d'une nouvelle philosophie de gestion et de stratégies orientées vers la satisfaction du client. Nous observons également de nouvelles façons de segmenter le marché et l'apparition de nouveaux services complémentaires.

2. **HISTORIQUE** Aux Etat-Unis, la réglementation dans le domaine du transport a pris forme vers la fin du siècle dernier, plus précisément en 1887. C'est à cette date que le gouvernement américain créa l'Interstate Commerce Commission (I.C.C.) dans le but de réglementer l'industrie du transport ferroviaire et de protéger ainsi le public contre les abus de pouvoir d'oligopole ou de monopole.

Pendant la dépression, l'industrie du transport routier connut une période de croissance. Plusieurs expéditeurs, tels les fermiers, n'hésitèrent pas à opter pour le camionnage. Ce type de transport comportait deux avantages très nets par rapport au transport ferroviaire:
- des tarifs plus concurrentiels que ceux de l'industrie réglementée du chemin de fer;
- une plus grande flexibilité, car l'activité des camions n'est pas limitée par la disponibilité de rails et de gare spécialisées.

Les entreprises de chemin de fer ont réagi en se plaignant que ce nouveau mode grugeait peu à peu leur part de marché du transport des marchandises, jusqu'alors majoritaire. Elles ont donc favorisé la réglementation du transport routier. L'industrie du camionnage a aussi reconnu qu'une réglementation pouvait apporter certains bénéfices importants comme une plus grande stabilité financière et une diminution de la concurrence soi-disant destructrice de l'époque. C'est à cet effet que le congrès américain a voté en 1935, le Motor Carrier Act.

Dernièrement la libéralisation réglementaire du transport a été stimulée par plusieurs facteurs: la situation financière précaire des transporteurs par chemin de fer, le lobby de l'industrie du transport routier de marchandises, qui réclamait une plus grande flexibilité des contrôles réglementaires, et finalement la prise de conscience que la régle-mentation entraîne une hausse artificielle des prix supportée par les expéditeurs. Il s'agit donc ici d'une remise en question de la réglementation du transport telle qu'elle se présente vers la fin des années 70.

Le Motor Carrier Act, voté en 1980, est à l'origine de la déréglementation partielle du transport en Amérique du Nord. Cette nouvelle loi réduit sensiblement les mesures de contrôle de plusieurs façons et stimule la concurrence. Elle atténue fortement les barrières à l'entrée. En effet, un nouveau transporteur n'est plus tenu de prouver que son offre de service ne nuira pas à ceux déjà en place (élimination du fardeau de la preuve). La nouvelle loi permet aux transporteurs de couvrir un plus grand territoire, de desservir un plus grand nombre de clients et de fixer leurs tarifs de façon autonome. Cette libéralisation donne une plus grande marge de manoeuvres aux formes alternatives de transport routier, tels les courtiers et les transporteurs à contrat.

Le principal bénéfice attendu de cette déréglementation est une baisse des taux de transport. En principe, ceci devrait favoriser les expéditeurs qui profiteront de services de transport plus souples et moins dispendieux. La déréglementation devrait encourager la prise de risque. On espère que des entreprises de camionnage pourraient y voir une opportunité pour développer de nouveaux marchés, probablement par l'application de moyens innovateurs.

3. IMPACT DE LA DEREGLEMENTATION SUR LA STRUCTURE DE L'INDUSTRIE

Cette section analyse les profondes modifications de structure qu'a

connues l'industrie depuis 1980. Il s'agit de voir comment un nouveau contexte réglementaire peut créer des changements et favoriser l'émergence de nouvelles règles du jeu. On y traite principalement de trois sujets: 1) l'impact de la déréglementation sur les segments des charges complètes (TL) et des charges partielles (LTL) du point de vue des nouveaux entrants, des tarifs et du service; 2) l'ampleur du mouvement de faillites survenues après 1980; et finalement; 3) l'accroissement de substituts des transporteurs traditionnels.

3.1 Nouveaux entrants, impacts sur les tarifs et sur le niveau de service

Le secteur des charges complètes (TL) Lorsque les contraintes réglementaires ont été abolies, plusieurs nouveaux entrants ont été attirés par le secteur des charges complètes. Les barrières à l'entrée dans ce segment sont faibles puisque les activités ne demandent pas d'immobilisations très coûteuses tels les terminus, qui sont par contre nécessaires dans le LTL pour permettre la consolidation des envois. Pourtant, l'invasion de ce secteur a été plutôt lente. En 1982, le nombre de nouvelles firmes n'avait augmenté que de 5,6%, la plupart embauchant du personnel non syndiqué. La récession économique de l'époque n'est probablement pas étrangère à cette faible pénétration de l'industrie de charges complètes. Il fallu attendre 1984 pour voir le nombre d'entreprises doubler et atteindre 31,000. Cette plus grande rivalité a entraîné une chute dramatique des tarifs. Plusieurs nouveaux entrants trouvaient plus facile de réduire les tarifs établis, n'ayant pas à supporter les salaires élevés inhérents à la syndicalisation de leurs employés. Ce phénomène a secoué plusieurs firmes de transport syndiquées qui opéraient principalement dans les charges complètes. N'étant pas en mesure de concurrencer les nouveaux venus, elles devaient réorienter leurs opérations dans d'autres secteurs ou se retrouvaient en faillite. Heureusement, la qualité du service n'a pas été affectée par ces chutes de prix (Boisjoly et Corsi, 1982; DeJarnette, 1986; Ludwick, 1987; Boucher, 1985a). La déréglementation a donc vraiment contribué à rendre ce secteur plus concurrentiel.

Le secteur des charges partielles (LTL) Aucun nouvel entrant majeur n'a pénétré le secteur des charges partielles depuis 1980. A l'inverse des charges complètes, les prix dans ce segment ont sensiblement augmenté. Cette hausse de prix n'est peut-être pas étrangère à l'augmentation du taux de concentration qui a caractérisé ce segment durant cette période: on estime que la part de marché des dix plus grands transporteurs se situait à 38% en 1976, à 39% en 1978, à 48.5% en 1982 et à près de 60% en 1986 (Ludwick, 1987; Bigras, 1988). Ces résultats sont cependant en contradiction avec l'étude de Boisjoly et Corsi (1982) qui estime qu'en 1982, la concentration et les acquisitions dans ce secteur avaient diminué. La baisse du nombre d'acquisitions pourrait s'expliquer par la perte de valeur des permis d'opérations qui peuvent être obtenus plus facilement aujourd'hui. Maintenant, les firmes préfèrent élargir leur territoire d'opération en s'appropriant directement de nouveaux permis plutôt que par l'achat de concurrents.

Différents sondages effectués auprès des expéditeurs démontrent une amélioration du service depuis 1980, puisque la proportion d'expéditeurs insatisfaits diminue. Plusieurs expéditeurs soulèvent qu'un temps de transit inférieur est la preuve tangible d'un meilleur service. Enfin, la crainte d'un service déficient en régions éloignées ne s'est pas concrétisée (Bogers et Myers, 1986; Marcus, 1985; DeJarnette, 1986).

La déréglementation a favorisé l'émergence d'entreprises spécialisées dans les envois sur longues distances (1,000 milles et plus). Grâce à des terminus répartis dans tout le pays, les firmes peuvent réaliser des économies propres au domaine du transport, soit des économies d'utilisation et de configuration de réseau. Ces termes spécifiques proposés par Michel Boucher réfèrent à la vaste distribution spatiale des terminus (configuration) et à l'utilisation intensi-ve de ces derniers (utilisation). Ces firmes spécialisées peuvent ainsi assurer un service plus rapide que les autres transporteurs et réduire le prix de transport des clients grâce aux grandes possibilités de consolidation à travers leur système. Elles utilisent donc une approche de type "hub and spoke".

Le marché des lots brisés, autrefois constitué de généralistes desservant des régions spécifiques, n'est maintenant plus homogène. On y retrouve deux créneaux différents: celui des transporteurs spécialisés dans les mouvements sur longues distances et celui des transporteurs régionaux. Les premiers ne sont pas intéressés au marché régional car ils sont inefficaces sur courtes distances. On peut donc dire que ces deux créneaux sont complémentaires plutôt qu'en concurrence directe (Boucher, 1985b).

3.2 Faillites et effets pervers Depuis 1980, la possibilité de faillite est plus réelle et plus menaçante car le nombre d'entreprises a considérablement augmenté dans l'industrie et les permis ont perdu de leur valeur. Il faut tout de même souligner que la récession de 1982 a aussi joué un rôle dans les difficultés financières des entreprises. La déréglementation fut-elle la source de tous ces problèmes? Il est difficile de trancher sur ce point car les effets de la récession et de la déréglementation se confondent souvent.

Néarmoins, la revue Transport Routier rapportait en 1987 que quatre camionneurs par jour avaient fait faillite en 1985 et que depuis 1980, environ 30% des grandes compagnies américaines ne sont plus en affaire (Alary, 1987).

L'étude de Chow et Gritta (1985) est tout aussi alarmiste. En utilisant un modèle prévisionnel de faillite, les auteurs en viennent à la conclusion que près de 59% des firmes de camionnage constituant leur échantillon devraient fermer leurs portes à court terme ou sont du moins dans une position incertaine. Il faut préciser cependant, que cette étude ne traite que de variables financières et ne s'adresse qu'aux grandes entreprises.

Boisjoly et Corsi (1984) nous renseignent sur les causes et sur les

victimes des faillites survenues avant et après la déréglementation. Alors que les difficultés de trésorerie constituaient la principale cause de faillites avant 1980, on remarque qu'après 1980, ce sont les salaires trop élevés et les revenus trop faibles qui ont entraîné l'échec de certaines entreprises de camionnage. La taille des victimes de ces faillites était quatre fois plus importante que celle des entreprises qui avaient fermé leurs portes avant 1980.

La concurrence accrue a touché plus durement deux types d'entreprises: les petits transporteurs généralistes ayant une faible structure de capital et les grandes firmes déjà en difficulté alors qu'elles étaient protégées par des contrôles réglementaires plus stricts. On peut supposer, tel que le propose Boucher (1985b), qu'il existe une taille maximale d'opération au-delà de laquelle se manifestent des déséconomies d'échelle. Ce phénomène entraînant une baisse de rentabilité des opérations, expliquerait les faillites de certains gros transporteurs généralistes.

Par contre, les spécialistes et les transporteurs qui ont su s'adapter aux exigences d'un régime concurrentiel ont montré les meilleures performances. Disposant de terminus bien établis, dispersés géographiquement, ces firmes sont en mesure de gérer efficacement les envois LTL les plus profitables. Les charges complètes ne représentent que 20 à 30% de leur chiffre d'affaires (Morash et Enis, 1982; DeJarnette, 1986).

La déréglementation semble être en partie responsable des faillites survenues après 1980, mais la récession y a sûrement joué un rôle non négligeable. Au Canada, même sans une réforme réglementaire, le trafic et les tarifs ont chuté en 1982. Ceci s'explique par la nature de la demande de transport qui est dérivée de la demande des biens à être transportés.

Le premier effet pervers directement relié à la déréglementation est l'augmentation des accidents. Les causes principales semblent être liées à l'embauche de conducteurs ayant moins d'expérience et à une négligence dans l'entretien du matériel, le tout dans le but de diminuer les coûts (Ludwick, 1987). On a accusé aussi la déréglementation d'avoir entraîné une chute de productivité. Transport Routier (1985) affirme que les performances sont passées de 608 milliards de tonnes-milles transportées en 1979 à 529 milliards en 1982 et enfin, à 559 milliards en 1985. Il faut cependant être prudent en analysant ces chiffres car encore une fois, la récession est en partie responsable de ces résultats.

3.3 La croissance de substituts des transporteurs traditionnels Un autre résultat de la déréglementation se manifeste par la croissance explosive des courtiers et des intermédiaires de toutes sortes. Ceux-ci peuvent maintenant entrer directement en contact avec les transporteurs et les expéditeurs. L'industrie devient donc plus complexe car cette nouvelle forme de concurrence peut représenter un substitut menaçant pour le camionnage public. On estime qu'en 1981, les courtiers représentaient 6% du trafic domestique alors qu'en 1986,

ils en avaient envahi 20%. Ils sont passés d'une poignée d'entreprises à 4,000 en 1985. Les courtiers se positionnent comme des firmes offrant un service de distribution complet. En plus du service de transport, ils offrent la manutention, la gestion de l'inventaire et l'emballage. L'étendue de leurs services confère aux courtiers un avantage concurrentiel face aux transporteurs traditionnels qui ne prennent en charge que le transport des marchandises.

On prévoit que les entreprises auront de plus en plus recours aux services des courtiers. Si de petits expéditeurs y ont déjà fait appel, plusieurs firmes figurant parmi les 500 plus grandes relevées par Fortune auraient développé des relations avec des courtiers pour certaines parties de leurs activités. Les transporteurs doivent donc rester à l'affût de ces nouvelles conditions car des intermédiaires comme les courtiers risquent d'élargir sans cesse leurs champs d'activités.

4. UNE NOUVELLE RELATION CLIENT-TRANSPORTEUR Nous tenterons maintenant d'examiner en quoi la déréglementation a modifié la relation client-transporteur en insistant davantage sur les nouvelles exigences des expéditeurs et sur leur processus de décision lors de l'achat de services de transport. Ceci pourrait permettre aux entreprises de camionnage de mettre en oeuvre des stratégies cohérentes avec les attentes de leurs clients.

Cette section traite essentiellement de trois sujets: en premier lieu le processus de décision traditionnel de l'expéditeur, ensuite les modifications dans leurs habitudes de transport suite au Motor Carrier Act de 1980 et finalement, l'identification du vrai preneur de décision chez la firme cliente.

4.1 Le processus de décison traditionnel de l'expéditeur Dans l'industrie du camionnage, les firmes se font concurrence sur les prix et sur le niveau de service. Le compromis prix/service dépend grandement des caractéristiques de la marchandise transportée comme la périssabilité, le poids, etc. Pourtant, plusieurs études, dont celles de Stock et Lalonde (1978) et de McGinnis (1978), tendent à démontrer que le service demeure le plus souvent la variable propondérante dans le choix d'un transporteur. Dans un contexte où les tarifs sont réglementés, les entreprises ne peuvent que très difficilement se différencier par leurs prix. Il est donc normal qu'avec des prix quasi uniformes à travers l'industrie, les expéditeurs se tournent vers le service en tant que facteur de décision (Wyckoff, Tardiff et Johnson, 1982). Cette règle est toutefois moins applicable et évidente au Québec, où la réglementation était moins sévèrement appliquée. Une certaine concurrence sur les tarifs était donc possible avant même que l'on procède à des assouplissements dans la réglementation québécoise.

On peut toutefois se demander jusqu'à quel point les expéditeurs considèrent la décision du choix d'un transporteur comme importante. La théorie de l'implication décisionnelle nous donne des bases théoriques sur le sujet. Lorsque l'acheteur se sent fortement

impliqué, il suit une série d'étapes dans son processus de décision, soit: l'éveil du besoin, la recherche active d'information, l'évaluation des choix, l'intention d'achat, l'achat proprement dit et finalement une réévaluation après l'achat. Le processus est complexe et l'acheteur perçoit un certain risque à l'achat (financier, psychologique).

Par contre, lorsque le processus décisionnel est routinier ou automatique, l'achat est considé-ré comme peu important et il n'y a souvent que peu ou pas d'éva-luation après l'achat. Dans certains cas, il y a absence totale de processus de décision. Selon Statter (1983), avant 1980, le processus de décision utilisé dans l'achat de services d'une entreprise de camionnage suivait le modèle de la faible implication. Le processus de sélection d'un transporteur était considéré comme une décision comportant peu de risques et occupait une faible position dans la hiérarchie des décisions du gestionnaire. La décision était donc automatique et le transporteur choisi était rarement réévalué.

4.2 Modification des habitudes de transport des expéditeurs En quoi la déréglementation va-t-elle modifier la façon de faire des expéditeurs? Selon Marcus (1985), les expéditeurs doivent développer des aptitudes de négociation pour traiter avec les transporteurs lorsqu'il est question de tarifs et de services. Ils doivent démontrer de l'initiative en développant de nouvelles idées et doivent accorder une importance accrue au transport et à la logistique plutôt qu'à d'autres fonctions telles la production ou le marketing.

La relation client-transporteur est donc appelée à être profondément modifiée. Les firmes doivent aujourd'hui faire face à une industrie plus dynamique voire instable, où il y a de nouveaux entrants, des substituts offrant d'autres genres de services, des transporteurs en faillite, etc. Ces faillites forcent les expéditeurs à s'adresser à de nouveaux transporteurs qui se révèlent parfois insatisfaisants; la fiabilité étant le problème majeur.

Face à ces changements radicaux dans leur environnement, les expéditeurs ont réagi en modifiant leurs habitudes de transport et en adoptant une nouvelle approche de gestion des activités de logistique qui se veut à la fois plus complexe et plus efficace.

Un processus de décision plus complexe Aujourd'hui, les expéditeurs développent des stratégies de transport qui tendent à être cohérentes avec les objectifs corporatifs et logistiques de leur firme. De plus, la diminution des contraintes réglementaires a transformé le rôle du responsable du trafic (et/ou du transport). Si ce dernier devait auparavant se contenter d'un rôle plutôt routinier, il devient désormais un gestionnaire très au fait du monde du transport et en mesure d'analyser les diverses propositions de services qui lui sont soumises. Le gestionnaire en transport a donc une plus grande autorité, un rôle plus actif dans la prise de décisions et fournit plus d'intrants à la formulation de stratégies. De même, plus les coûts de logistique augmentent par rapport aux ventes totales, plus

la haute direction s'implique dans les décisions de distribution physique. En résumé, l'achat de services de transport n'est plus considéré comme un achat routinier mais plutôt comme une décision complexe qui compor-te certains risques. De là, une plus grande implication de la part du décideur (Statter, 1983).

Une gestion plus efficace de la distribution physique On se préoccupe de plus en plus aujourd'hui de l'efficacité de la distribution physique. Ceci engendre un intérêt grandissant pour le développement de politiques de transport et de gestion des stocks mieux adaptés à l'environnement actuel. De plus, lorsque les mouvements de marchandises passent du niveau régional au niveau national et transcontinental, les clients deviennent plus soucieux des mécanismes de contrôle requis. Ainsi, le service sur une seule ligne, le repérage des expéditions et les mesures de sécurité du produit sont des facteurs très recherchés. Aujourd'hui, les expéditeurs réalisent qu'il est avantageux d'acheter le plus grand nombre de services (consolidation, arrangement des mouvements complexes, inventaire, stockage) d'une seule source. Cette concentration améliore le contrôle tout en diminuant leurs coûts. Les firmes sont donc à la recherche de compagnies offrant un service complet. Enfin, pour mieux gérer la distribution physique, fonction qui devient de plus en plus complexe, les firmes embauchent des gestionnaires en logistique beaucoup plus qualifiés qu'auparavant (Ross, 1983; Eckler, 1987; Bigras, 1988).

Apparition de nouvelles exigences On a souvent accusé les expéditeurs de ne pas être conscients de leurs besoins. La réforme réglementaire a entraîné une prise de conscience chez les clients qui sont devenus, par conséquent, plus exigeants en matière de distribution physique. Ainsi, ils s'attendent à un service plus personnalisé et sont prêts à payer pour des caractéristiques spéciales de services. Par exemple, la fonction distribution des firmes clientes est appelée à devenir plus communément déléguée, voire offerte en sous-contrat à des entreprises extérieures tels les transporteurs et les courtiers. En déléguant les tâches majeures de distribution à des transporteurs, les firmes seront capables de réduire le personnel de distribution afférent et pourront se concentrer sur d'autres activités plus lucratives. Cette pratique est courante en Europe où les entreprises de transport n'ont pas connu la même forme de réglementation économique. Il est donc possible qu'elle se développe graduellement en Amérique du Nord dans ce nouveau contexte (Wickoff, Tarditt et Johnson, 1982; Ross, 1983; Anderson et Probst, 1986).

Savoir identifier le preneur de décision Les transporteurs doivent savoir vers qui diriger leurs efforts lorsqu'ils s'adressent à leurs clients. Ils doivent donc savoir qui est le vrai preneur de décision. Or, cette tâche s'avère beaucoup plus difficile qu'auparavant et de nombreuses études (Wyckoff, Tardiff et Johnson, 1982; McGee et Carlock, 1982; Statter 1983) soulèvent cette question sans y apporter de réponse satisfaisante. Quel département contrôle la décision? Il semble que dans près de 42% des entreprises, ce soit le département de production-opérations qui en est responsable. Le

département de marketing, quant à lui, contrôle la décision dans 32% des cas seulement. Consulter les ouvrages et les articles sur le sujet ne permet pas de trouver réponse à des questions qui présentent des avenues de recherche intéressantes, à savoir: la décision se prend-elle de façon individuelle ou en groupe? Jusqu'à quel point la haute direction influence-t-elle le choix du transporteur? Les réponses à ces questions seraient d'une grande importance stratégique pour les transporteurs.

4.4 Synthèse sur la relation client-transporteur En somme, la relation client-transporteur peut se résumer en ces quelques lignes:
- avant 1980, la décision d'achat de services de transport se prenait de façon routinière et comportait peu de risques;
- depuis la déréglementation, cette décision est considérée comme plus complexe et plus risquée. Le décideur doit s'impliquer davantage et il participe souvent à la formulation de stratégies en transport;
- les expéditeurs s'intéressent maintenant aux politiques de transport et de gestion des stocks dans le but d'améliorer l'efficacité de leur distribution physique;
- les firmes clientes prennent de plus en plus conscience de leurs besoins, ce qui les rend plus exigeantes. Dans un avenir rapproché, les transporteurs pourraient se voir déléguer une partie de la fonction distribution de leurs clients;
- nous avons peu de détails sur le preneur de décision chez l'expéditeur. Il serait pourtant très intéressant pour les transporteurs de savoir qui contrôle vraiment la décision.

La déréglementation a donc eu un impact non seulement sur les transporteurs mais aussi sur les expéditeurs. Ces derniers ont réalisé l'importance d'une bonne gestion en distribution physique et plus particulièrement en transport. Les transporteurs doivent maintenant les satisfaire en développant des approches de gestion appropriées. La prochaine section brosse le tableau des actions stratégiques entreprises par les transporteurs depuis 1980 pour s'adapter au nouveau contexte.

5. ADAPTATION DES TRANSPORTEURS AUX NOUVELLES REGLES DU JEU L'objectif de cette partie est d'analyser les opportunités qui se présentent aux transporteurs depuis la déréglementation. Nous verrons, plus particulièrement, comment les transporteurs peuvent profiter d'outils stratégiques pour conquérir leur marché. Nous nous pencherons sur deux sujets, soit le changement d'orientation stratégique que la déréglementation a provoqué et l'importance nouvelle que revêtent le marketing et la stratégie pour les transporteurs.

5.1 La déréglementation: un changement radical d'orientation stratégique La réforme réglementaire apparaît comme une discontinuité majeure dans l'environnement de l'industrie du camionnage qui force les entreprises à revoir leur mode de penser. Elle oblige celles qui veulent demeu-rer compétitives à effectuer un tournant décisif dans leur formulation stratégique. Un tel bouleversement

constitue un changement radical. D'ailleurs Marcus (1985) affirme que l'on porte maintenant une plus grande attention au marketing, au contrôle des coûts et à l'efficience de la production, ce qui remplace l'attention qui avait été consacrée à la réglementation et aux relations publiques. La planification à long terme et les concepts innovateurs de taux et service sont devenus des éléments importants pour survivre dans un environnement déréglementé.

Un changement aussi radical est très difficile à effectuer car très souvent, et c'est le cas dans l'étude qui nous préoccupe, il demande un profond changement dans la mentalité, dans la façon de percevoir le marché, donc un changement de culture de l'entreprise.

Statter (1983) voit dans cette situation un changement de philosiphie de gestion du marketing. Les transporteurs passent de l'orientation production, où l'on se préoccupe de la réglementation et des opérations, à une orientation marketing où l'on s'intéresse aux besoins des clients. En effet, on peut concevoir l'optique production comme une orientation de gestion basée sur l'hypothèse que les clients préfèrent les produits disponibles et abordables. La tâche essentielle de la direction est donc d'améliorer continuellement le processus de production, alors que l'optique marketing préconise qu'une organisation atteigne ses objectifs en déterminant les besoins et les désirs des marchés cibles, et en s'organisant en vue de satisfaire ces souhaits de façon plus efficace et rentable que ses concurrents (Kotter, McDougall et Picard, 1983).

C'est ce tournant que doit entreprendre l'industrie du camionnage. La planification stratégique et le marketing sont les deux outils qui peuvent aider les transporteurs à relever ce défi.

5.2 L'importance de la planification stratégique et du marketing

Les stratégies développées par Porter (1985) peuvent constituer un cadre théorique intéressant pour étudier les différentes stratégies dont disposent les transporteurs. Porter présente trois types de stratégies génériques: la différenciation, la stratégie d'avantage de coûts et la stratégie de focus.

La différenciation consiste pour une firme à acquérir une caractéristique unique (que ne possèdent pas ses concurrents) à laquelle les clients attachent de la valeur. Cette différenciation peut être technique et/ou symbolique (reliée à l'image par exemple). Pour sa part, la stratégie d'avantage de coûts réfère à la possibilité pour une entreprise de réaliser des profits supérieurs à ses concurrents parce qu'elle dispose des coûts les plus bas. Finalement, la stratégie de focus consiste à se concentrer sur un segment très restreint du marché et à y trouver une niche.

Corsi, Grimm et Smith (1986) se sont penchés sur l'utilisation et l'opérationnalisation des deux premières stratégies de Porter dans le monde du camionnage depuis 1980. Chez les firmes qui optent pour une stratégie de différenciation, on remarque une augmentation sensible des dépenses en commissions aux vendeurs, en publicité et en

communication, par rapport aux dépenses d'opération. Certaines entreprises vont même jusqu'à doubler leur budget de publicité. Elles tentent donc d'avoir du succès en misant sur le marketing et sur le service à la clientèle. D'autre part, les firmes suivant la stratégie d'avantage de coûts utilisent les actifs de façon plus intensive et réduisent les fais d'assurance et de sécurité. Elles mettent l'accent non plus sur l'accroissement du volume mais bien sur le profit.

Les possibilités de segmentation du marché On peut supposer que tous les expéditeurs n'ont pas les mêmes besoins ni les mêmes attentes en matière de transport. Les transporteurs ne doivent donc pas envisager leur marché d'une façon uniforme. C'est pourquoi il est utile de segmenter le marché.

Traditionnellement, la segmentation en transport routier reposait sur des bases géographiques et le terminal était considéré comme l'unité stratégique (SBU). Cependant, depuis 1980, de nombreux chercheurs ont tenté de découvrir de nouvelles façons de diviser la population des acheteurs, plus appropriées au domaine du transport routier. Certains modèles sont très simples alors que d'autres sont plus complexes, comportant plusieurs variables.

Walters (1985) offre une alternative à la segmentation géographique en regroupant les clients selon la valeur de leurs produits, la taille de la firme, l'attitude et les besoins des expéditeurs, le type d'industrie, etc. Ensuite, ayant choisi le type de segmentation le plus approprié pour son entreprise, le gestionnaire développe une stratégie propre à chacune des unités stratégiques (ou terminal). Finalement, on alloue les ressources humaines à chaque terminal en fonction du volume de clients qu'il dessert. L'auteur souligne que l'information externe, telles les études de marché et l'évaluation de la concurrence, est essentielle à l'évaluation des performances de la firme. Pourtant, il semble que jusqu'à maintenant, les entreprises de transport aient négligé l'information externe au profit de l'information interne (rapports financiers) qui elle, fournit seulement des renseignements a posteriori alors qu'il est souvent beaucoup trop tard pour réagir.

Wickoff, Tardiff et Johnson (1982) utilisent un modèle logit pour déterminer si les caractéristiques des produits (marchandises en vrac et liquide en vrac) influencent la sensibilité au prix et au service. Cette méthodologie permettant d'illustrer les compromis que doivent faire les expéditeurs s'est révélée concluante et confirme la présence de segments de marché distincts. Donc, les poids relatifs attribués aux caractéristiques du service et au prix diffèrent dans chacun de ces segments.

Dans la même veine, McGee et Carlock (1982) ont étudié comment l'importance des coûts de transport par rapport au prix de vente du produit influence la sensibilité au prix et au service. En fait, les entreprises fabriquant des types de produits où les coûts de transport représentent une faible proportion du prix de vente sont plus

sensibles au service, et au contraire, celles dont les produits impliquent des coûts de transports très élevés par rapport au prix de vente seront très sensibles au tarif. De même, le choix du mode de transport dépend de cette sensibilité. Les entreprises ayant des coûts de transport élevés se tournent de plus en plus vers le transport de camionnage public alors que celles ayant de faibles coûts de transport se dotent plutôt d'une flotte privée ou font appel à des transporteurs à contrat. On peut conclure que les firmes de camionnage public peuvent segmenter par rapport à cette sensibilité au prix et au service.

Ross (1983) propose une segmentation plus sophistiquée, reposant sur trois dimensions: les exigences de l'expéditeur (politiques d'achat, niveau de service, importance du tarif), les caractéristiques de l'envoi (TL, LTL, petit colis) et les caractéristiques du mouvement (local, régional, national, international). La stratégie suggérée consiste à aggréger certains de ces facteurs pour arriver à de vrais segments de marché, dans le but d'offrir à chaque segment déterminé le bon service au bon prix et au bon moment. Un transporteur pourrait, par exemple, décider de desservir le segment LTL, local et régional, exigeant des tarifs moyens mais en lui offrant un service exceptionnel. L'auteur croit que les efforts promotionnels et la publicité sont les voies à suivre pour se différencier et réussir dans l'industrie vu le caractère intangible du service offert.

Plus récemment encore, Bigras et Roy (1989) ont étudié le marché du LTL au Québec en utilisant une approche sectorielle grâce à laquelle ils ont pu démontrer l'existence de comportements fort différents chez les expéditeurs selon le secteur industriel auquel ils appartiennent; i.e. meubles, pièces d'automobiles, alimentation, textile ou pharmaceutique.

Le développement de nouveaux services Une autre stratégie possible relevée par Anderson et Probst (1986) consiste à travailler en étroite relation avec les expéditeurs pour leur offrir des services à leur mesure et, dans certains cas, aller jusqu'à fournir des services complets de distribution pour répondre à la demande de clients plus exigeants. Les pratiques innovatrices développées par les transporteurs sont: l'assemblage et la distribution (a & d), le contrat de logistique et le service d'information logistique.

L'assemblage et la distritution réfèrent à la cueillette de marchandises provenant de plusieurs fournisseurs, ou plusieurs terminus, pour un seul client. Cette pratique est particulièrement attrayante pour les expéditeurs régionaux opérant dans un environnement "just-in-time". Leurs opérations d'approvisionnement et de réception sont ainsi facilitées.

Fortement utilisé en Europe, le contrat de logistique, se définit comme l'utilisation d'une tierce partie qui exécute les fonctions de distribution (transport, manutention, réseau d'information, contrôle d'inventaire) en totalité ou en partie. C'est la délégation de la fonction distribution au transporteur.

Le service d'information logistique, offert par certains courtiers et firmes de transport, est un système de réseaux informatisés permettant au client d'avoir accès directement à toutes sortes d'informations, telles le repérage des expéditions, la facturation et les paiements automatiques, les estimations de temps d'envoi, etc.

Le développement de ces nouveaux services démontre vraiment une orientation vers le marché et constitue une autre forme de différenciation car souvent ces services ne sont pas encore disponibles chez les concurrents.

5.3 Synthèse sur l'adaptation des transporteurs aux nouvelles règles du jeu Voici les principales constatations concernant l'adaptation des transporteurs au nouveau contexte concurrentiel. Ces nouvelles orientations leur permettront de prospérer et d'établir une nouvelle relation avec le client:
- un changement de philosophie de gestion: d'une orientation vers la réglementation et la production à une orientation vers le marché;
- le développement de stratégies générales telles la différenciation et l'avantage de coûts;
- de nouvelles façons de segmenter le marché des acheteurs de services de transport. On s'aperçoit que la segmentation géographique n'est pas idéale;
- l'offre de nouveaux services aux clients tels l'assemblage et la distribution, les contrats de logistique et les services d'information. Ces développements sont une prise en charge partielle ou complète de la fonction distribution du client.

En conclusion, les stratégies démontrent toutes une plus grande orientation vers la satisfaction du client. Alors que certaines approches sont des raffinements de stratégies classiques, d'autres sont très innovatrices voire inusitées et s'adressent plus précisément aux entreprises de transport.

6. CONCLUSION Dans ce texte, nous avons cherché à résumer comment, dans la dernière décennie, les effets de la déréglementation américaine du transport routier des marchandises ont été ressentis par les transporteurs et expéditeurs canadiens. Nous avons ainsi observé l'émergence d'une nouvelle relation entre transporteurs et expéditeurs, ces derniers accordant beaucoup plus d'importance à la saine gestion de leurs activités logistiques. De leur côté, les transporteurs doivent évoluer dans un environnement plus concurrentiel et apprendre à satisfaire les besoins de leur clientèle de façon plus sélective.

Avec la récente harmonisation de la réglementation canadienne avec celle des Etats-Unis et compte tenu de l'entente de libre-échange intervenue entre ces deux pays, il sera de plus en plus intéressant d'observer l'évolution de l'industrie canadienne du transport routier des marchandises et de proposer des axes de développement permettant d'assurer sa pérennité.

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Globalization of the Airline Industry and Implications for Canada*

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I. Introduction

In the mid 1980's, a wave of mergers swept the U.S. airline industry, resulting in the formation of roughly eight "mega" carriers.[1] Shortly thereafter, consolidation came to Canada resulting in a duopoly consisting of Air Canada and Canadian Airlines International Limited (CAIL). Some consolidation is also taking place in Europe, with the merger of British Caledonian into British Airways, and the proposed acquisition of Air Inter and UTA by Air France. BA and Air France now join what had been an exclusively American $7 billion club.

The question now is whether this consolidation movement will cross international borders. Will truly global carrier systems emerge? If globalization does come, what form will it take? Will there be outright mergers, or will the consolidation take the form of strong or weak carrier alliances? This paper addresses these questions. To do so, it starts out with a discussion of the forces which give rise to pressures for the industry to consolidate. Next, it posits three forms which globalization could take: simple carrier alliances, strong carrier alliances using equity positions, and outright merger. Finally, the paper provides some observations of recent developments and draws conclusions.

The paper finds that cost advantages are not strong enough to give rise to consolidation, but that there are strong demand side forces which could. These include the higher value consumers place on same carrier service, information cost savings, and the powerful effect of frequent flyer programs (if allowed to spread outside of North America). Currently, there are legal and political obstacles to outright merger of carriers of different countries. Simple carrier alliances are too volatile to justify the investments needed to bring to market the advantages of a truly global carrier. Therefore, at least in the next few years, "globalization" is most likely to take the form of strong carrier alliances involving minority equity positions. This is somewhat akin to the domestic carrier networks built by trunk carriers taking equity positions in "affiliated" regional airlines.

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[1]These are United ($8.8), American ($8.6), Texas Air ($8.4), Delta ($7.4), Northwest ($5.6), Federal Express ($5.6), US Air ($5.2) and TWA ($4.4). Pan Am ($3.6) might also be included. Figures in parenthesis are 1988 revenues in billions of U.S. dollars. Source is ATA(1989).

II. What is a "Global" Carrier?[2]

Before one can discuss globalization of the airline industry, the concept of a global carrier must be defined. some carriers provide services on many continents, and might even completely circumnavigate the globe. Most of these are *international carriers*. They carry passengers between countries, but most of their customers originate from the carrier's home base. Some carriers, Pan Am for example, may have fifth freedom rights allowing them to transport passengers between "foreign" countries. But again, if the passengers they carry are largely from the home country, perhaps they should not be considered global carriers. In this paper, the term international carrier will be used.

A few carriers go a step beyond in that they may primarily transport patrons from countries other than their home base. These are the *sixth freedom carriers*. They fly passengers from one "foreign" country to another via their home base. The Netherland's KLM is a good example. Its' home population is small, but by developing sixth freedom routes, it has been able to build a formidable traffic base. An example from the Asia Pacific region is Singapore Airlines.

An important aspect of the operation of a sixth freedom carrier is that it is hub and spoke. However, the operation is of a single hub. Single hubs have a good ability to provide feed traffic into the system from medium and sometimes small communities which are short air distances from the hub. However, the further one gets from the hub, the more likely it is that the carrier is transporting point-to-point passengers. KLM may be effective in obtaining a share of Vancouver originating passengers going to Europe (or beyond). But it is not likely to pick up feed traffic to Vancouver. Its Vancouver competitor, CAIL, is more likely to pick up feed from say Kelowna, B.C., bring it to Vancouver, and keep it on-line for the long haul to Europe. Passengers going beyond a CAIL European station would then connect to another carrier, with no particular carrier having a pronounced advantage in obtaining CAIL's "feed." Thus, sixth freedom carriers will tend to rely on point-to-point traffic the further a station is from its home base hub.

In this paper, the term *global carrier* is reserved for an airline which can gather feed traffic from many points throughout the world, and channel that feed onto its long haul routes. Such a carrier would have the ability to carry on-line a passenger from origin to destination for a large portion of the world. An analogy with the U.S. domestic market may help clarify the concepts. A single hub carrier would be the domestic equivalent of a sixth freedom carrier. US Air's pre-merger single hub (Pittsburgh) operation would be an example.[3] A full coverage multiple hub carrier like American Airlines would be the domestic equivalent of a global carrier.[4] American has the ability to take a passenger from an awesome number of places in the U.S. and keep him/her on-line to the ultimate U.S. destination.

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[2]Mr. Jim Tennant of Air Canada provided many useful observations on this subject, during his stay as executive in residence at UBC.

[3]US Air subsequently developed other hubs and acquired hubs via acquisition of Piedmont and PSA.

[4]American operator hubs in Chicago (East-West northern tier), Dallas-Fort Worth (East-West southern tier), Raleigh-Durham (North-South east coast), Nashville (North-South midwest), and San Jose (North-South west coast). In addition it has a Caribbean hub in San Juan, and a developing hub in Miami which could feed the South American route system it hopes to purchase from Eastern Airlines.

At present, no true global carriers exist in the world, although much talk has been heard recently about their potential emergence. This paper examines whether there are forces which may give rise to these carriers, and what form the carriers may take. First, the "consolidation" forces which would drive globalization are discussed.

III. Forces Leading to Consolidation

Economies of Scale: Network Size Versus Traffic Density

White (1979) surveyed all major studies of the nature of airline costs and concluded that "economies of scale are negligible or non-existent at the overall firm level." Why, then, has the recent wave of airline mergers occurred in both the US and Canada? The first reason is that a simple manufacturing industry concept of economies of scale is inadequate for modelling the relationship between inputs and outputs in this network-oriented service industry. Second, costs alone do not determine market structure. Demand is also relevant, and there are several aspects of demand that favour larger carriers.

Caves, Christensen and Tretheway (1984) distinguish between airline economies of traffic density and economies of firm size. Under the latter output is expanded by adding points to the network; under the former output expands by increasing service within a given network (set of points served). Gillen, Oum and Tretheway (1986) applied this concept to Canadian airlines, and developed it further by distinguishing between different types of airline traffic (scheduled, charter, freight). These and studies of other airlines[5] reach a common set of conclusions. Roughly constant returns to firm or network size exist for rather broad ranges of airline traffic. That is, adding or dropping cities from an airline's network does not raise or lower unit cost. In contrast, sizeable economies of traffic density seem to exist up to fairly large volumes of traffic. That is, adding more flights or more seats per flight on a given route will result in lower "per seat" costs. However, once the minimum efficient traffic density level is reached, the curve is flat over a wide range, indicating that there are no more gains associated with greater density.

Demand Side Forces Favourite Large Carriers

Market equilibrium and therefore market structure is determined by the interaction of both supply (i.e. costs/production) and demand. In airline markets there are demand forces such that consumers prefer large airlines over small ones, all other factors such as prices being the same. In this context, large airlines mean those that serve a large number of points. Some of these forces have been present for some time, while others have been stimulated by marketing practices introduced since deregulation.

In practice, there are at least three reasons why consumers prefer large airlines. One reason is due to information costs. A traveller knows that a large carrier can get him or her to just about anywhere in the country, while smaller carriers serve only a limited number of communities. Travel agents act as intermediaries for the consumer, but even here large network airlines have an edge, such as when an agent in one region needs to book flights in other regions.

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[5]See, for example, studies of international airlines in Tretheway (1984) and Caves, Christensen, Tretheway and Windle (1987).

A second reason consumers favour large airlines is attributable to the higher quality of service these airlines offer. If connections must be made, less of the traveller's time will be required with a single airline than when the trip involves switching airlines because single airline flight connections are more likely to be timed to minimize waiting time at intermediate points (hubs).[6] Consumers are also aware that there is a lower probability of baggage being lost or delayed with a single airline, as well as a higher probability that the same airline's outbound flight would be held for a traveller on a delayed inbound flight.

The third factor causing consumers to favour larger over smaller carriers is the existence of frequent flyer programs. These programs reward the *individual* for patronizing a single carrier (even though the fare for business travellers may be paid by their employers). It is much easier to accumulate points with an airline that flies to a large number of destinations.[7]

Conclusion

In sum, there are natural market forces favouring large airlines in spite of evidence of constant returns to "scale." These are economies of traffic density, and in addition, the demand side factors such as information costs, higher quality travel and reward programs inducing consumers to favour large over small airlines. It appears that economies of traffic density can be fully exploited by an airline the size of CAIL, and thus those traffic economies will not drive the industry to globalize. However, the marketing factors such as information costs and frequent flyer programs could be sufficient to give rise to global network building.

There are three keys to whether or not a global carrier would have an advantage over the present system for moving a passenger from origin to destination. The first is whether the global carrier can operate with significantly lower *costs* and thus sustain lower prices in the long run. Thus far the evidence seems to suggest this will not be the case. The second is whether passengers will be offered more convenient *service*. Here, a properly operated global carrier could offer some advantages. By coordinating flight schedules, passenger ground time for connections might be reduced. A key to a convenient operation will be ease of changing flights, including all the challenges of moving from one gate to another, passing through customs, no requirement for the passenger to retrieve and re-check baggage, etc. Also related here, is a requirement that the global carrier offer a minimum of backtracking or circuitous routing, in order to minimize travel times for the customer.

The third key to the success of a truly global carrier depends on building *customer loyalty*. A global carrier needs a tool to insure that a customer will choose it for all air travel, even if routings may be a bit circuitous at times. Perhaps one way to build loyalty is via superior service. However, the U.S. experience with frequent flyer programs have shown the power of rewarding the passenger for loyalty. If carriers are thwarted in spreading frequent flyer programs worldwide, or if they are unable to design other loyalty inducing rewards, then perhaps globalization will never come about. However, a carrier which invents the right formula in this regard could reap enormous advantages and profits. The next section discusses what forms global carrier building could take.

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[6]Using the results of Carlton, Landes and Posner (1980), the value of an on-line connection to travellers can be estimated to be about $31 (1989 Canadian dollars).

[7]See Tretheway (1989) for a discussion of the potential anti-competitive effects of frequent flyer programs.

IV. Three Levels of Global Network Building

What form would consolidation take in this industry? This paper identifies three potential strategies. At one extreme carriers from different countries merge outright with a single surviving corporate identity. At the other extreme, carriers keep their unique identities but use simple marketing agreements to coordinate traffic flows. In between, there is a stronger form of marketing agreement, solidified with an equity position but not merger. Each of these is discussed in turn.

A. Corporate Merger

The most obvious way to build a global network is to buy airlines in various countries, and merge them into a single corporate entity. Some precedent exists for such multinational airlines. SAS is owned by government and private interests in Denmark, Norway and Sweden.[8] Air Afrique services 12 countries in Western Africa. While a few other examples can be found, all involve pooling the traffic generating ability of small countries within a close geographic region. Some attempt has been made by airlines to purchase airlines of other countries. SAS, for example, bid for British Caledonian as well as Aerolineas Argentinas, but was unsuccessful in both attempts.

From an operational point of view, outright merger is the most desirable form of consolidation. It allows full advantage to be taken of fleet and crew utilization possibilities, amasses purchasing and borrowing power, allows the adoption of a single consumer identity, etc. Mergers, however, meet with many political obstacles. For example, Canada and the United States have laws limiting foreign ownership of their respective carriers to 25%. For many countries, national identity is tied to the existence of a "flag" carrier. Many high skill managerial and technical jobs are linked to the city with the corporate headquarters. A merger could transfer such jobs from one country to another.

For these and similar reasons, it is hard to envision outright mergers taking place, at least at present. Would the French government allow Air France to disappear by being swallowed up by Texas Air Corp, Lufthansa, or Japan Air Lines? While global merger may be attractive from the airline managers' point of view, it seems to be an idea whose time has not yet come. Next, the other extreme case, that of simple carrier alliances, will be discussed.

B. Simple Carrier Alliances

Simple carrier alliances involve "marketing agreements" between carriers of different countries for preferential exchange of traffic. Air Canada, for example, may sign an agreement with Cathay Pacific whereby it books Canadian travellers going to various Asia Pacific destinations on Cathay. Similarly, Cathay books passengers going to destinations east of Vancouver on Air Canada flights. Both carriers may gain traffic which would have gone to rival Canadian Airlines International Ltd. (CAIL) who serves both domestic Canada and the Asia-Pacific region.

Marketing agreements may go further than this, specifying code sharing or frequent flyer participation. A travel agent in Seattle, for example, will see a British Airways flight

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[8]Each country also has its own domestic carrier.

to London listed on the Computer Reservation System (CRS). In fact it consists of a United Airlines flight from Seattle to Chicago (using BA's CRS code), connecting to a BA flight to London. United has no Chicago-London rights and BA has no flights to Seattle. By being listed via code sharing as a single airline service, the flight will appear in the CRS display with a higher priority. In addition a United Airlines patron may prefer this "BA" flight if it earns United frequent flyer award credits for the entire journey.

While carrier agreements undoubtedly are effective marketing tools, they are limited in being easy to cancel. BA could easily switch to another carrier to provide feed to its Chicago-London flight. United could win rights to fly the route as well. A parallel for this volatility existed with the U.S. feeder carriers in the immediate post-deregulation years. Some trunk carriers lined up feeder service at various hubs, only to see the feeder switch its allegiance to a different trunk. The trunk carriers needed to stabilize their feeder arrangements, and they did so by taking equity positions in the smaller carriers.

C. Strong Airline Alliances Involving Equity Swaps

This strategy might be referred to as the "strong alliance" option. Carriers of different countries maintain their own corporate identity, but they are affiliated in order to provide a global service network. In order to take advantage of the potential of the global network, the component carriers will need to engage in much coordination of their marketing efforts. This will include routing decisions, schedule timing, the establishment of joint fares, code sharing in CRS data bases, common frequent flyer programs (where allowed), some coordination of dynamic seat management decisions,[9] etc. There could also be coordination on the cost side, with joint purchasing of fuel, catering services, and possibly aircraft. Ground services would be rationalized. In order to take advantage of these benefits, the carriers will need to make substantial investments, or to reluctantly give up some previous functions (or routes) to the other carrier. Such undertakings are not easily made, and can only be justified when a strong commitment is given by all parties.

A logical form for this commitment involves an equity stake of one carrier in another, or possible mutual equity stakes. There is precedence for this in the relationship between a trunk carrier and its turboprop feeder carriers. After experiencing problems in the early 1980's with feeder carriers changing which trunk they were affiliated with, the trunks took minority equity stakes in their feeders in order to make the relationship more permanent. In many cases, the more permanent relationship resulted in substantial investment and expansion by the regional carrier. The same procedure could be employed for alliances between trunk carriers of different countries. In some cases, it may be logical for the affiliated carriers to take equity stakes in each other. The intent of these equity positions is not so much for one airline to control another (which may not be permitted by one or both countries), but rather to solidify an operating relationship.

Before leaving this section, it should be pointed out that many of the benefits from building a global network depend on information systems (e.g., seat management, frequent flyer programs, establishment of joint fares, etc.). The core of all of these airline information technologies is increasingly becoming the computer reservation system (CRS). This suggests that affiliated carriers will all need to share the same CRS system. When this argument is carried to its most extreme, it suggests that global carrier networks will

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[9]For a description of airline seat management, see Kraft, Oum and Tretheway (1986).

be built around the existing CRS systems.[10] Since both of Canada's airlines use the Covia system, does this imply that one but not the other will become part of a global carrier network?

V. Recent Developments

SAS was one of the earliest carriers to talk about and attempt globalization. In 1986 it proposed a merger with Sabena Belgian. After this was rejected, it bid in 1987 for part ownership in British Caledonian, but lost out to British Airways which offered and got complete ownership. SAS was successful in 1988 in purchasing a non-controlling 9.9% stake in Texas Air Corp. and 24.9% of Airlines of Britain. In 1989, SAS and Swissair agreed to a 5% to 10% equity swap, and SAS signed marketing agreements with All Nippon, CAIL, Finnair and Lan Chile.

In 1989, British Airways and KLM each purchased 20% of Sabena Belgian, with the latter changing its name to Sabena World. KLM has also purchased 14.9% of Air UK, and 25% of Northwest. The U.S. ordered KLM to reduce its holding in Northwest, fearing that KLM's financing of other owners of Northwest could lead it to exert ,control. During 1989, British Airways was part of a consortium attempting to acquire United Airlines. That bid was rejected, although it has indicated it may make another attempt.

In the Pacific, Ansett owns 25% of America West as well as stakes in several small South Pacific Airlines. Japan Air Lines (7.5%), Quantas (20%) and American (7.5%) purchased a total of 35% of Air New Zealand. JAL also owns, for the present, 20% of Hawaiian Airlines.

In addition to these equity purchases, scores of simple airline marketing agreements have been signed. CAIL alone has simple alliances with JAL, Lufthansa, Alitalia, Midway, Air France, SAS and Aeroflot.

It seems unreasonable that a North American carrier will build a network involving several Western European carriers. A more sensible and profitable arrangement would likely involve a single European carrier, so the airlines can gather traffic from their respective continents and feed it to the other. SAS claims that its arrangement with Texas Air's Continental Airlines has already boosted its trans-Atlantic traffic by 28%.[11] Continental has benefited from SAS's experience in providing high quality passenger service with the establishment of the SAS/Texas Air Quality Service Institute.[12]

While current industry alliance building activity may seem confusing, and in a few cases illogical, there is a clear trend toward forging some kind of airline alliances. Nevertheless, carriers seem to be not sure what form globalization will eventually take or who the most valuable partners will be. Thus, current activities might best be described as jockeying for position while sorting out what is possible, what will work and what won't.

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[10]The major North American systems are American Airlines' Sabre system, United Airlines Covia CRS, Texas Air's SystemOne, and the proposed amalgamation of the TWA/Northwest PARS CRS with Delta's Soda system.

[11]See Business Week, 27 November 1989, p. 142.

[12]See Business Week, 31 July 1989, p.36.

While there is much uncertainty about the form globalization will take, it goes without saying that the first to *successfully* build global networks will reap the highest awards. The analogy of Canada's Wardair being locked out of the feeder traffic markets when Air Canada and CAIL tied up all the major regional carriers, should not be lost in the globalization race. If there are strong forces driving international consolidation, then eventually all major carriers will be aligned in a global network, and these networks will be roughly equally profitable. The high returns are transitory, and only the first will earn them.

VI. Implications for Canada

If globalization takes place in the industry, how would Canada fare? To answer this, one must distinguish between effects on Canadian consumers versus effects on Canadian carriers. If globalization unleashes additional competitive forces, then it could have a positive effect on consumers, through lower prices, more convenient services, etc. However, this simple answer must be tempered with the potential of consolidation to step away from competitive outcomes and move in the direction of monopolistic results.

At the present, the effect on Canadian carriers does not seem to bode well. Neither Air Canada nor Canadian are close to joining the $7 billion club, much less having the resources necessary to build a global carrier.[13] Their choices will likely be ones of "going it alone" or joining someone else's global network.

In order to be attached to a global network a Canadian airline needs to look at what it can bring to the bargaining table. Canada's airports, as presently operated, are not attractive for the role of exchanging non-Canadian traffic. In-transit facilities are limited at best, and offer almost no amenities, shopping opportunities or rest facilities. U.S. bound travellers must pre-clear U.S. customs in Canada, thus inconveniencing the passenger with the burden of fetching baggage, clearing customs, and re-checking it. Canada also offers some inconvenient routings. For example, Asian originating passengers travelling to South America must fly to Vancouver, then to Toronto and finally down to South America. Development of a Japan-Toronto route would greatly help, or as an alternative, connecting South America to Vancouver. Both of these, however, press the capabilities of existing aircraft, making it difficult to compete with the power of Los Angeles.

In the global scheme, Canada is of less value as a market, compared to the U.S. Access to the U.S. should be a strength a Canadian airline could bring to the bargaining table. Unfortunately, Canadian access to the U.S. is limited. The current Canada-US bilateral is restrictive.[14] Key U.S. markets, such as Washington, D.C. and Denver, are not connected. Clearly, free trade in airline services between Canada and the U.S. would be an asset for Canadian airlines, although one which has a price in bringing in domestic competition from U.S. megacarriers. Nevertheless, a Canadian carrier does bring to the bargaining table the *potential* to access the important U.S. market.

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[13]The option of merging the two carriers together in order to compete globally would have such undesirable domestic policy implications that it is not considered here.

[14]See Dresner, Hadrovic and Tretheway (1988) for a discussion of the Canada-U.S. bilateral air treaty.

If Canada does develop better access to the U.S., then it would have a bit of an advantage in offering direct service from Asia or Europe with no backtracking. Canada lies on the great circle air routes. Passengers could change planes in Canada enroute to the U.S., rather than at some point inside the U.S. with several customers backtracking to ultimate destinations.

Canada also has some underutilized airports which will become increasingly attractive as congestion worsens. Although not appreciated over the past two decades, Montreal's Mirabel airport has great potential in this role. It has virtually the only landbank for airport development anywhere in the Northeastern part of North America. Over the next 25 years, the white elephant could become white gold.

While Canada's value in a global network may seem limited in the immediate moment, problems should be viewed as opportunities. There is a need for a new Canadian policy for international air services, a policy which considers the opportunities and challenges of airline globalization. At the core of this new policy must lie improved access to the U.S. market, and a better in-transit system for our airports. Montreal, Vancouver and Toronto, with their base population in the millions, have the potential to play critical roles in a global carrier network. Capacity at the latter two will be an important determinant in Canada's global opportunities. Other airports on the major great circle airways, such as Edmonton or Halifax, may also provide opportunities.

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U.S. AIRLINE PERFORMANCE FROM 1978 TO 1988: THE BRIDGE FROM REGULATION TO DEREGULATION

by

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Introduction

The enactment of the Airline Deregulation Act (ADA) in the United States on October 24, 1978, set in motion fundamental changes in the legal environment in which U.S. airlines operate.[1] While the legislative process to enact this law took approximately four years, the economic adjustments following its enactment have taken even longer.[2] More than eleven years have now passed since the economic process of deregulation began, and data are presently available through 1988 -- ten full years since the introduction of deregulation.

Airline deregulation came to Canada much later than the U.S. Even though regulation was liberalized by ministerial policy on May 10, 1984, formal deregulation was not enacted until mid-1987, with Royal Assent being given to the National Transportation Act (NTA) on August 28, 1987, to become effective January 1, 1988.[3] Thus, Canadian airlines continued to operate under economic regulation for nine years after the U.S. airlines began their adjustments to deregulation. As such, the performance of the regulated Canadian carriers provide a basis for measuring the effects of deregulation on the performance of U.S. carriers during the early years of deregulation.[4]

This paper will provide evidence on how deregulation has affected U.S. airlines during this first decade by comparing the performance of U.S. airlines with that of Canadian airlines. The topics to be covered in the limited space available will be the effects of deregulation on entry, exit and the number of airlines in existence, traffic growth, and changes in average fares.

Entry

During 40 years of regulation from 1938 through 1978, the U.S. Civil Aeronautics Board (CAB) allowed 16 trunk, 21 local service, one Alaskan and two Hawaiian carriers to operate scheduled interstate passenger service with large aircraft. By 1978, only 23 of those 40 original carriers were still operating, with most of the attrition occurring through a series of mergers in the postwar years.[5]

Table 1 shows that, in sharp contrast to the regulated years, at least 70 new airlines operating jet aircraft introduced scheduled interstate passenger service between 1978 and 1988. Ten of these airlines were existing intrastate, supplemental or all-cargo carriers that simply expanded their formerly restricted services in 1978-82, mainly under the early CAB policy which allowed any airline to operate in city pairs where nonstop service was not being provided by the incumbent certificated carrier(s). The remaining 60 carriers, however, were brand-new airlines that entered primarily between 1981 and 1986, with the 17 carriers that entered in 1984 making it the peak year.[6]

The Canadian airline experience supports the conclusion that regulation severely restricts entry. Between 1938 and 1978, the various Canadian regulatory agencies allowed only Air Canada and, eventually, CP Air to be national carriers. Then, starting in 1966, five regional carriers were allowed to operate scheduled passenger service with two-engine jet aircraft, making a total of seven jet operators in 1978.[7] This was similar to the U.S. experience under regulation. In the years after 1978, the Canadian Transport Commission (CTC) continued its restrictive policy and authorized no new entry into scheduled passenger operations with jet aircraft prior to the policy liberalization in May 1984. Table 1 shows that between 1978 and 1984, the entry score was 53 new carriers for U.S. deregulation versus zero for Canadian regulation.

Things changed a bit starting in August 1984. In that month, under the liberalized policy direction, the CTC authorized Wardair to provide scheduled service between Toronto and San Juan, Puerto Rico.[8] The following May it authorized Wardair to provide scheduled service between Canada and the United Kingdom, and scheduled domestic service was authorized in March 1986.[9] The San Juan and U.K. services were inaugurated in November and December 1985, followed by domestic service in May 1986.[10] Three other carriers were allowed to begin limited scheduled jet service in 1986 -- Nationair between Hamilton-U.K. and Mirabel-Brussels; First Air between Ottawa-Iqaluit; and Norcanair between Regina/Saskatoon-Minneapolis/St. Paul.[11] It wasn't until 1988, following deregulation in Southern Canada, that Air BC, Air Nova, Air Ontario and Northwest Territorial Airlines began operating jet aircraft in scheduled service.[12]

The above evidence is unambiguous with regards to entry. In both countries, regulation served to limit and often prohibit entry while, during the initial years of deregulation, large numbers of new airlines were able to enter and attempt to establish viable operations.

Table 1

Number of Airlines Entering, Leaving and in Existence
Canadian and U.S. Airlines Operating Jet Aircraft, 1978-88

Year	Number of Airlines			
			In Existence	
	Entering	Leaving	At Year End	During the Year
		A. U.S. Interstate		
1978	1	0	24	24
1979	9	3	30	33
1980	4	2	32	34
1981	6	2	36	38
1982	10	3	43	46
1983	6	3	46	49
1984	17	10	53	63
1985	9	12	50	62
1986	5	14	41	55
1987	2	12	31	43
1988	1	2	30	32
Total	70	63		
		B. Canadian		
1978	0	0	7	7
1979	0	1	6	7
1980	0	0	6	6
1981	0	0	6	6
1982	0	0	6	6
1983	0	0	6	6
1984	0	0	6	6
1985	1	0	7	7
1986	3	2	8	10
1987	0	1	7	8
1988	4	0	11	11
	8	4		

Sources: Statistics Canada, Air Carrier Operations in Canada, Cat. 51-002 (October-December 1978-88).
U.S. CAB/DOT, Air Carrier Traffic Statistics (December 1978-1988); and Form 41, Schedule T-1(a) for individual carriers (1978-88).

Exit

While entry serves to increase the number of carriers providing service, exit reduces that number, and it is the net inflow or outflow of carriers that determines the change in the total number of players in the industry during any given year. In addition to listing the 70 new U.S. carriers that entered the scheduled passenger industry, Table 1 shows that 63 carriers left the industry between 1979 and 1988. Not surprisingly, there was a lag between the peak period of entry during 1979-84 and the peak period of exit during 1984-87. The 63 departing carriers, however, did not come exclusively from the ranks of the new carriers. Of the 23 original certificated carriers operating in 1978, ten were no longer in existence by the end of 1988. Conversely, out of the 70 new airlines, 17 still provided scheduled passenger service at the end of 1988.[13] Overall, the transition from regulation to deregulation saw considerable change in the composition of the U.S. industry. There were winners and losers among both the original and the new carriers.

Exit from the scheduled passenger industry can occur in three ways -- merger into another carrier, transfer of operations to scheduled cargo or nonscheduled passenger/cargo operations, or the complete termination of operations, often through bankruptcy. Of the ten original certificated carriers who left the industry, eight merged with other carriers while two terminated through bankruptcy (the original Braniff and Wien). Mergers were proportionately less frequent among the new airlines. Only eleven of the 53 who terminated scheduled passenger service did so through merger.[14] Seven others merely transferred operations to all-cargo or nonscheduled service, and a few simply ceased operations and sold their assets in an orderly liquidation. The majority, however, went bankrupt. It is important to recognize that regardless of how exit occurred, it generally did not mean the destruction of assets. Even in the extreme case of bankruptcy, workers found employment elsewhere, while aircraft were sold to other carriers.

Canadian exit is also shown in Table 1 and, again, the contrast with the U.S. experience is unambiguous. Only four carriers left the industry between 1979 and 1987 -- all through mergers, the time-honored method of exit under deregulation.[15] While this is a large number relative to the seven original airlines in existence back in 1978, it is relevant that all but one of the mergers occurred after regulatory policy was liberalized in May 1984. It could be argued that these were preemptive moves on the part of the regulated carriers (learning from the U.S. experience) to eliminate the competitors that would be most capable of expanding following the introduction of deregulation.

The radically different experience with regards to entry and exit shown in Table 1 makes it clear that there was considerably more flux in the U.S. airline industry during the transition from

regulation to deregulation than in the Canadian industry which continued to operate under regulation. There has been a substantial decline in new entry in the U.S. since 1986, and much less exit since 1988. It remains to be seen if stability will characterize the U.S. industry in the future, or if a significant flow of airlines into and out of the industry will continue.

Number of Airlines in Existence

Table 1 also shows that the number of U.S. airlines operating in any given year increased substantially with the advent of deregulation, while in Canada the number of carriers changed very little under continued regulation. The peak period in the U.S. occurred in 1984 when 63 airlines provided scheduled passenger service with jet aircraft -- 40 more than the number providing such service in 1978. This clearly supports the predictions made during the Congressional hearings that deregulation would increase the number of airlines in existence, thereby increasing competition in the industry.

The decline from the 1984 peak, however, has been almost as rapid as the rise to that peak. By 1988, just 32 carriers provided service, and only 30 were in operation at year end. Since then, at least four additional carriers (new Braniff, Florida Express, Piedmont and Presidential) left the industry, leaving approximately 26 carriers to provide competition. This is not much greater than the original 23, albeit with major changes in the carriers comprising the industry.

Of course, the comparison should not be made with the 23 certificated carriers that existed at the end of 1978. That number was a marked decline from the 40 trunk, local service, Alaskan and Hawaiian carriers certificated by the CAB, and there is no doubt that there would have been further decreases as additional mergers occurred after 1978. Indeed, at the time the ADA was enacted the CAB was hearing two merger cases -- Pan American/National and North Central/Southern.[16] Both of these mergers were subsequently approved by the CAB, thereby reducing the number of original carriers to 21. The mergers of Hughes Airwest into Republic, and Texas International into Continental were also approved by the CAB in 1980-82. Whether these mergers were a result of deregulation or a continuation of a long-term trend under regulation, may be debated, but it seems likely the number of passenger carriers would have been less than 20 by 1988 had regulation continued. Thus, the 26 or so carriers operating as of early 1990 are a third to a half more than the number that would have existed had regulation continued.

In addition to the increased number of airlines in existence, the fact is that fares, routes and service levels were coordinated and controlled through CAB regulation, while, under deregulation, the present carriers are free to fly where they please in the U.S.,

at fares they chose to adopt and at service-quality levels they chose to provide. This implies that competition is indeed appreciably greater under deregulation than it would have been had regulation continued.

Traffic Growth

One way to measure the impact of deregulation on performance is to compare the growth in scheduled revenue passenger-miles (RPM) in the U.S. with that in Canada between 1978 and 1987. Table 2 lists these RPM by major carrier group for each country and, in addition, presents index numbers for total RPM showing overall traffic growth for the airlines of the two countries since 1978. In the U.S., scheduled RPM grew by 75.0 percent between 1978 and 1987. In contrast, under continued regulation, scheduled RPM in Canada grew only 37.8 percent -- just half the U.S. rate. This implies that consumers responded favorably to airline innovations and competition during the initial years of deregulation.

It is possible that the Canadian carriers' 18.7 percent increase in system RPM in 1988 (25.8 index numbers) was due in large part to the implementation of deregulation that year. Wardair provided substantial competition as it endeavored to become a major player in transcontinental and European routes, and four Level II carriers introduced service with jet aircraft that year. This large increase, compared to the 4.6 percent increase in RPM for the more mature U.S. carriers, is consistent with what would be expected from the initial implementation of deregulation. In any case, it certainly cannot be said that the introduction of deregulation had an adverse impact on Canadian traffic volumes.

Some historical perspective is provided by recognizing that the 1978 total U.S. RPM represented essentially the growth in passenger traffic for the large airlines over the entire 40 years of regulation between 1938 and 1978. Thus, the 75.0 percent increase in RPM during the first nine years of deregulation to 1987 corresponds to three-quarters of the RPM growth throughout the history of regulation.[17] Overall, it seems likely that by 1990 the RPM produced by the U.S. carriers operating jet aircraft will be double the 1978 level -- just 12 years following the introduction of deregulation. These figures provide some insights into why there have been airport congestion and air traffic control problems during the past decade.

Changes in Average Fares

A major prediction regarding the effects of deregulation was that lower airline fares would result. The great expansion in the use of discount fares since 1978 is one indication that fares paid by many travelers are lower under deregulation, but regular economy, business and first-class fares may be higher.[18] The complexity of the present-day fare structure makes it infeasible to

Table 2

System Scheduled Revenue Passenger-Miles
Canadian and U.S. Airlines Operating Jet Aircraft
by Carrier Group, 1978-88

Year	Scheduled Revenue Passenger-Miles (000)				Total RPM Index No. (1978=100)
	Trunk or National	LS/AH or Regional	New	Total	
			A. U.S. Airlines		
1978	208,252,317	18,341,853	4,545,613	231,141,783	100.0
1979	233,657,887	21,954,204	6,370,688	261,982,779	113.3
1980	221,206,069	23,663,524	9,773,670	254,643,263	110.2
1981	206,628,594	26,059,247	15,501,555	248,189,396	107.4
1982	209,407,981	29,406,736	20,382,887	259,197,604	112.1
1983	224,654,529	31,299,143	25,714,947	281,668,619	121.9
1984	235,594,863	33,441,377	36,601,293	305,637,533	132.2
1985	257,176,859	39,664,141	39,764,599	336,605,599	145.6
1986	282,779,367	41,506,830	42,259,658	366,545,855	158.6
1987	343,679,866	30,798,227	30,056,792	404,534,885	175.0
1988	358,877,550	37,384,679	27,039,330	423,301,559	183.1
			B. Canadian Airlines		
1978	16,757,940	1,432,697	-	18,190,637	100.0
1979	19,607,567	1,701,782	-	21,309,349	117.1
1980	20,556,366	1,905,154	-	22,461,520	123.5
1981	19,966,442	1,999,153	-	21,965,595	120.8
1982	18,294,017	1,648,809	-	19,942,826	109.6
1983	17,885,357	1,599,621	-	19,484,978	107.1
1984	19,404,556	1,787,238	-	21,191,794	116.5
1985	20,103,063	2,114,966	42,812	22,260,841	122.4
1986	20,457,527	2,287,068	1,556,001	24,300,596	133.6
1987	21,374,880	1,381,556	2,305,236	25,061,672	137.8
1988	25,313,013	-	4,446,978	29,759,991	163.6

Sources: Statistics Canada, Air Carrier Operations in Canada, Cat. 51-002 (October-December 1978-87).
___, Aviation Statistics Centre, Special Tabulations for Level II Carriers, 1986-88 (October 13, 1989 and November 21, 1989).
U.S. CAB/DOT, Air Carrier Traffic Statistics (December 1978-1988), plus Form 41, Schedule T-1(a) for individual carriers (1978-88).

make detailed comparisons of individual fares. Thus it is necessary to compare average fares, or yields, to determine if fares in general were lowered by deregulation, even though averages can obscure important factors.

Table 3 lists the average scheduled passenger yields for the major carrier groups among both U.S. and Canadian airlines. The first section lists the current-dollar values in the currencies of each country, the second section uses each country's consumer price index to yield deflated constant-dollar values, while the third calculates index numbers showing how constant-dollar yields changed relative to 1978.

Both the current and constant-dollar figures indicate that the passenger yields for the U.S. trunk and Canadian national carriers were very similar in 1978, as were the combined yields for the total carriers in each country. The roughly one cent-per-mile lower yield in the U.S. largely reflects the somewhat higher purchasing power of the U.S. dollar. In both countries, the then dominant economy fares were calculated from fare formulas approved by the CAB and CTC. For the 20 years between 1958 and 1978 these fare formulas provided virtually identical economy fare levels and distance-related fare tapers in the two countries.[19]

It is a common error to use exchange rates when comparing the airline fares or yields of two countries. While it is appropriate to use exchange rates when comparing what Canadians pay when traveling in the U.S. as opposed to flying in Canada (and vice versa for American travelers), it is not correct to do so when comparing the fares Canadians pay for traveling on Canadian carriers with the fares American pay for utilizing U.S. carriers. Those are strictly domestic transactions of largely nontraded services and, at best, can only be compared using purchasing power parity data which are not currently available for Canada in relation to the U.S.[20]. This problem will be circumvented here by comparing percentage changes in average U.S. fares with percentages changes in average Canadian fares from the common 1978 base year. These comparisons will show the relative changes in fare levels between the two countries and, from this, indicate any differences in average fare changes due to deregulation.

Table 3 shows that current-dollar yields in the U.S. rose 47.9 percent between 1978 and 1981. At the same time, constant-dollar yields fell in 1979 but increased in 1980-81 until total 1981 yields were 6.1 percent higher than in 1978. These increases were contrary to expectations regarding the effects of deregulation. However, they were due to another important development -- the large increases in fuel prices which followed the decontrol of aviation fuel prices in February 1979 during the second oil crisis of 1978-80. Between 1979 and 1980, U.S. aviation fuel prices increased by 165 percent over 1978 levels, and this had to be reflected in increased fares and yields.[21]

Table 3

System Scheduled Passenger Yields
Canadian and U.S. Airlines Operating Jet Aircraft
by Carrier Group, 1978-88

Year	Yield (Cents per RPM)[a]								
	Canadian Airlines					U.S. Airlines			
	Nat.	Reg.	WD/NX	L. II	Total	Trunk	LS/AH	New	Total
	A. Current-Dollar Values								
1978	8.79	14.64	-	-	9.25	7.96	12.00	7.84	8.27
1979	9.02	15.24	-	-	9.52	8.32	12.50	9.00	8.68
1980	10.37	17.34	-	-	10.96	10.49	15.53	9.85	10.93
1981	12.33	20.42	-	-	13.06	11.78	16.95	10.27	12.23
1982	13.34	23.88	-	-	14.21	11.27	16.15	10.00	11.72
1983	13.70	24.97	-	-	14.62	11.26	15.83	10.33	11.68
1984	13.75	24.52	-	-	14.66	11.83	16.69	10.65	12.22
1985	14.30	23.80	8.06	-	15.19	11.18	15.23	11.17	11.66
1986	14.90	22.40	9.61	52.23	15.38	10.43	13.80	10.79	10.85
1987	15.70	23.63	9.42	37.57	15.70	10.73	14.93	11.60	11.11
1988	16.40	-	9.55	36.43	16.18	11.48	15.76	11.98	11.89
	B. Constant-Dollar Values[b]								
1978	11.89	19.81	-	-	12.52	11.10	16.74	10.94	11.53
1979	11.18	18.90	-	-	11.80	10.41	15.65	11.26	10.86
1980	11.63	19.51	-	-	12.33	11.58	17.14	10.87	12.06
1981	12.33	20.42	-	-	13.06	11.78	16.95	10.27	12.23
1982	12.04	21.55	-	-	12.82	10.61	15.21	9.42	11.04
1983	11.69	21.31	-	-	12.47	10.27	14.44	9.43	10.66
1984	11.24	20.05	-	-	11.99	10.35	14.60	9.32	10.69
1985	11.24	18.71	6.34	-	11.94	9.44	12.86	9.43	9.80
1986	11.25	16.92	7.26	39.45	11.62	8.65	11.44	8.95	9.00
1987	11.36	17.10	6.82	27.19	11.36	8.58	11.94	9.28	8.89
1988	11.40	-	6.64	25.33	11.25	8.82	12.11	9.21	9.14
	C. Constant-Dollar Index No. (1978 = 100.0)								
1978	100.0	100.0	-	-	100.0	100.0	100.0	100.0	100.0
1979	94.0	95.4	-	-	94.2	93.8	93.4	102.9	94.2
1980	97.8	98.5	-	-	98.5	104.3	102.4	99.4	104.6
1981	103.8	103.1	-	-	104.3	106.1	101.3	93.9	106.1
1982	101.3	108.9	-	-	102.4	95.6	90.9	86.1	95.7
1983	98.3	107.6	-	-	99.6	92.5	86.3	86.2	92.5
1984	94.5	101.2	-	-	95.8	93.2	87.2	85.2	92.7
1985	94.5	94.4	-	-	95.4	85.0	76.8	86.2	85.0
1986	94.6	85.4	-	-	92.8	77.9	68.3	81.8	78.1
1987	95.5	86.3	-	-	90.7	77.3	71.3	84.8	77.1
1988	95.9	-	-	-	89.9	79.5	72.3	84.2	79.3

Table 3 (continued)

[a]Canadian cents for Canadian airlines, U.S. cents for U.S. airlines.

[b]Current-dollar values divided by Consumer Price Indices for each country (1981 = 100.0).

Sources: Calculated from data in --
Bank of Canada Review (January 1990), p. S113.
Economic Report of the President (Feb. 1990), p. 359.
Statistics Canada, Air Carrier Operations in Canada, Cat. 51-002 (October-December, 1978-88).
___, Aviation Statistics Centre, special tabulation (October 5, 1989).
U.S. CAB/DOT, Air Carrier Financial Statistics (December 1978-88).
___, Air Carrier Traffic Statistics (December 1978-88).

In Canada, the National Energy Program delayed the large increases in fuel prices by one year to 1980. This delay explains why Canadian constant-dollar yields did not rise above 1978 levels until 1981 and 1982. Canadian fuel prices rose by 172 percent over 1978 levels by 1982 and, in response, current-dollar yields increased by 53.6 percent for the same period, and constant-dollar yields increased 4.3 percent in 1981 and 2.4 percent in 1982. (The sizes and timing of these increases in U.S. and Canadian yields does much to explain the differences in the timing and sizes of the RPM declines shown for Canada and the U.S. in Table 2.)

Given the impact of the fuel price increases in the early years of U.S. deregulation, the clearest indications of the effects of deregulation on airline fares are obtained from the yields shown in Table 3 for the U.S. after 1981, and after 1982 for Canada. In the U.S., current-dollar yields generally declined slightly between the 1981 peaks and 1988. Because of inflation, these slight declines in current-dollar yields resulted in substantial declines in constant-dollar yields through 1987/88, with index numbers of 71.3 to 79.5 indicating decreases in real yield of 20.5 to 28.7 percent for the former trunk and local service/A/H carriers. The new carriers had a smaller decline to just 84.2 index numbers. That 15.8 percent decline, however, is not suprising since their predecessors in 1978, the intrastate carriers, were already low-fare carriers over short-haul routesin that last year of regulation.

The contrast with Canadian carriers is again useful. Generally speaking, the current-dollar yields increased for the national carriers and remained essentially constant for the regionals between 1982 and 1987. In the same period, constant-dollar yields declined to 1987 index numbers of 95.5 for the nationals, 86.3 for the regionals, and 90.7 for total carriers. The 95.5 index number for the nationals was 18.2 points higher than the U.S. trunks, while the total 90.7 index number in 1987 was 13.6 points higher

than the U.S. index number of 77.1, despite the Canadian constant-dollar values being deflated somewhat more by the higher inflation rate in Canada (87.0 percent CPI increase between 1978 and 1987, vs. 74.3 percent in the U.S.).

Again, comparisons between the U.S. and Canada provide useful evidence regarding the effects of deregulation. Constant-dollar yields in the U.S. fell appreciably more after 1981 under deregulation than did Canadian yields after 1982. Thus, while some individual fares in specific city pairs may not have been lowered by deregulation, fares on average were lowered significantly. The large growth in scheduled RPM between 1981 and 1987 is consistent with this finding.

Conclusion

The comparisons between U.S. and Canadian airline performance between 1978 and 1987/88 demonstrate that the initial years of deregulation in the U.S. resulted in many of the changes predicted at the time deregulation was proposed. Substantial entry did occur, competition increased, average fares fell and traffic grew by very large amounts. Many would consider these results from deregulation to be quite positive.

The negative aspect of the first decade of deregulation is the large number of airlines that left the industry during this period. However, this large amount of exit should not be too surprising. Exit also occurred during regulation, and there is every reason to believe that it would have continued to occur had regulation survived. At the same time, the general experience in the U.S. is that about half of new firms in all industries terminate business within five years of entering. In the airline industry, the number in this initial period of deregulation has been 75 percent of the new carriers terminating service within ten years after entry began. Time will tell whether the airline industry will eventually conform to the U.S. norm.

Numbers of successful carriers, however, do not indicate the full impact of new entry. Even some of those that failed contributed to current performance. Carriers such as People Express provided new ideas on how to operate. There is little doubt that the performance of the industry today is significantly different than it would have been had regulation continued with operations limited to the survivors of the 23 original carriers in existence back in 1978.

When debating the pros and cons of deregulation and regulation it is important to recognize the fact that technology made the airlines a dynamic and growing industry under regulation and has continued to do so under deregulation. The demand for fast, safe and efficient air travel is large and as yet no substitute technology has appeared to change this. Government intervention

through regulation has not been required to maintain a dynamic and growing industry since 1978 and, therefore, there seems to be little reason for society to bear the direct and indirect costs of regulation.

At the same time, deregulation has lowered airlines fares, thereby bringing the price of air travel down to the level where it can be afforded by many consumers who would have used other forms of transportation if they traveled at all. This is a net gain to society and should be kept in mind when considering any future changes in government policy regarding the airlines.

Endnotes

[1]Public Law No. 95-504, 92 Stat. 1705.

[2]The legislative process in the U.S. started in November 1974 with the investigation of Civil Aeronautics Board practices and procedures by the Kennedy Subcommittee. Hearings Before the Subcommittee on Administrative Practices and Procedures of the Committee on the Judiciary, United States Senate, Ninety-Fourth Congress, Vol. 1 (Washington: U.S. Government Printing Office, 1975), p. 1.

[3]Canada, Minister of Transport, New Canadian Air Policy (Ottawa: Transport Canada, May 10, 1984). National Transportation Act, 1987, 35-36 Elizabeth II, Chapter 34.

[4]It may be debated whether or not liberalized regulation following May 1984 began the implementation of deregulation in Canada. The comparative data in this paper sheds some light on this issue. There is little question, however, that by mid-1984 the Canadian airlines recognized that some form of deregulation would be adopted in Canada. Efforts to modify the policy change are reflected in the limitation of deregulation to Southern Canada (Section 67, NTA), and the establishment of the National Transportation Agency to replace the Canadian Transport Commission, rather than simply transferring residual regulatory activities to the Department of Transportation as was done in the U.S. (Section 6, NTA).

[5]U.S. CAB, Handbook of Airline Statistics, 1973 ed. (1974), pp. 1-2, 510 and 568-69. The 24th carrier listed in Table 1 for 1978 was Seaboard World. In 1978, the CAB allowed that all-cargo carrier to provide limited scheduled passenger service to military personnel in the upper deck of its B-747 cargo aircraft. Seaboard is considered to be a new carrier in this analysis even though its restricted service was authorized by the CAB prior to deregulation.

[6]The CAB's regulation of entry on domestic routes continued until December 31, 1981. While the Board was generous in making route awards, there were administrative delays and expenses in obtaining a certificate. As of January 1, 1982, new airlines only had to obtain an operating certificate from the Federal Aviation Administration verifying the carrier's ability to operate safely. Sec. 1601, 92 Stat, 1744.

[7]Statistics Canada, Aviation in Canada (1971), p. 24.

[8]CTC(A) Decision No. 8298 (August 27, 1984).

[9]Wardair International Ltd., Annual Report 1984, p. 3; and Toronto Globe & Mail (March 21, 1986), p. A11.

[10]Wardair International Ltd., Annual Report 1985, pp. 7 and 9.

[11]Toronto Globe & Mail (May 17, 1986), p. B6, and (November 5, 1986), p. D1. Official Airline Guide, North American Edition (February 15, 1986) and (April 1, 1986).

[12]Official Airline Guide, North American Edition (December 1, 1988).

[13]Exit has continued since the end of 1988. Florida Express was acquired by Braniff on April 19, 1988, and continued operating as Braniff Express until Braniff suspended all operations on November 6, 1989, following filing for Chapter 11 bankruptcy on September 28, 1989. Also, Piedmont was merged into USAir on August 5, 1989, and Presidential went bankrupt and terminated services in December 1989. Aviation Week and Space Technology (December 21, 1987), p. 33, and (December 11, 1989), pp. 43-44; Globe and Mail (November 8, 1989), p. B20; and USAir Magazine (February 1990), p. 7.

[14]For a list of mergers, see W. A. Jordan, "Problems Stemming from Airline Mergers and Acquisition," Transportation Journal, Vol. 27, No. 4 (Summer 1988), p. 29.

[15]W. A. Jordan, Airline Regulation in America (Baltimore: The Johns Hopkins Press, 1970), pp. 32-33.

[16]U.S. CAB, Dockets 33282 and 33136 (1978).

[17]The calculation is little affected by deleting the 533,052(000) scheduled RPM carried in 1938 and 1978. U.S. CAB, Handbook of Airline Statistics, 1973 ed. (1974), p. 23.

[18]It is widely reported that about 90 percent of passengers on U.S. airlines utilize discount fares. In Canada, 61.6 percent of passengers utilizing domestic scheduled service by Level I carriers in Southern Canada travelled on some form of discount ticket during the fourth quarter of 1988. That was up from 55.0 percent in the same quarter of 1987. Statistics Canada, Air Carrier Operations in Canada (October-December 1988), pp. 13 and 15.

[19]W. A. Jordan, Performance of Regulated Canadian Airlines in Domestic and Transborder Operations (Ottawa: Consumer and Corporate Affairs Canada, 1982), pp. 5-20, esp. p. 6. Also, W. A. Jordan, "Airline Performance Under Regulation," Research in Law and Economics, Vol. 1 (1979), pp. 43-50.

[20]Ibid., Performance of Regulated Canadian Airlines, pp. 198-99.

[21]W. A. Jordan, Comparative Analysis of Airline Performance in Canada and the United States, Report for Transport Canada Submitted to the Standing Committee on Transport, House of Commons (March 13, 1987), pp. 21-32, esp. p. 27.

MULTI-MODAL FREIGHT FORECASTING

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ABSTRACT

This paper outlines the methodology followed within Transport Canada during the development of short and long term(1) marine and rail commodity flow(2) forecasts. Included is a short outline of the data sources, inherent limitations and ongoing improvements to the statistics. The current rail and marine forecasts can be obtained, upon request, from the Director, Marine and Surface Statistics and Forecasts Branch, Transport Canada.

INTRODUCTION

Transport Canada has been preparing freight forecasts, primarily for operational planning purposes within the Department, since the mid-1970s.(3) The scope of the forecasting exercise and the dissemination of the results, certainly with respect to the marine and rail sectors, have been extended considerably in recent years. Transport Canada forecasts are now increasingly being used by other government departments, agencies and private sector organizations which have an interest in expected commodity flow trends.

Freight forecasts are reviewed and updated on an annual basis for each of the transportation modes. This paper will however be limited to a discussion of the marine and rail sectors only. The reasons for this limitation are twofold; first, the air sector forecasts are concerned with an entirely different type of commodity than are the surface modes. As a result, the approach to developing the air cargo forecasts are considerably different from that used for the surface modes. Second, forecasts developed for the trucking sector have, to date, been limited to an aggregate approach rather than the commodity specific analysis conducted for the marine and rail sectors. As the available trucking data is improved, more detailed forecasts will be developed.

Within Transport Canada the commodity flow forecasts have three primary functions. First, expected traffic

trends are used as demand indicators for operational planning purposes. Second, the forecasts are used as inputs into other forecasting models (i.e. vessel movement forecasting models) developed within the Department.(4) Third, the forecasts are used to meet numerous recurring and ad hoc departmental and private sector requirements each year.

DATA AVAILABILITY

Freight traffic statistics for the marine and rail sectors are available from a number of sources. One of the more comprehensive is Statistics Canada. Other government departments and agencies, such as the National Transportation Agency (NTA) and Energy, Mines and Resources (EM&R), also maintain considerable data banks related to commodity traffic. Detailed information is available from private sector sources which are acknowledged experts with respect to specific commodities/commodity groups and contacts within private companies provide privileged information which is used to ensure that any assumptions made during the forecasting exercise are both realistic and legitimate.

Statistics Canada

Statistics Canada maintains statistics on both marine and rail traffic. In the case of marine, coastwise and international shipping data along with financial and operating statistics are collected. For rail, information is available on output, size, structure and the economic performance of Canada's Class I and Class II railways.

Domestic marine shipping statistics refer to the carriage of goods between ports in Canadian coastal waters, the Great Lakes and the St. Lawrence Seaway. Domestic shipping information is collected through the use of the S.1 Domestic Shipping Report and the S.4 Towboat and Ferry Operators Shipping Report. A record of activity is filed with Statistics Canada for each vessel entering or leaving a Canadian port while engaged in domestic shipping, with the exception of (i) cargo vessels under 15 net register tonnes, (ii) tugs or other vessels under 15 gross register tonnes, (iii) Canadian naval or fishing vessels, (iv) research vessels, and (v) ballast movements for towboat and ferry operators on the West Coast.(5)

International vessel traffic and origin and destination

commodity statistics are compiled from data collected on the A6 General Declaration and supporting cargo reports supplied to Statistics Canada by Revenue Canada-Customs and Excise, or equivalent reports from shipping lines and port authorities. Data is collected from all vessels entering or leaving Canadian ports while engaged in international shipping with the exception of (i) Canadian or foreign fishing vessels, (ii) maintenance or service vessels, (iii) research vessels, and (iv) other non-commercial vessels such as hospital ships.(6)

In addition to the vessel types/sizes which are not included in the survey, the marine statistics have a number of other inherent limitations. First, the waiving of reporting requirements due to vessel size has a considerable impact on the traffic reported in areas such as the Fraser River. Second, commodity flows are available on a port origin/destination rather than true origin/destination basis. It is therefore not possible to establish certain types of information (e.g. transhipments via the United States). Third, the available data related to the transport of freight on ferry services is incomplete. Fourth, at the present time there is about a one year lag in the availability of data. While this time lag is not unreasonable considering the collection, editing and data transfer requirements, from a user's point of view more timely information would be welcomed.

Rail sector revenue freight traffic statistics are collected from twenty-one Class I and Class II railways operating in Canada. Information is available on the aggregate volumes of freight loaded and unloaded (by commodity), along with freight and other carrier specific information for CN and CP. In the case of the Class II railways, traffic data only is available.(7)

As with the marine sector, comprehensive origin/destination (O/D) rail statistics are not currently available. As a result, the information has to be inferred from a number of different sources. Estimates of Class I O/D have been received from the NTA or the Canadian Institute for Guided Ground Transportation (CIGGT). For the Class II railroads information is limited to loadings and unloadings (from the Statistics Canada data base) therefore both origin/destination information and data on traffic interlining with other carriers (Canadian and U.S.) has to be inferred within Transport Canada. In order to ensure that all double counts are eliminated, a mathematical solution is being used to derive accurate O/D statistics for all carriers. In addition, carriers

associated with the Quebec/Labrador trough have been isolated in order that the data can be properly analyzed, corrected and applied during the forecasting exercises.

Other Government Departments

In 1987, the transport of grains and key minerals (iron ore, non ferrous concentrates and coal) accounted for 47 percent of the total domestic and international marine and rail commodity flows. Due to the importance of these bulk commodities, considerable effort is made to ensure that information is accessed from departments which have acknowledged expertise with respect to these products.

Energy, Mines and Resources (EM&R) is an important source of commodity specific information, providing data on mine capacities, ore grades, extraction rates and production of concentrates.(8) Using this information, transportation requirements from the mine to smelters, refineries and export markets can be traced. Similarly, import requirements, and the corresponding mode of transport, can be established.

As outlined earlier, the NTA provides Transport Canada with estimates of origin/destination statistics for Canadian National and Canadian Pacific railways. This information is then combined with data from other sources, such as Statistics Canada, to provide a more comprehensive and accurate data base.

Information is also regularly received from the Department of Fisheries and Oceans, Agriculture Canada and from other sources such as Ports Canada.

Private Sector Sources

There are a number of key private sector organizations which are recognized experts with respect to specific commodities. These sources view each industry from a global perspective, ensuring that all factors which influence supply and demand are taken into consideration. Historical and forecast information is purchased from these companies to ensure that the traffic flow forecasts prepared by Transport Canada reflect accurately Canada's role in the future supply and demand expectations of each industry. These sources are also used to confirm such issues as expected technological changes, freight rates and market shifts. It must be emphasized that the forecasts provided by these companies cannot be used directly as traffic flow

forecasts in a Canadian context, but rather as indicators to be used as inputs into Transport Canada's forecasting process.

Industry Contacts

Transport Canada has established contacts within a number of key companies across Canada. During the preparation of the forecasts, information is sought from these contacts in order to confirm assumptions made by the analyst. All information from these sources is treated in a proprietary manner, care being taken to ensure the confidentiality of both the information and the source.

METHODOLOGY

Transport Canada prepares short and long term freight forecasts for both the marine and rail sectors. Thirty six commodities/commodity groups plus containerized shipments are included in the exercise (See Appendix - Table 1). While commodity information is provided by Statistics Canada on up to 640 commodities for the marine sector and 320 commodities for the rail sector, developing forecasts for each available commodity would only confuse, rather than clarify, future planning requirements. Following receipt of the information from Statistics Canada, the data is aggregated into the groups shown in the Appendix. If required, the historical and forecast information can be further aggregated into broad categories (e.g. grains, forest products, etc.) for use in planning exercises.

The determination of the 37 commodity groups is based on the following criteria: **(i) importance in terms of volumes transported**--the following bulk commodities (coal, coke, iron ore, salt, alumina and bauxite, titanium, copper, lead, nickel, zinc, stone and limestone, sand and gravel, gypsum and cement) account for significant proportions of all cargo moved by the marine and rail modes. These commodities are therefore forecast individually; **(ii) environmental concerns**--in addition to accounting for large proportions of the total volumes carried by the marine and rail modes, crude oil, gasoline, fuel oil and "other refined petroleum products" are of significant interest from an environmental perspective. As such, historical and forecast information relating to these commodities are available on an individual basis; **(iii) containerized traffic**--this is a high-value, fast growing sector and

there is constant demand for information on the movement of containerized cargo. It must be noted that identification of commodities contained in containerized shipments is not done at this time unless specifically requested; **(iv) regional and national economic impact**--a) Grains--the movement of grains by rail and marine are a very important part of the Canadian surface transportation system. Forecasts are therefore developed individually for barley, corn, oats, rye, wheat, flax seeds, rapeseeds and soyabeans. b) Forest Products--the forest products industry is very important from both a national and regional perspective to the Canadian economy. Forecasts are developed for each of the following commodities (logs and bolts, pulpwood and chips, lumber, woodpulp and newsprint). c) Fertilizer Materials--Canada is a world leader in the production of fertilizer materials therefore potash, sulphur and phosphate rock shipments are forecast individually; **(v) commodities which have similar characteristics but which do not, on an individual basis, account for large volumes.** These commodities are grouped as transportation equipment and "other commodities" (residual). In terms of volume, transportation equipment and "other" commodities account for between 9 and 10 percent of total domestic and international marine and rail commodity flows.

In Canada, supply sources such as mines, grain producing areas and forest tracts are often located very far from both domestic and foreign markets. As such, both the rail and marine modes are often utilized to transport required commodities to their final destination. All exports and imports, with the exception of certain U.S. bound or originating products and high value, low bulk products moving by air, are carried by the marine mode. With few exceptions, there is also a further requirement to move goods to and from seaports. Because of this multi-modal requirement and the resulting transportation costs, Canada's ability to compete in foreign export markets is sometimes adversely affected. Factors such as these must be taken into account during the preparation of the forecasts (e.g. loss of Canadian potash sales to India due to the lower transportation costs of importing directly from Jordan).

The forecasts must also take into account factors such as the future role of East and West Coast ports. This analysis is particularly important in the case of grain shipments for export. While it is relatively obvious that shifts are occurring, the difficulty lies in trying to determine the extent of changes that will occur and the period of time that it will require for these changes to stabilize.

It is therefore imperative that the analyst preparing the forecast is familiar with the supply/demand factors, both domestic and international, that have an impact upon each particular commodity, and the expected effect of these factors on the transportation flows of the commodity. Because all of the forecasts are developed on an origin/destination basis, analysis, in terms of routings, form an important part of the exercise. Time series are used to examine the reliability of the data and to test historical stability. Future modal shares must be developed, bearing in mind expected shifts due to changing domestic and international policies, transportation costs, availability of alternate modes, exchange rates and, in some cases, political instability. Within Canada, the transport of each commodity must be analyzed from both a national and regional perspective. For example, the same low value commodity that, on the Prairies, will be transported short distances by truck may, in Ontario and Quebec, be transported by ship (e.g. sand and gravel), because longer distances are involved between supply and demand locations.

Each commodity forecast is initially prepared and presented in the form of an eighteen by eighteen matrix, which represents the world divided into 9 domestic, 2 U.S. and 7 offshore regions (See Appendix-Table 2). In the case of rail, only the 9 domestic and 2 U.S. regions are relevant. Both inter and intra regional flows are forecast and available to users. Using the SIMNAV system (4), the forecasts can be further disaggregated into 83 regions (63 domestic, 11 U.S. and 8 offshore.

Due to the diversity of supply/demand factors that impact upon each specific commodity/commodity group, the forecasts are prepared using a "bottom-up" approach. Each commodity is analyzed separately, and the applied methodology is dependant upon the commodity under consideration. For example, in the case of commodities associated directly with the construction industry (gypsum, stone and limestone), it is possible to utilize econometric models to develop legitimate "first-cut" forecasts. In most other cases (e.g. alumina and bauxite, copper, etc.) technology driven models are the most effective. For commodities such as grains and petroleum products, analysts now depend heavily on forecasts prepared by private sector experts, with adjustments made to ensure that forecast rail flow patterns and future export/import volumes reflect current and expected government and industry policies. In the future however, optimization models may be developed for products such as grains in order that the

analyst can establish the most cost efficient routing for expected exports. In a few cases,(e.g salt) the forecast is highly dependant on an analysis of historic trends and analyst judgement. In all cases, the forecasts are subject to comments from a number of Departmental and other experts prior to finalization.

It must be emphasized that due to the wide diversity of factors that impact upon the movement of each commodity, it is not possible to develop a credible aggregate forecast of all the commodities combined using one all purpose econometric model. This type of approach, if used, should be limited to determining general trends for the future. It most certainly should not be used for the determination of commodity specific forecasts by applying market share disaggregation based on historical trends. It is also not possible to develop forecasts for each commodity using one interactive model. Due to the complexity and the number of factors that impact upon the transport of each commodity, there is no "short cut" to the development of credible freight forecasts.

In order to demonstrate the above, an outline of the approach followed during the development of the rail and marine flow forecasts for copper have been included. This commodity has been chosen because it can be used effectively to demonstrate the points that have to be taken into consideration but at the same time is relatively simple in terms of the number of steps required.

Forecast of Marine and Rail Copper Concentrate Flows:

Step 1: Identification of each Canadian refinery along with its respective current and forecast production capacity and expected annual production rate (Noranda, INCO and Falconbridge). Current and forecast capacity and production data are supplied by EM&R and private sector sources such as Commodities Research Unit (CRU) and Resource Strategies Incorporated (RSI). In turn, these sources base their forecasts for Canadian facilities on a global outlook (demand) for refined copper.

Determination of demand, rather than supply, is the first step in the development of the transportation flow forecasts for copper concentrate. This is based on the following rationale: first, the development of refinery facilities and the subsequent production rates

are based on global demand. While the initial development of the refineries were probably, to some extent, motivated by the availability of supply sources in Canada, future additions and/or reductions will be a function of global demand for refined copper. As such, production at the supply level (mines) in Canada is to a large extent dependant upon the demand for feedstock at the smelters/refineries.

In western Canada, concentrate is exported directly to Pacific Rim markets. Again, demand for Canadian concentrate dictates production at these mines. Should the offshore demand decrease or shift to other sources, these mines would also reduce/stop production even though large volumes of reserves continue to be available.

Step 2: Identification of each smelter resident in Canada and determining which refinery(ies) it provides feedstock to. Current and forecast capacity and production rates are available from CRU, RSI and Energy, Mines and Resources.

Noranda's refinery utilizes feedstock from three sources, their own smelter at Murdockville, the Horne smelter and Hudson Bay Mining and Smelting (HBM&S). INCO and Falconbridge utilize feedstock from their own smelting facilities.

Step 3: Identification of the sources of concentrate (mines or imports) for each of the smelters. During the 1989 forecasts update, 36 individual Canadian mines were taken into consideration. Included were mines which were forecast to close/open during the forecast period. Current and forecast production capacity, extraction rates, ore grade, and life expectancy were available from EM&R, CRU and RSI. In addition, those smelters for which it is, and will continue to be, more economical to import concentrate were identified along with the supply source of the feedstock. Finally, those mines from which either some or all production are exported were identified and forecasts of these exports were prepared.

The advantage of developing the forecast in this fashion is that the transportation mode used on any particular leg of this network is immediately identified, along with the volumes

carried. For example, in order for the smelter to continue operating at Murdockville, concentrate must be carried by rail from Heath, New Brunswick. However, between 75 and 80 percent of the required concentrate is imported from offshore sources by ship. As a result, during the process of completing the industry analysis, the logical allocation of flows is also addressed.

The same logic follows for exports. For the most part, copper concentrate from mines in B.C. are destined to offshore markets. For example, output from Highland Valley are initially moved by rail to B.C. deep sea port facilities. The final leg to the port of destination is by ship. In this example, the corresponding rail flows would be presented as B.C. to B.C. flows. The marine segment would be presented as B.C to one of the specified offshore or U.S. regions.

Following completion of the above, the analyst has a preliminary year-by-year forecast, by inter and intra regional rail and marine flows, for the commodity under consideration. These forecasts are then reviewed by department and other transportation and industry experts prior to finalization.

It must be stressed that while the regional and national economic conditions forecast for the country are important in this process, in technology driven models direct input of these indicators are rare. The impact of national and international economic conditions are evident by more concrete indicators. For example, if the price of copper is dropping and future expectations are that demand for this product will decline or stay stable, very little investment is allocated to the development of new mines, smelters or refinery facilities. If, on the other hand, industry is optimistic about the commodity's prospects, these economic indicators are manifested in increased investment and production. During the forecasting process the analyst must bear in mind the current and forecast physical limitations of each facility (mines, smelters, refineries) and on international factors governing exports/imports and limit forecast flows to these, rather than pure economic, indicators.

Each of the technology driven models are in the process of being fully computerized within the Department at this time. In terms of forecast updates, this will make the addition or removal of inputs more efficient and the

impact of expected changes can be calculated more rapidly.

Forecasts for commodities such as forest products take much the same form as outlined above from the supply side, however the demand side of the equation is much more reliant on econometric approaches. Demand in many cases is a function of regional and national economic conditions reflected by such indicators as housing starts and commercial development. The forecasting process takes into account demand, supply, public policy (e.g. use of recycled product), transportation costs and tariffs. In some instances the availability of a viable "backhaul" commodity plays a major role in keeping overall transportation costs down (e.g. the shipment of lumber to the U.S. east coast from B.C. and a backhaul of phosphate rock) thereby ensuring continued demand for lumber from this region. This therefore is a valid example of how a combination of econometric and technology driven forecasting methods are sometimes required.

CONCLUSIONS

There is no available "short-cut" in the process of developing credible commodity flow forecasts if the object is to take into account individual commodities at the origin/destination level. Each commodity/commodity group must be analyzed on it's own, taking into account regional, national and international factors impacting on supply and demand for the product. Different approaches lend themselves to forecasting traffic flows for different commodities however, in most instances it can be accepted that a combination of factors that impact upon supply and/or demand, rather than a pure economic or demographic indicator or an analysis of past trends, must be taken into consideration.

FOOTNOTES

1) Short term is defined as base year plus 2 to base year plus 7 inclusive. Long term is currently defined as the year 2000.

2) Commodity flows refer to the volume of freight moved between two points; freight handled indicates the tonnage loaded and/or unloaded at a particular point. For example, if 1 tonne of wheat is loaded at Point 1 and unloaded at Point 2, the commodity flow in this network is equal to 1 tonne whereas the volume handled is equal to 2 tonnes.

3) "Progress Report: Freight Forecasting Project" Regional Analysis Section, Economic and Regional Analysis Branch (DERA) September, 1979
"Air Cargo Forecasts - Vancouver International Airport" 1974 Statistics and Forecasts-Air (ACAC) Transport Canada.

4) Two vessel movement forecasting models have been developed within the Economic Analysis Directorate, the Vessel Movement Forecasting System (VMFS) and the Marine Traffic Simulation and Forecasting System (SIMNAV). Additional information on these systems can be obtained from the Director, Marine and Surface Statistics and Forecasts Branch.

5) Statistics Canada, Catalogue 54-205, 1987 Page 129

6) Statistics Canada, Catalogue 54-205, 1987 Page 129

7) Statistics Canada, Catalogue 52-211, 1986 Page v

8) One of the better reference documents is the Canadian Mineral Yearbook, Review and Outlook, produced on an annual basis. The publication provides summaries on forty seven specific commodities/commodity groups. The Department also publishes detailed studies on a number of commodities each year (Mineral Policy Sector Internal Reports). In addition, information is also directly available from commodity specialists within the Department.

APPENDIX I

TABLE 1

COMMODITY GROUPS

Barley Corn Oats Rye Wheat Flax Seeds Rapeseeds Soyabeans	) "GRAINS"
Logs & Bolts Pulpwood & Chips Lumber Woodpulp Newsprint	) "FOREST PRODUCTS"
Potash Sulphur Phosphate Rock	) "FERTILIZER MATERIALS"
Copper Nickel Lead Zinc	) "NON-FERROUS CONCENTRATES"
Stone & Limestone Sand & Gravel Gypsum Cement	) "CONSTRUCTION MATERIALS"
Crude Petroleum Gasoline Fuel Oil Lubes, LPG & Other	) "PETROLEUM PRODUCTS"

Alumina & Bauxite	Coal
Titanium	Coke
Salt	Iron Ore
Transportation Equipment	Containers
Residual-Other Commodities	

TABLE 2

DOMESTIC AND OFFSHORE REGIONS

1. Newfoundland
2. Maritimes
3. Magdelan Islands
4. Quebec
5. Valleyfield
6. Ontario
7. Prairies
8. British Columbia
9. Territories
10. U.S. Great Lakes
11. U.S. Other
12. Western Europe
13. Eastern Europe
14. Mediterranean
15. Africa
16. Asia and Oceania
17. Central America
18. South America

SHIFTS AND TRENDS IN MULTIMODAL TRAFFIC FLOWS

Canada-U.S. Free Trade Agreement: An Impetus For North-South and East-West Flows

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I. ABSTRACT

With the signing of the Canada-U.S. Free Trade Agreement and the passing of the New National Transportation Act comes a more open and competitive operating environment for Canada's transportation industry. The provision of relevant, reliable and consistent statistics on commodity flows and multi-modal transportation networks is an important prerequisite for assessing and monitoring the impact of these legislative developments on Canada's transportation sector.

Changes in traffic patterns, shifts in freight movements and fluctuations in activity levels also reflect fundamental changes in regional expansion and industrial production across all facets of the economy.

This paper provides an integrated and comprehensive picture on commodity traffic trends in Canada over the last ten years. It examines shifts in domestic cargo carriage activities and looks at recent developments in Canada-U.S. freight movements. The analysis focuses on the rail and truck modes and are based on data derived from a number of statistical programs.

In order to provide a more cogent perspective on recent developments, different statistical yardsticks are used. Domestics activities, or more specifically East-West traffic flows, are measured by way of registered origin/destination tonnage levels whereas emerging trends on North-South movements to and from the United States are measured by the value of merchandise exported/imported.

Finally, the analysis provided contemplates possible forthcoming shifts in commodity traffic flows as a result of the Free Trade Agreement, and outlines a few areas where further analysis is required.

II. INTRODUCTION

The transportation industry in North America is experiencing some of the most sweeping changes since the birth of our nation. Although the Free Trade Act will be phased in over the next ten years, many companies (both Canadian and American) have taken certain initiatives the effects of which are already evident. This is especially obvious in the trucking industry where many of the firms are struggling to survive. This combined with deregulation of the Canadian industry in 1987 and the earlier (1984) deregulation of the U.S. industry results in a period of economic uncertainty for this vital, normally stable industry. Observing these changes is both interesting and very important. Statistics Canada's role as observer has never been more important and the ongoing changes occurring in our statistical measurement tools reflect our recognition of this fact.

This paper will examine the trends over a 10 year period, focusing on the years 1978, 1981, 1984 and 1987. Figures for the year 1988 are not readily available at the time of the writing of this paper, however they will be included in the presentation in June. It would be interesting to revisit this topic again in five years time at the anticipated end of this period of adjustment. Emphasis is placed on trucking and rail statistics for the purposes of this study. To put the different modes into perspective Table 1 and 2 are presented. Combined, truck and rail activities represent 61.2% of the total transport sector. The purpose of these tables is to illustrate the importance of these two modes within the transport sector. The remaining 38.8% of the industry includes, among others, the marine sector as well as the aviation (passenger and cargo traffic) sector. Therefore, concentrating on the truck and rail modes will give a reasonable perspective on the freight industry as a whole.

TABLE 1: SIZE[1] OF THE TRUCKING AND RAIL SEGMENTS,1986
(Value Added)

		%
Truck		43.0
- for-hire	25.2	
- private	17.8	
Rail		18.2
% OF TRANSPORTATION INDUSTRY TOTAL		**61.2**

It is recognized that the other modes represent a significant portion of the totality of the transportation industry, it is however, safe to state that their contribution to East-West and North-South freight traffic movement is limited. In addition, the rail and truck modes are expected to be the two modes most significantly affected by Free Trade and deregulation.

Perhaps, a better indicator of the magnitude of these two segments of the industry would be a comparative table on the total tonnage transported by each of the modes.

TABLE 2: SUMMARY STATISTICS - RAIL AND TRUCK TRANSPORTATION, 1987

	Railway* Transport	Trucking** For-Hire	Trucking** Private
Carriers Reporting	28	6,729	2,230
Operating Revenues***	7,189	9,345	-
Operating Expenses***	6,148	8,936	4,349
Number of Employees****	75,115	114,178	89,137
Compensation***	2,633	4,809	2,513
Tonnage:*****			
Domestic	214 511	204 835	67 259
Transborder	43 415	26 396	1 878
TOTAL	257 926	231 231	69 137

* Includes Class I, II and III carriers but excludes VIA Rail.
** Includes all carriers earning more than $100,000 annually (for-hire). Includes carriers with a fleet size of 15 vehicles or more (private).
*** $000,000
****Trucking data includes estimates for owner/operators and their renumerations
***** '000 Metric

The first part of this paper will examine the changes in intra and interprovincial traffic flows which have taken place over the last decade. As well, the changes in commodity mix between modes is examined. The second section, using trade figures for the years 1978, 1983 and 1988 examines the shifts of merchandise exports and imports between Canada and the United States by mode of transport. The general findings of this section are summarized in the conclusion along with some speculation on the future of the transportation industry in light of the recent legislative changes. Topics for further analysis are also suggested. This is the beginning of a more substantial study which will be published in the Statistics Canada 1988 edition of *Trucking in Canada*.

III. DOMESTIC TRAFFIC FLOWS (For-Hire versus Rail)

Traditionally, the majority of the traffic flows have been both within and between the regions of greatest economic production (i.e. Ontario and Quebec) and other regions. For the purposes of this study, the following provinces have been grouped into the regions listed in Table 3: Newfoundland, Prince Edward Island, New Brunswick, Nova Scotia are grouped into the Atlantic region; Manitoba, Saskatchewan and Alberta are grouped into the Prairie region; and the B.C. region includes British Columbia, the Yukon and the Northwest Territories.

TABLE 3[2]: TONNES TRANSPORTED BY MODE, BY REGION OF ORIGIN/DESTINATION, 1978/81/84/87

Destination / Origin ('000)	Atlantic	Quebec	Ontario	Prairies	B.C.	TOTAL
ATLANTIC						
Truck (For-Hire)						
1978	6 343	371	183	32	4	6 916
1981	9 706	528	356	12	4	10 606
1984	9 876	571	386	13	3	10 847
1987	14 162	513	649	13	4	15 341
Rail						
1978 (total only)	-	-	-	-	-	9 819
1981 (total only)	-	-	-	-	-	8 793
1984	7 997	1 419	1 189	108	40	10 753
1987	8 830	1 262	1 165	82	32	11 371
QUEBEC						
Truck (For-Hire)						
1978	601	19 584	2 722	175	74	23 157
1981	733	21 767	3 363	211	105	26 179
1984	738	24 241	3 794	228	109	29 110
1987	840	29 758	4 912	288	93	35 891
Rail						
1978 (total only)	-	-	-	-	-	14 471
1981 (total only)	-	-	-	-	-	11 983
1984	1 565	5 187	3 862	810	375	11 797
1987	1 368	4 630	3 882	749	381	11 010
ONTARIO						
Truck (For-Hire)						
1978	326	3 349	39 258	767	182	43 882
1981	548	3 322	47 409	891	220	52 390
1984	509	4 155	58 402	877	270	64 213
1987	747	4 584	70 911	1 081	284	77 607
Rail						
1978 (total only)	-	-	-	-	-	36 323
1981 (total only)	-	-	-	-	-	35 640
1984	2 486	5 860	19 262	3 178	1 121	31 907
1987	2 221	5 211	15 983	3 081	1 275	27 771

TABLE 3: TONNES TRANSPORTED BY MODE, (cont'd) BY REGION OF ORIGIN/DESTINATION, 1978/81/84/87

Origin ('000) / Destination	Atlantic	Quebec	Ontario	Prairies	B.C.	TOTAL
PRAIRIES						
Truck (For-Hire)						
1978	37	191	559	18 814	1 746	21 347
1981	17	186	644	31 965	2 378	35 190
1984	11	200	777	32 319	1 968	35 280
1987	41	257	1 440	40 732	2 531	45 001
Rail						
1978 (total only)	-	-	-	-	-	52 578
1981 (total only)	-	-	-	-	-	61 291
1984	594	1 854	25 228	6 463	32 703	66 842
1987	463	1 936	24 430	6 985	38 147	71 961
B.C. & TERRITORIES						
Truck (For-Hire)						
1978	9	50	114	1 513	14 013	15 699
1981	11	26	155	1 793	14 728	16 713
1984	11	45	170	2 080	20 283	22 589
1987	7	60	167	2 722	28 031	30 987
Rail						
1978 (total only)	-	-	-	-	-	22 903
1981 (total only)	-	-	-	-	-	26 020
1984	153	1 137	2 584	2 229	26 646	32 749
1987	208	1 678	3 974	2 196	26 854	34 910
CANADA TOTAL						
Truck (For-Hire)						
1978	7 316	23 545	42 836	21 301	16 019	111 001
1981	11 015	25 829	51 927	34 872	17 435	141 078
1984	11 145	29 212	63 529	35 515	22 633	162 039
1987	15 797	35 172	78 079	44 836	30 943	204 827
Rail						
1978 (total only)	-	-	-	-	-	136 094
1981 (total only)	-	-	-	-	-	143 727
1984	12 793	15 457	52 125	12 788	60 885	154 048
1987	13 090	14 717	49 434	13 093	66 689	157 023

Source: Statistics Canada - Transportation Division

Rates of Growth

- Table 3 indicates the overall stability and growth of both the rail and trucking industry over time. An overall increase of 46% (94 million tonnes) was recorded for the truck mode between 1978 and 1987.

- Between 1978 and 1987, all five regions of origin and destination recorded increases in the amount of freight transported by truck. Ontario recorded an increase of 43% (34 million tonnes) for traffic originating from the province and an increase of 45% (35 million tonnes) from traffic destined for Ontario. These were the largest 10 year increases in terms of total tonnes transported for the truck mode. A large increase (45% or 32 million tonnes) in intraregional movements is responsible for a large part of the overall increase.

- There were no recorded decreases in all regions of origin and destination except for a decrease of 19 million tonnes (-146%) for goods originating in the Atlantic region and destined for the Prairie region.

- A region by region analysis of the rail sector shows a less consistent rate of growth when compared to the trucking mode. An overall increase of 13% (21 million tonnes) was recorded between 1978 and 1987.

- Again, between 1978 and 1988, for the five regions of origin, decreases were registered for Ontario (-31% or 9 million tonnes) and Quebec (-31% or 3 million tonnes). These were countered by increases in traffic originating from the Prairies (27% or 19 million tonnes) and British Columbia (35% or 12 million tonnes). Figures for 1978 and 1981 are not available by region of destination for the rail mode.

- Many small increases and decreases were recorded between regions for the rail sector (between 1984 and 1987). The largest drop recorded was intraregional traffic in Ontario (-21% or 3 million tonnes).

Intraregional versus Interregional Traffic Flows

- A close examination of Table 3 reveals the predominance of intraregional movements for the for-hire trucking modes.

- The percentage of total tonnages moved intraregionally by truck is very high. For example, all regions but Quebec recorded more than 90% of their total tonnes moved within their own regions. In the Quebec region, 83% of the tonnes moved was within the province. This can be explained in part by the fact that Quebec does slightly more business with other regions, especially with Ontario, than average.

- The percentage of total tonnes moved intraregionally by rail is not as consistent. The percentages range from a high of 77% (recorded for Ontario and B.C.) to a low of 10% for the prairie region. This low can be easily explained. In 1987, 87% (63 million tonnes) of the tonnes

originating in the prairie region were destined for the regions of Ontario and B.C. In other words, the principle rails commodities of wheat, coal and potash (see Table 4) which are produced in the prairie provinces are being transported by rail to the ports of Thunder Bay and Ontario. This flow has remained virtually unchanged in the last ten years.

Table 3A: Traffic Originating From Top 3 Regions 1978 & 1987

Origin:	TOTAL	Ontario	Quebec	Prairies
1978				
Truck	111 001 (45%)	43 882 (39%)	23 157 (21%)	21 347 (19%)
Rail	136 094 (55%)	36 323 (26%)	14 471 (11%)	52 578 (39%)
1987				
Truck	204 827 (57%)	77 607 (38%)	35 891 (18%)	45 001 (22%)
Rail	157 023 (43%)	27 771 (18%)	11 010 (7%)	71 961 (46%)

- Between 1978 and 1987, the total volume of tonnes transported by both the rail and truck modes has grown substantially. As illustrated above there were 361 million tonnes transported within Canada in 1987, an increase of 32% over the 247 million tonnes transported in 1978.

- It is interesting to note the shift between modes in terms of percent of market shares between 1978 and 1987. In 1978, goods transported by rail accounted for 55% of the total market compared with just 43% in 1987.

- For Ontario, although the volume of tonnes transported by truck from the province increased dramatically (34 million tonnes or 43%), the share of the total tonnes transported dropped 1%. For the rail mode, both the volume and % share for traffic originating from Ontario dropped. The corresponding figures for the Quebec region reveal the same changes as Ontario.

- In the prairie region both the amount of freight transported and the percentage share of the total market increased between 1978 and 1987.

East/West versus West/East Flows

- In 1984, 58 622 million tonnes of freight (49 881 million tonnes of it by rail, the rest by truck) was transported from the east to the west. By 1987, this had increased to 60 398 million tonnes (49 985 million tonnes by rail, 10 413 by truck).

- Similarly, in 1984 44 909 million tonnes (38 899 by rail, 6 010 by truck) was transported from the west to the east. This increased to 51 734 million tonnes (43 373 by rail, 8 260 by truck) by 1987. This represents a slight imbalance of traffic from east to west.

TABLE 4: TOP TEN COMMODITIES HANDLED BY TRUCK/RAIL, 1978/81/84/87

TRUCK			RAIL		
Rank	**('000t)**	**%**	**Rank**	**('000t)**	**%**
	1987			**1987**	
1. Sand & Gravel	29 899	14.6	1. Bituminous Coal	29 521	18.8
2. Pulpwood Chips	14 939	7.3	2. Wheat	27 234	17.3
3. Logs & Bolts	11 055	5.4	3. Potash	11 443	7.3
4. Cement & Concrete	9 232	4.5	4. Lumber	7 378	4.7
5. Dairy Products	6 551	3.2	5. Barley	6 503	4.1
6. Lumber	6 447	3.1	6. Gypsum	5 687	3.6
7. Other Food Preparations	6 240	3.0	7. Sulphur	5 458	3.5
8. Petroleum & Coal products	5 743	2.8	8. Pulpwood Chips	5 285	3.4
9. Plate, Sheet & Strip Steel	5 705	2.8	9. Wood Pulp	5 256	3.3
10.Fuel Oil	5 520	2.7	10.Newsprint Paper	4 375	2.8
Total	**101 331**	**49.4**	**Total**	**108 040**	**68.8**
	1984			**1984**	
1. Sand & Gravel	22 203	13.7	1. Bituminous Coal	28 607	18.6
2. Logs & Bolts	9 050	5.6	2. Wheat	24 946	16.2
3. Cement & Concrete	5 745	3.5	3. Potash	11 009	7.1
4. Pulpwood Chips	5 688	3.5	4. Lumber	7 743	5.0
5. Plate, Sheet & Strip Steel	5 448	3.4	5. Pulpwood Chips	5 806	3.8
6. Other Food Preparations	5 330	3.3	6. Sulphur	5 669	3.7
7. Lumber	5 103	3.1	7. Gypsum	5 483	3.6
8. Crude Mineral Oils	5 007	3.1	8. Barley	5 305	3.4
9. Fuel Oil	4 931	3.0	9. Wood Pulp	4 869	3.2
10.Dairy Products	4 720	2.9	10.Newsprint Paper	4 534	2.9
Total	**73 225**	**45.1**	**Total**	**103 971**	**67.5**
	1981			**1981**	
1. Sand & Gravel	17 706	12.6	1. Wheat	19 969	13.9
2. Cement & Concrete	7 024	5.0	2. Bituminous Coal	19 008	13.2
3. Fuel Oil	5 857	4.2	3. Potash	10 131	7.0
4. Lumber	5 673	4.0	4. Barley	6 415	4.5
5. Plate, Sheet & Strip Steel	5 451	3.9	5. Pulpwood Chips	5 660	3.9
6. Pulpwood Chips	4 686	3.3	6. Lumber	5 657	3.9
7. Gasoline	4 629	3.3	7. Sulphur	5 611	3.9
8. Crude Mineral Oil	4 579	3.2	8. Wood Pulp	4 950	3.4
9. Other Food Preparations	4 525	3.2	9. Nickel, Copper Ores	4 946	3.4
10.Dairy Products	4 508	3.2	10.Gypsum	4 817	3.4
Total	**64 638**	**41.9**	**Total**	**87 164**	**60.5**

TRUCK (cont'd)	1978		RAIL (cont'd)	1978	
1. Sand & Gravel	9 891	8.9	1. Wheat	17 778	13.1
2. Cement & Concrete	6 909	6.2	2. Bituminous Coal	15 474	11.4
3. Fuel Oil	6 852	6.2	3. Potash	9 754	7.2
4. Lumber	4 135	3.7	4. Iron Ore & Concentrates	7 947	5.8
5. General Freight	4 113	3.7	5. Pulpwood Chips	7 006	5.1
6. Gasoline	4 100	3.7	6. Lumber	6 436	4.7
7. Petroleum & Coal Products	3 649	3.3	7. Barley	5 227	3.8
8. Dairy Products	3 183	2.9	8. Gypsum	4 852	3.6
9. Logs and Bolts	2 987	2.7	9. Wood Pulp	4 811	3.5
10.Pulpwood Chips	2 601	2.3	10.Newsprint Paper	4 338	3.2
Total	**44 307**	**43.6**	**Total**	**83 633**	**61.4**

Leading Commodities

- In terms of commodities handled, the increases in total tonnage moved by rail and truck between 1978 and 1987 were mainly related to increases in the haulage of the top 10 commodities.

- Shipments of wheat, coal and potash are constant top three commodities in the rail sector. In 1978, they accounted for 31.7% (43 million tonnes) of the total goods moved by that mode. By 1987, this figure had risen to 43.4% (69 million tonnes).

- In comparison, the for-hire trucking industry was more diversified in terms of commodities handled. Bulk, as well as processed and fabricated products composed the top 10 commodities.

- The top 10 commodities carried by truck accounted for roughly 40% to 50% of the total tonnes moved over a ten year period compared with 60% to 70% for the rail sector for the same period.

- Sand and gravel remained the leading commodities moved by truck between 1978 and 1987. However, tonnage handled for the top three ranking commodities reached 24 million tonnes (21.3% of the total) in 1978 compared to 56 million tonnes (27.3% of the total) in 1987. These activity shares are considerably smaller than the composite shares of the rail sector's top 3 commodities.

IV. TRANSBORDER TRAFFIC - AN INTERNATIONAL PERSPECTIVE

Introduction

The objective of this section of the paper is to analyze the importance of different modes in transporting goods traded between Canada and the United States. The analysis is based on trade data obtained from the International Trade Division of Statistics Canada. The statistical yardstick used for measuring market shares by mode of transport is the value of the merchandise. It is recognized that this statistical yardstick has its limitations from a transportation point of view; however, it is the only one available for all modes of transport in a consistent, comprehensive manner.

Definitions/ Data Coverage

- The mode of transport covers both private and for-hire carriers domiciled either in Canada or the United States.
- Exports and Imports by mode of transport indicate the mode by which the merchandise enters or exits Canada.
- Data presented exclude those transactions which are not considered to be part of Canadian merchandise exports or imports such as transhipments.

Findings

- For Canadian merchandise trade with the United States, truck transport dominates; in 1988, 73.8% of Canadian imports and 57.9% of Canadian exports were transported by the truck. Corresponding numbers for rail were 13.2% and 26.1% respectively. All other modes combined captured just 13.0% of the imports market and 16.0% of the exports market.

- The market share of the trucking industry on the import side has grown from 54.1% to 73.8% during the last ten years (1978 to 1988) while the share of the railway industry decreased from 16.2% to 13.2%. On the exports side motor carriers' share over the same time period increased from 47.8% to 57.9% while rail's share declined from 31.2% to 16.2%.

- These shifts in market shares can partially be explained by the comparative advantages of different modes and by the changing commodity mixes exported and imported by Canada. To illustrate; passenger automobiles exported by Canada (and carried by the trucking industry) represented 12.3% of total exports in 1978 but increased to 16.9% by 1988. Similarly, the importance of commodities imported by Canada, which enter the country by truck, increased during this period. For example, "other consumer goods" (mainly transported by the trucking industry) accounted for 1.9% of imports in 1979 but represented 5.9% of total imports by 1988.

TABLE 5:TRADE BETWEEN CANADA AND THE UNITED STATES, BY MODE OF TRANSPORT 1978, 1983, 1988

Exports = Out
Imports = In

	North Eastern		North Central		Southern		Western		TOTAL	
	Out	In	Out	In	Out	In	Out	In	Out	In
($ '000'000)										
ATLANTIC										
1978										
Road	433	132	33	60	41	64	23	17	532	274
Rail	186	12	80	27	57	20	19	13	343	72
Other	472	35	10	30	171	39	37	27	691	131
1983										
Road	943	21	64	65	69	165	22	46	1098	492
Rail	225	1	47	17	15	25	1	7	288	61
Other	750	65	9	85	175	121	23	66	958	338
1988										
Road	1533	351	114	323	341	272	42	103	2030	1050
Rail	410	11	124	14	120	23	8	8	663	56
Other	1544	43	50	26	492	70	33	49	2125	188
QUEBEC										
1978										
Road	1572	1260	773	445	331	512	83	137	2759	2353
Rail	975	107	929	454	272	222	62	117	2237	900
Other	356	225	372	250	325	197	90	435	1143	1106
1983										
Road	3133	2143	1265	555	763	834	202	416	5464	3947
Rail	1479	167	1399	640	603	245	64	118	3546	1170
Other	671	255	400	314	461	139	125	533	1656	1242
1988										
Road	5512	3142	3190	1134	1663	1740	593	521	10958	6537
Rail	1980	117	1667	475	1119	746	246	141	5012	1479
Other	709	345	353	359	709	474	251	969	2023	2248
ONTARIO										
1978										
Road	2828	3270	8538	7663	1254	1729	399	481	13018	13143
Rail	1349	363	3337	2842	454	425	344	180	5485	3809
Other	322	695	596	2261	76	491	143	3877	1137	7323
1983										
Road	6095	6244	14785	11459	2725	3732	741	6178	24347	27614
Rail	1409	613	5967	3386	1039	650	655	181	9069	4830
Other	1877	1416	751	2120	1688	502	478	1104	3274	5143
1988										
Road	8804	8866	23750	26205	5402	8707	1404	3384	39360	48162
Rail	5629	483	8059	6307	826	1339	823	386	15337	8515
Other	1160	1396	530	1893	485	1061	673	1947	2849	6297

TABLE 5:TRADE BETWEEN CANADA AND THE UNITED STATES, BY MODE OF TRANSPORT 1978, 1983, 1988

Exports = Out
Imports = In

	North Eastern		North Central		Southern		Western		TOTAL	
	Out	In	Out	In	Out	In	Out	In	Out	In
($ '000'000)										
WESTERN PROVINCES										
1978										
Road	111	189	500	1279	116	564	831	1097	1558	3129
Rail	444	93	1623	492	813	143	705	13	3586	891
Other	254	154	1966	421	132	208	2530	1030	4883	1813
1983										
Road	167	450	1034	1721	372	813	1598	2153	3172	5137
Rail	467	113	1464	576	929	188	770	219	3630	1095
Other	693	134	4772	646	323	201	3720	808	9508	1790
1988										
Road	570	513	1740	3059	738	1414	3079	3085	6127	8071
Rail	850	103	2278	571	1191	335	1035	353	5355	1362
Other	1155	229	4069	785	610	425	3335	1103	9168	2542
TOTAL U.S. REGIONS										
1978										
Road	4944	4851	9845	9448	1742	2869	1337	1732	17867	18899
Rail	2955	576	5970	3815	1596	809	1130	473	11651	5673
Other	1404	1109	2944	2961	705	935	2800	5370	7853	10374
1983										
Road	10339	9052	17249	13801	3930	5545	2563	8792	34081	37190
Rail	3580	904	8878	4618	2586	1109	1489	525	16534	7156
Other	3991	1872	5933	3166	1127	963	4346	2511	15397	8513
1988										
Road	16419	13873	28794	30722	8144	12133	5118	7093	58475	63822
Rail	8870	714	12128	7366	3257	2443	2112	890	26367	11413
Other	4568	2012	5003	3163	2297	2032	4297	4067	16165	11274

- The majority of Canadian imports (55.6%) in 1988 was received by Ontario. Seventy-six percent of these imports arrived by truck. The corresponding numbers for 1978 were 37.6% and 54.1%. These figures clearly indicate the increased share of Ontario in terms of total imports and the increased share of the trucking mode over time.

- On the exports side Ontario's share increased from 34.8% to 39.0% while the share of the trucking industry rose from 66.3% in 1978 to 68.4% in 1988. A change not as pronounced as for imports.

- The largest shift in market shares occurred in the western provinces where the share of the trucking industry in the exports market increased from 15.5% in 1978 to 29.7% in 1988. This change is probably explainable change in the commodities exported from these provinces.

The corresponding numbers on the imports side are 53.6% and 67.4%.

- A similarly large shift occurred in the Atlantic provinces where the market share of rail declined from 15.2% of total imports and 21.9% of exports in 1978, to 4.3% and 13.8%, in 1988.

- When examining the flow of goods to and from the United States regions, over 45.0% of all trade is carried on with the North Central States. However, the dominance of these states has decreased since 1978 when they represented close to 50%. In 1988, 74.5% of imports from these regions and 62.7% of exports were carried by truck, which is up from 58.2% and 52.5% in 1978.

- In terms of the direction of trade flows, rail generally carries a higher proportion of goods exported than imported. These figures were 16.2% for imports in 1978 and 31.2% for exports. The corresponding 1988 market shares stood at 13.2% and 26.1%. These numbers are explainable by the mix of commodities exported and imported by Canada.

- The other mode of transport, mainly marine, plays a vital role in Canadian exports from the Atlantic region and from the Western provinces, representing a market share of close to 45.0%; virtually unchanged since 1978. On the imports side, for these regions the "other" mode is less significant, with 14.5% for the Atlantic region and 21.2% for the Western provinces. Furthermore, their relative importance was reduced significantly since 1978 (27.5% and 31.1%)

- It is interesting to note that the market share of trucking in Quebec's export and import market is very well balanced representing 63.7% of imports and 60.9% of exports. This is in sharp contrast to the other regions where the share of trucking in the export market is markedly lower than in the imports market.

Analysis of the table presented in Table 6 (below) and other more detailed tabulations reveal the following interesting facts:

- The relative importance of the 10 most important commodities imported increased from 60.7% to 64.0% during the study period. The corresponding export numbers were 63.1% and 67.1% respectively.

- The share of the two most important commodities exported and imported, namely passenger automobiles and motor vehicle parts increased from 28.7% to 30.8% for imports and from 23.8% to 27.2% for exports.

- In 1988 the large majority (72.3%) of passenger automobiles and vehicles parts were imported into Canada by truck. Unfortunately, the corresponding 1978 figures are not considered reliable enough to make an accurate comparison. The dominance of the truck mode is more pronounced for motor vehicle parts than for passenger automobiles where the railway industry also plays an important role.

TABLE 6:TRADE BETWEEN CANADA AND THE UNITED STATES, BY MODE OF TRANSPORT AND COMMODITIES, 1978, 1988

IMPORTS

	ROAD		OTHER		TOTAL	
COMMODITIES ($'000,000)	1978	1988	1978	1988	1978	1988
Motor Vehicle Parts	4,344	12,934	3,370	3,235	7,714	16,170
Passenger Auto	2	4,946	3,036	3,646	3,038	8,592
Other Equip. & Tools	1,728	5,851	784	1,651	2,511	7,502
Other Industrial Mach.	1,340	4,272	394	586	1,734	4,858
Trucks & Other Vehicles	358	2,369	1,035	856	1,392	3,226
Agricultural Machinery	910	-	429	-	1,339	-
Other Chem & Rel. Prod.	551	1,595	402	722	953	2,317
Office Machine & Equip	575	2,790	319	1,487	894	4,277
Misc. End Product	573	1,837	262	527	834	2,364
Aircraft, Engines & Parts	267	897	503	2,118	770	3,014
Other Communic Equip.	-	2,121	-	946	3,067	-
TOP 10 TOTAL	10,647	39,612	10,533	15,775	21,180	55,386
GRAND TOTAL	18,899	63,822	16,047	22,687	34,946	86,509

EXPORTS

	ROAD		OTHER		TOTAL	
COMMODITIES ($'000,000)	1978	1988	1978	1988	1978	1988
Motor Vehicle Parts	3,124	9,113	1,133	1,264	4,257	10,377
Passenger Auto	2,994	8,538	1,832	8,502	4,626	17,040
Other Equip. & Tools	-	2,733	-	413	-	3,146
Trucks & Other Vehicles	1,795	4,875	940	3,050	2,735	7,926
Lumber	586	1,752	2,062	1,731	2,648	3,483
Newsprint Paper	339	1,715	1,995	4,375	2,334	6,090
Natural Gas	-	2	2,190	2,953	2,190	2,954
Crude Petroleum	-	4	1,573	3,948	1,573	3,952
Woodpulp	41	357	1,137	2,614	1,178	2,971
Industrial Machinery	1,053	3,131	110	145	1,163	3,277
Petroleum & Coal Prod.	58	-	769	-	827	-
TOP 10 TOTAL	9,990	32,221	13,540	28,995	23,530	61,216
GRAND TOTAL	17,867	58,475	19,504	42,532	37,372	101,008

- On the export market 87.9% of the motor vehicle parts exports were transported by truck in 1988. The corresponding figure for 1978 was 73.4%.

- Passenger automobile exports were evenly divided between the rail and truck mode.

- On the export side a significant shift occurred in the transportation of lumber. In 1987, one half of lumber exports were transported by truck compared with just 22% in 1978.

V. CONCLUSIONS

Domestic Traffic Flows

In summary the major findings of investigation of the domestic traffic flows are as follows:

- In the past 10 years the market share (as measured using total tonnage carried) has grown substantially for the for-hire trucking segment when compared to rail. This increase would probably be even more substantial if the private trucking sector of the industry were taken into consideration.

- Intraregional trucking accounts for more than 80% of the total domestic for-hire trucking traffic.

- Intraregional rail movements are much less important in the rail sector.

- Ontario, Quebec and the Prairies are the principle regions of traffic movement for both the truck and rail modes.

- Between 1978 and 1987 there was a shift between modes. In 1978, goods transported by rail accounted for 55% of the total market compared with just 43% in 1987.

International Traffic Flows

- It is evident from the data presented and analyzed that the majority of Canadian exports and imports to and from the United States are carried by the motor carrier mode (both private and for-hire). The market share of this mode for imports in 1988 was 73.8% while exports of it amounted to 57.9%.

- The share of the motor carrier mode has increased during the 10 year study period from 54.1% to 73.8% for imports and from 47.8% to 57.9% for exports.

- The increased share of the motor carrier mode on the imports side can largely be explained by the shift of mode in the transportation of motor vehicle parts. In 1978, 56.4% of motor vehicle part imports were brought

into Canada by truck. This share increased to 80.0% by 1988. "Motor Vehicle Parts" are the number one ranking commodity for both exports and imports.

- On the export side, the share of the motor carrier mode in the transportation of motor vehicle parts increased from 73.4% in 1978 to 87.8%. This explains to a large extent the increased modal share of the motor carrier industry.

VI. FUTURE CONSIDERATIONS/RESEARCH REQUIRED

Speculations

- Due to integration of North American economies, further shifts towards North/South as opposed West/East traffic are anticipated.
- Given the change in commodity mixes, trucks will continue to dominate especially if one considers that the majority of the trade is with the border states. These short distances combined with greater flexibility of the truck mode will assure this dominance in future.
- Given economic integration, intercorporate hauling, performed by the private trucking sector, is expected to increase substantially.
- It will be interesting to observe the battles for market shares between the Canadian and United States based truck carriers.

Further Research

- Any further studies should include all modes of transport including pipelines the private trucking and marine transport industries.
- More transportation variables could be used in further research. For example, tonne-kilometres, tonnes, average length of haul, by types of commodities should be used to analyze market shares by modes on the international market.
- An analysis of transhipments to and from the U.S. could prove interesting and informative. Unfortunately, using pure trade data, this was not feasible this time.
- An analysis of Canadian-owned versus U.S.-owned carriers performing transborder movements is worthy of further research.

END NOTES

1. Figures are based on unduplicated value-added revenues as derived by the Input/Output Division for Gross Domestic Product calculations. Estimates for the private trucking sector were derived by the Transportation Division of Statistics Canada.

2. The rail figures only include the activities of CN and CP only. As well, provincial figures for the years 1978 and 1981 are not available. Trucking statistics include only for-hire carriers with more than $100,000 in intercity annual revenues.

3. The views and opinions expressed in this paper are those of the authors and do not necessarily reflect those of Statistics Canada.

CANADA-CARIBBEAN CARGO CONSOLIDATION

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UNB Transportation Group

INTRODUCTION

The Transportation Group was retained to examine the feasibility of developing a consolidation centre in Saint John for the Canadian-Caribbean trade. Saint John was selected for investigation in this market niche study as it has served as a major point of entry/exit for Caribbean and other Latin American trade. In recent years, an increasing amount of Caribbean-bound general cargo has been diverted through Southern U.S. ports as improved inter-modal rail systems resulted in decreased freight rates and enhanced service levels. These competitive improvements eroded the viability of an all-water route from Canada to the Caribbean.

A consolidation centre may potentially offset traffic diversion through the U.S. A consolidation centre would enable reasonable sized volumes of general cargo and other commodities to be assembled for shipment. Such consolidation could make the port of Saint John attractive to Caribbean-bound carriers using larger vessels (resulting in economies of scale and lower freight rates) and improved service frequency.

The scope of this analysis was limited to commodity movements to and from Eastern Canada and seven Caribbean countries (Bahamas, Barbados, Cuba, Dominican Republic, Jamaica, Puerto Rico, and Trinidad and Tobago). The analysis included Canada-Caribbean trade movements, the identification of potential opportunities for enhanced Canadian export trade, transportation system needs including all relevant modes, the consideration of Eastern Canadian shippers' perspectives on trade with the Caribbean, and consolidation centre requirements and options.

CONSOLIDATION CENTRE CONCEPT

The conceptual design of a Caribbean consolidation centre involves inter-modal transportation. Arriving freight packages could be consolidated into full container loads (FCL) for shipment to the Caribbean. Similarly, import shipments could either be transported inland as

FCLs and full truck loads (FTL) or stripped into less than truck load (LTL) size for delivery to nearby destinations.

A review of several existing inter-modal terminals (in Canada, U.S., and Sweden) revealed that few, if any, serve the proposed role of the Saint John facility. That is, consolidating a wide range of commodities for a specific geographic destination. Normally, such facilities limit the range of goods handled and distribute them globally. However, these existing facilities did define the minimum size of consolidation centres, throughput levels, and facilities required.

Inland consolidation facilities play a significant role in the design of a port consolidation centre in the Canadian context. These inland facilities permit containers to be stuffed or stripped at a location closest to their point of origin or destination.

Typically, inland consolidation centres are spaced between 800 and 1400 kilometres apart (Slack, 1988). Trucks serving a radius of 400 to 700 kilometres are used to deliver goods to and from the inland facility. Unit trains carrying FCLs on flatcars can then be used to transport the consolidated commodities to the designated port consolidation centre.

EASTERN CANADA - CARIBBEAN TRADE ANALYSIS

Published information from Statistics Canada (1988) along with a special tabulation on exports on a tonnage basis (Statistics Canada, 1987) was used to determine the extent of commodity movement between Canada and the seven selected Caribbean countries.

As shown in Figure 1, in 1987, Eastern Canada (Ontario, Quebec and the Atlantic provinces) exported some 30 percent of the Canadian tonnage to the Caribbean. On a dollar value basis (Figure 2), Eastern Canadian exports accounted for almost 70 percent of all the goods shipped to the Caribbean.

Cuba is the main recipient of Canadian export goods (primarily wheat) in terms of both tonnage and value. In terms of dollar value, Puerto Rico is the main Caribbean trading nation for Eastern Canada being the destination for some 38 percent of exported goods (primarily manufactured commodities).

The four Atlantic provinces contributed 79 percent of the Eastern Canadian exports to the Caribbean on a tonnage basis and 35 percent on a dollar value basis (Figures 3 and 4). Nova Scotia contributed the greater proportion of export tonnage to the Caribbean at 45 percent of the Atlantic total. New Brunswick provided the highest proportion of exports by value at 43 percent.

The major exports from the Atlantic provinces to the Caribbean on a tonnage basis in 1987 included flour and wheat (28 percent), newsprint (16 percent), other chemicals (13 percent), paperboard (10 percent), potatoes

CANADIAN EXPORTS TO CARIBBEAN
(1987 IN TONNES)

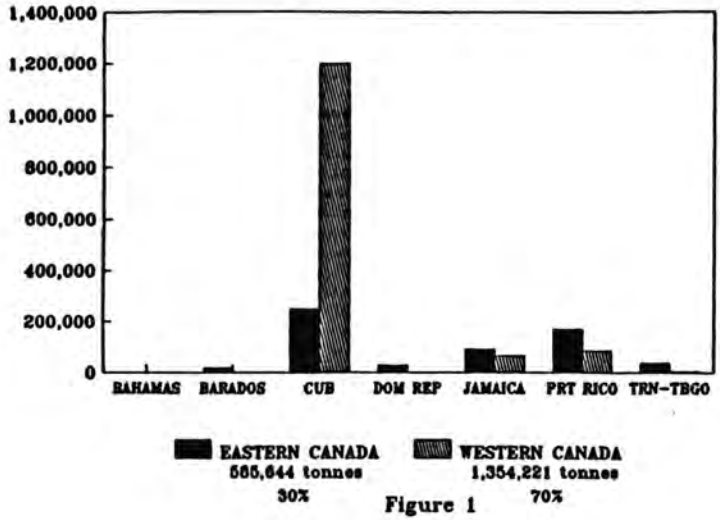


Figure 1

CANADIAN EXPORTS TO CARIBBEAN
(1987 IN $000)

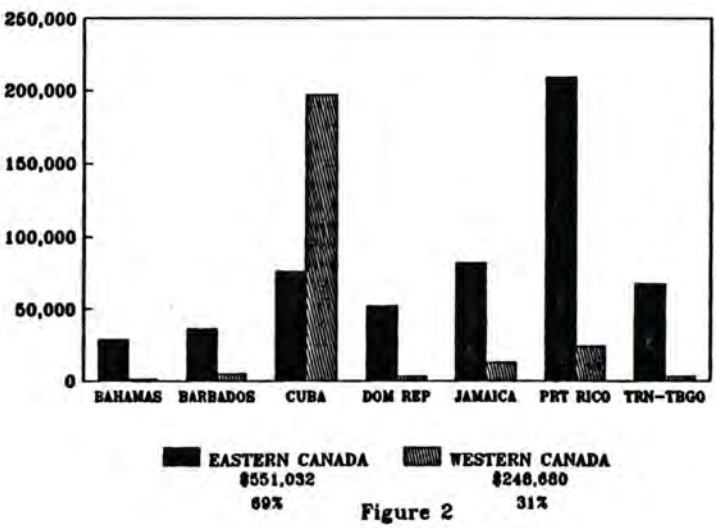


Figure 2

Ircha/Christie

EASTERN CANADA EXPORTS TO CARIBBEAN
(1987 IN TONNES)



Figure 3

EASTERN CANADA EXPORTS TO CARIBBEAN
(1987 IN $000)

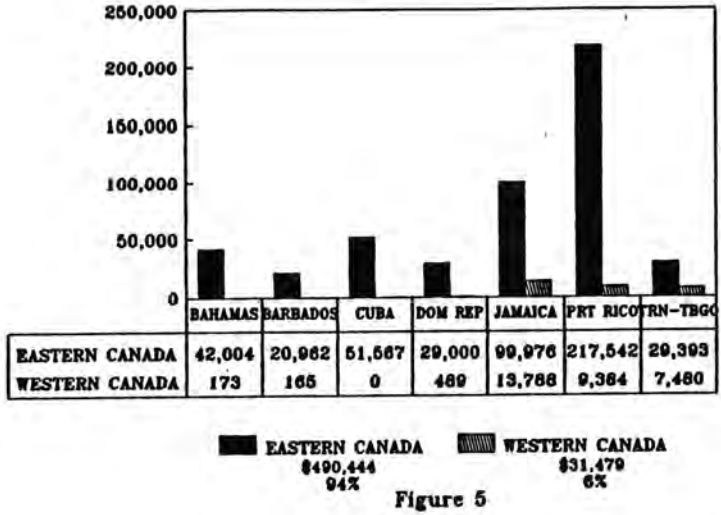


Figure 4

(9 percent) and dimesioned stone (9 percent). On a dollar value basis, the major exports included preserved fish (21 percent), newsprint (21 percent), vegetables (13 percent), other food (13 percent), paperboard (11 percent) and flour and wheat (9 percent).

In 1987, total Canadian imports from the Caribbean amounted to $522 million compared to $800 million worth of exports (Figures 2 and 5). Puerto Rico was the main Caribbean country exporting goods to Canada with its commodities valued at $217 million or 43 percent of the total Canadian imports. The major commodities imported by Canada were manufactured goods (23 percent), aluminum ores (18 percent) primarily from Jamaica, and other food (17 percent). Eastern Canada accounted for 94 percent of the imported Caribbean commodities, with the Atlantic provinces importing some 11 percent or about $51 million worth of goods.

CANADIAN IMPORTS FROM CARIBBEAN
(1987 IN $000)



	BAHAMAS	BARBADOS	CUBA	DOM REP	JAMAICA	PRT RICO	TRN-TBGO
EASTERN CANADA	42,004	20,962	51,567	29,000	99,976	217,542	29,393
WESTERN CANADA	173	165	0	489	13,788	9,384	7,480

Figure 5

The main exports to the Caribbean from the Atlantic provinces were food (including wheat and flour) and paper products supplied primarily by New Brunswick and Nova Scotia. In 1987, some $193 million worth of exports from the Atlantic provinces were shipped to the Caribbean compared to $51 million worth of imports.

Ircha/Christie

The vast array of commodities exported from Eastern Canada were examined to determine the amount which might be divertible through a Saint John consolidation centre to establish potential Caribbean-bound throughput.

CARIBBEAN TRADE ANALYSIS AND COUNTRY PROFILE

Despite the locational advantage of Caribbean countries to Canada, they have often been overlooked relative to other larger export markets. As individual island nations, each of the Caribbean countries offers little opportunity, but, taken as a whole the Caribbean Basin provides a considerable potential market for Canadian exporters, as shown in Table 1.

The data used to examine the Caribbean countries came from the International Monetary Fund's, Direction of Trade Statistics (reflecting 1987 information) and individual country profiles provided by External Affairs Canada. Tonnage data was unavailable, thus only dollar value commodity movements were used in this analysis.

There are inherent difficulties in relying only on monetary value information. These difficulties include: changes in the world price of a good may result in changes in the value shipped while tonnage remains constant; currency fluctuations affect the value of imports and exports; and countries supplying raw materials may be under-represented even if their shipped tonnage is large.

Table 1

Caribbean Market Size

Country	Population	GNP (1983) $US billions
Bahamas	255,000 (87)	1.1
Barbados	254,000 (87)	1.0
Cuba	10,246,000 (86)	10.0
Dominican Republic	6,600,000 (86)	6.7
Jamaica	2,410,000 (87)	2.7
Puerto Rico	3,200,000 (87)	12.7
Trinidad & Tobago	1,195,000 (87)	8.4
TOTAL	24,160,000	42.6

Potential export opportunities for Canadians in the Caribbean were identified by examining the current position of Canadian exporters within each sector of the local market, economic trends and structure of each

country, and specific country projections provided by External Affairs Canada. Detailed country by country analyses of specific Canadian export opportunities were undertaken.

The Caribbean countries examined have initiated "value-added" policies such as the establishment of import quotas, import tariffs, and currency devaluations to stabilize and enhance their local economies. The primary objective of these policies is to shift from a single commodity based economy to a more diversified structure.

The Caribbean countries' "value-added" policies provide opportunities for Canadian exporters as our major shipments to the region are raw/unprocessed commodities and machinery equipment - both designed to bolster the development of indigenous local economies. In addition, as tourism expands and the growth of the Caribbean countries' younger population continues, the need for construction materials and food will also increase. Canada is in a good position to supply this rising demand from the Caribbean.

Other potential Canadian exports to the Caribbean include semi-processed and finished goods such as textiles, pharmaceuticals, electronics, and transportation equipment.

Enhanced Canadian export trade to the Caribbean would further increase potential traffic through a Saint John consolidation centre.

POTENTIAL EXPORT TRAFFIC THROUGH SAINT JOHN

To determine the range of potential export traffic through the port of Saint John optimistic and conservative scenarios were developed based on existing and potential traffic to the Caribbean.

The optimistic scenario assumes that the Saint John consolidation centre could capture 100 percent of the Caribbean-bound bulk commodities from all of Eastern Canada (primarily grain). The conservative scenario limits the potential capture of bulk commodities to 50 percent. The recent deletion of the "At and East" grain subsidy by the federal government may make this differentiation meaningless.

Each of the 1987 exported commodities from Eastern Canada through all ports (including U.S.) were evaluated to determine whether or not they could be diverted through Saint John. Based on this evaluation, the potential increase in existing export traffic (including general cargo in the form of containers, neobulk forest products and dry/liquid bulk) in the port of Saint John varied from 104,000 tonnes to 170,000 tonnes dependent upon the scenario used.

In addition, potential growth in the Caribbean market based on identified opportunities for Canadian exporters increased the range of total additional exports through

Saint John from 140,000 to 207,000 tonnes. This represents an increase of between 86 - 127 percent of the current Caribbean-bound exports through the port.

TRANSPORTATION SYSTEM ANALYSIS

Five transportation system alternatives for the movement of commodities to the Caribbean were evaluated. These included inland transportation from Toronto/Montreal to each of five major ports - Montreal, Saint John, Halifax, New York and Miami - and subsequent ocean carriage to the Caribbean.

The transit time for the inland transportation leg to these ports is: Saint John/Halifax - 1 to 2 days (rail); New York - 1 day (truck); and Florida - 3 to 5 days (rail/truck). The ocean leg of the journey involves the additional time to destination in the Caribbean. A variety of ocean shipping services are currently available to the Caribbean (AGB, 1989). The total transportation time for Central Canadian commodities to the Caribbean from Montreal on currently scheduled services is 7 to 8 days; Saint John, 6 to 10 days; Halifax, 7 to 10 days; New York, 6 days; and Florida 4 to 8 days. Thus Saint John/Halifax is 1 to 2 days closer to the Caribbean than Montreal, and roughly competitive with New York and Florida.

Improvements to the ocean transit service may be achieved if increased Caribbean-bound commodity flowed through a designated consolidation centre. Increased tonnage could attract larger vessels with improved service frequency.

SHIPPERS' PERSPECTIVES ON THE CANADIAN - CARIBBEAN TRADE

A survey of Eastern Canadian shippers to the Caribbean sought information on their preference of port of export and why Saint John was not being used. As shown in Table 2, Saint John, Halifax and Miami were roughly equivalent in terms of preference, attracting about a third of the shippers. Montreal was the clear port of choice with 65 percent of the respondents using it for their Caribbean exports. When considering the average tonnage of Caribbean bound exports shipped through each of these ports, their relative positions changed. Montreal remains the dominant port of choice with 37 percent, followed by Halifax and Miami with 16 percent, New York, 13 percent, and Saint John, 6 percent.

Many shippers indicated Montreal was used because of convenience, minimum ground transportation, and frequent sailings. The major reasons for not using Saint John were the cost of inland transport to the port, freight forwarders determining optimal routings, and limited service in the port. In terms of shipping service, most exporters desired weekly sailings to the Caribbean. Over half of the exporters surveyed (59 percent) used FCLs for

their shipments to the Caribbean, a further 37 percent exported part loads in LCL shipments.

Table 2

Exporters' Use of Selected East Coast Ports

	Ports				
	St John	H'fax	Montreal	New York	Miami
No. of respondents using port for portion of exports (max. - 43)	14	15	28	9	14
Percentage of respondents using port (max. - 43)	33%	35%	65%	21%	33%
Mean percentage of export tonnage through each port	6%	16%	37%	13%	16%

In order to change the current perceptions of Eastern Canadian shippers, the port of Saint John will have to aggressively market its function as a Caribbean consolidation centre and establish itself as the primary Canadian - Latin American connection.

CONSOLIDATION CENTRE REQUIREMENTS

Using operating data from existing consolidation centres and inland facilities, the current cargo handling infrastructure at the port of Saint John was found to be more than adequate to handle the additional traffic which might be generated for the Caribbean trade. Conservative estimates of annual traffic volumes for a viable inland load centre and consolidation centre are 20,000 TEU and 6,000 TEU (twenty foot equivalent containers) respectively (Slack, 1988). Using the conservative scenario for the current and potential Caribbean container and neobulk exports through the port of Saint John, the traffic through the consolidation centre could amount to 3800 TEU from Ontario and Quebec and 17,500 TEU from the Maritime provinces. Only a small portion of these containers will require consolidation as many shippers would use FCLs from their factory gate.

Using distance criteria between consolidation centres, one inland centre located in Central Canada (either Montreal or Toronto) is needed to support a facility in Saint John. Obviously, the estimated 3800 TEU from Central Canada for the Caribbean falls short of the minimum inland centre throughput requirement of 20,000 TEU

for economic viability. Hence, a stand-alone facility designed exclusively for the Caribbean trade would not be feasible, rather an existing general inland centre handling a range of commodities should be used.

The volume of goods shipped from the Maritime provinces may be sufficient to justify a consolidation centre at the port of Saint John. If one-third of the volume required consolidation, the annual throughput in the centre at Saint John would be 5800 TEU, close to the 6000 TEU required for viability.

This analysis considers only export traffic to the Caribbean. Imports from the Caribbean to the Atlantic provinces amounted to about one third of the exports, hence, adding import data (if it were available on a tonnage basis) would further enhance the overall viability of the proposed consolidation centre.

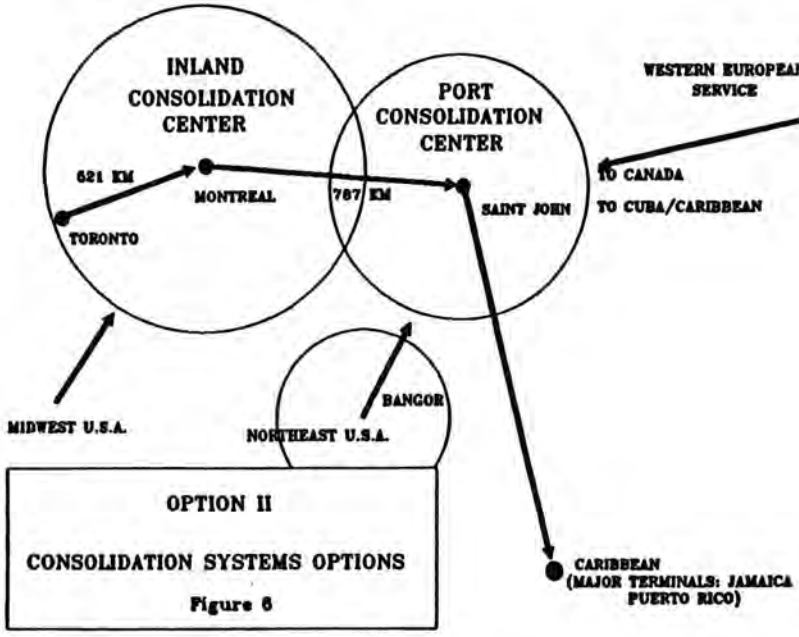
CONSOLIDATION SYSTEM OPTIONS

The efficiency and viability of a consolidation centre requires that it be located in a dense population market area to ensure that LCLs and LTLs can be readily consolidated into FCLs for economic handling. Toronto and Montreal are major markets and are thus prime candidates for an inland load centre consolidating Caribbean-bound traffic for Saint John.

Several options were considered in this study including: (i) developing a stand alone consolidation centre in Saint John, (ii) adding an inland load centre in Montreal and a smaller consolidation facility in Bangor Maine, and (iii) adding a further inland load centre in Toronto. It was concluded from the analysis that option (ii) and possibly (iii) appear most feasible for the development of a viable consolidation centre in Saint John. Figure 6 outlines option (ii).

The establishment of the Montreal facility (shown in Option ii) enables unit trains to operate from Montreal to Saint John, reducing freight rates and possibly resulting in competitive pricing with the all water route from Montreal to the Caribbean. Toronto is within 500 km of Montreal thus goods could be trucked to the Montreal consolidation centre. Similarly, a consolidation centre in Bangor, Maine would serve to consolidate Caribbean-bound commodities shipped from the North East U.S. through Saint John. The facility at Saint John would consolidate goods originating in the Maritimes as well as processing FCLs from Montreal and Bangor.

Given the minimum traffic flows anticipated through the Saint John consolidation centre, it is apparent that other traffic would be required to ensure economic viability. Although outside the scope of this market niche study, if Canadian exports to other Latin American countries were to be consolidated in the facility, the additional volumes would further warrant its development.



OPTION II

CONSOLIDATION SYSTEMS OPTIONS

Figure 6

The actual management of a Caribbean consolidation centre in Saint John depends upon the selection of an appropriate agency to oversee the overall network. Freight forwarders and shipping lines often establish consolidation facilities to reduce freight charges or to improve service to their customers. Freight forwarders are generally aggressive marketers and maintain close contact with shippers in various market niches. They usually have the ability and capacity to establish and operate an efficient consolidation centre system. Shipping lines, on the other hand, typically manage load centres within a port.

A further advantage is that freight forwarders normally seek to maximize the amount of freight moved regardless of its nature. Freight forwarders are often in the best position to coordinate transportation services from the point of inland origin to the final inland point of destination (from factory gate to customer's door). They bargain and make volume discount deals among shippers/receivers, inland transportation companies, port terminal operators, and shipping lines.

Overall, the successful management of a Caribbean consolidation centre in Saint John will likely require the services of a freight forwarder or a consortium of forwarders.

CONCLUSIONS

Atlantic Canada exports a number of commodities to the Caribbean. The main exports are food and paper products. Bulk wheat/flour movements normally are shipped from Halifax and neobulk paper products from Saint John. Quebec and Ontario tend to ship manufactured goods to the Caribbean. The Atlantic region ships 79 percent of the export tonnage to the Caribbean - much of this being low value commodities. Quebec and Ontario ship 65 percent of the exports by value.

In 1987, Eastern Canada exported 12 percent more products by value to the Caribbean than it imported with a net trade balance of $61 million. The Atlantic region exported more than three times the amount it imported by value with a net trade balance of $141 million.

Significant opportunities for Eastern Canadian exporters exist in the Caribbean market as our major exports to the region are raw/unprocessed commodities and machinery equipment (desirable for the "value-added" policies of the Caribbean countries). To successfully tap this considerable market comprised of many small countries, Canadian exporters will have to thoroughly understand the nature of each individual market within the Caribbean Basin. Many of these nations require small, but frequent, shipments of commodity. A consolidation centre in Saint John will aid in meeting some of this demand. The development of a complementary facility in the Caribbean would be beneficial in reinforcing and developing Canadian-Caribbean trade.

It is estimated that a consolidation centre in Saint John could attract an additional 104,00 to 207,000 tonnes through the port destined for the seven Caribbean countries evaluated in this study. The amount of commodity flow generated marginally justifies the establishment of a designated consolidation facility. However, if additional traffic between Eastern Canada and Latin America could be attracted through the Saint John consolidation centre, then the overall concept would likely be economically viable.

The existing cargo handling infrastructure in Saint John has sufficient spare capacity to enable the port to absorb additional traffic generated by an increase in Caribbean-bound throughput. Thus, no additional major capital facilities are required to implement a Canadian-Caribbean consolidation centre in Saint John.

What is required, however, is the appropriate marketing of the port as Canada's consolidation facility for Caribbean and Latin America commodities. Aggressive marketing to reinforce Saint John's image as Canada's Caribbean - Latin American connection is necessary to change the current perceptions of Eastern Canadian shippers and to develop appropriate commodity throughput.

ACKNOWLEDGEMENTS

The following graduate students in the Transportation Program provided much of the background statistical analysis and evaluation of the Canada-Caribbean consolidation centre study: Mr. D. MacKenzie; Ms. K. L. Robichaud; and, Ms. S. S. F. Wong. Their extensive contributions to this study are gratefully acknowledged.

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CANADIAN EXPORTS TO CARIBBEAN
(1987 IN TONNES)

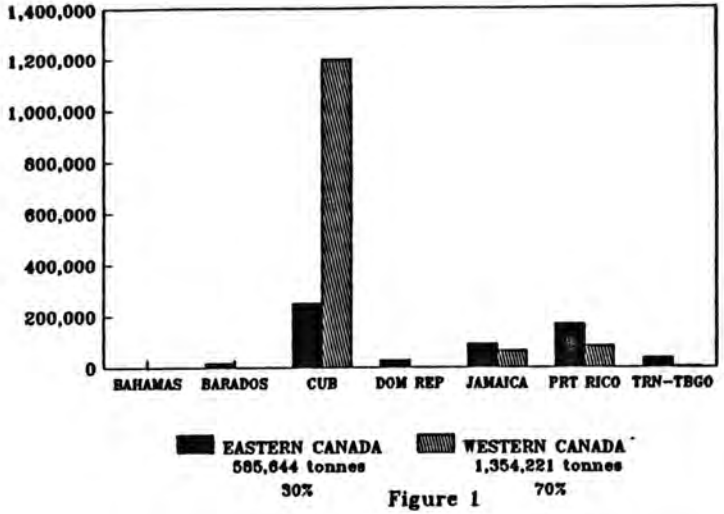


Figure 1

CANADIAN EXPORTS TO CARIBBEAN
(1987 IN $000)

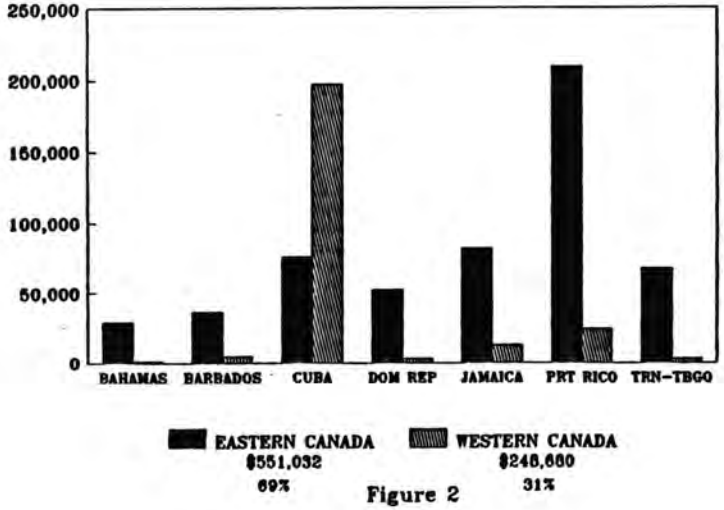


Figure 2

EASTERN CANADA EXPORTS TO CARIBBEAN
(1987 IN TONNES)



Figure 3

EASTERN CANADA EXPORTS TO CARIBBEAN
(1987 IN $000)

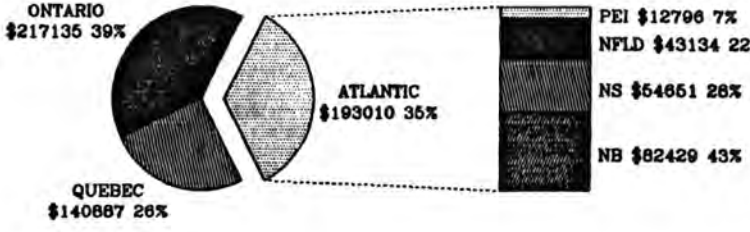


Figure 4

(9 percent) and dimesioned stone (9 percent). On a dollar value basis, the major exports included preserved fish (21 percent), newsprint (21 percent), vegetables (13 percent), other food (13 percent), paperboard (11 percent) and flour and wheat (9 percent).

In 1987, total Canadian imports from the Caribbean amounted to $522 million compared to $800 million worth of exports (Figures 2 and 5). Puerto Rico was the main Caribbean country exporting goods to Canada with its commodities valued at $217 million or 43 percent of the total Canadian imports. The major commodities imported by Canada were manufactured goods (23 percent), aluminum ores (18 percent) primarily from Jamaica, and other food (17 percent). Eastern Canada accounted for 94 percent of the imported Caribbean commodities, with the Atlantic provinces importing some 11 percent or about $51 million worth of goods.

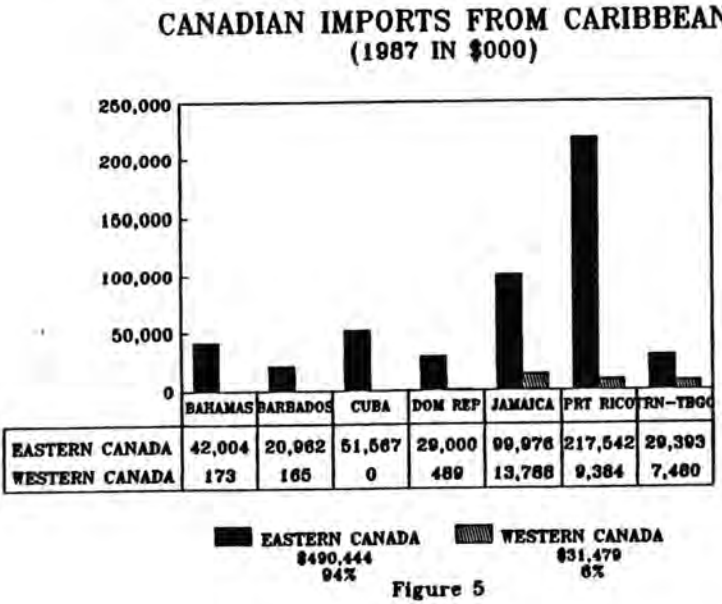


Figure 5

The main exports to the Caribbean from the Atlantic provinces were food (including wheat and flour) and paper products supplied primarily by New Brunswick and Nova Scotia. In 1987, some $193 million worth of exports from the Atlantic provinces were shipped to the Caribbean compared to $51 million worth of imports.

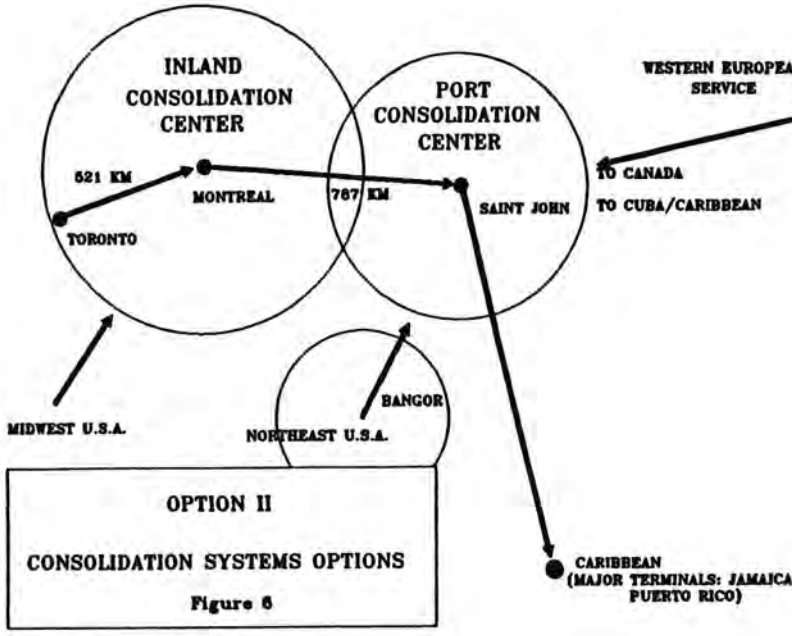


Figure 6

The actual management of a Caribbean consolidation centre in Saint John depends upon the selection of an appropriate agency to oversee the overall network. Freight forwarders and shipping lines often establish consolidation facilities to reduce freight charges or to improve service to their customers. Freight forwarders are generally aggressive marketers and maintain close contact with shippers in various market niches. They usually have the ability and capacity to establish and operate an efficient consolidation centre system. Shipping lines, on the other hand, typically manage load centres within a port.

A further advantage is that freight forwarders normally seek to maximize the amount of freight moved regardless of its nature. Freight forwarders are often in the best position to coordinate transportation services from the point of inland origin to the final inland point of destination (from factory gate to customer's door). They bargain and make volume discount deals among shippers/receivers, inland transportation companies, port terminal operators, and shipping lines.

Overall, the successful management of a Caribbean consolidation centre in Saint John will likely require the services of a freight forwarder or a consortium of forwarders.

OPTIMAL GRAIN TRANSPORT SYSTEMS (ABSTRACT)

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There are few transportation problems in Canada which have received more policy and research attention than grain transportation. The costs, pricing, and operation of the Prairie grain transport system have been the subject of a vast number of studies. Most of these studies have been focused on the system as it is; there has been little research which has examined the characteristics of the grain transportation system as it should be in order to maximize returns for its various participants.

This paper uses an interactive locational model of grain production and transportation to examine the design of an optimal grain transport system for a region with the characteristics of the Prairies. The model has the following basic characteristics. Grain farmers are profit-maximizers and grow grain on farms of equal size according to the same production function but with varying intensities of cultivation. The grain is brought to country elevators by farmers' trucks. Each elevator buys grain from all the farms located in its catchment area. From there it is sold to the railway for shipment to an export port. Farmers' grain production decisions are based on grain production costs, the cost of transporting grain from farms to elevators, and the price received for grain at the elevator. The cost of handling grain at elevators, the cost of transporting grain from elevators to seaports by railway branchline and mainline, and the world export price for grain determine the price which the elevators are willing to pay for grain. The railway, like the farmers, is a profit-maximizer and its decisions depend on its prevailing market type: competitive, monopolistic, or regulated. An important feature of the model is that it allows for different levels of utilization of the region's arable land: (1) a partially-developed region with circular elevator catchment areas; a more developed region with elevator catchment areas which have the shape of rounded hexagons; and (3) a fully-developed region where all arable land is used, catchment areas are hexagonal, and long run equilibrium will occur.

The model is used to simulate the outcomes of various transport and agricultural policy regimes on grain production, the design and operation of the grain transport system, and the surpluses available to farmers, the railway, and the government. The simulation runs

provide simultaneous specifications of the output of grain, the size of the branchline system, the maximum distance from farm to elevator, the size of the economic surpluses, and other system characteristics. Simulation results with an earlier version of this model suggest that co-operative ownership of railway branch lines would increase farmer incomes without impairing the efficiency of grain production or transportation.

The effect of inventory policy on freight volumes

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I. Introduction

One of the most neglected aspects of inventory theory is the interaction between freight-rate structure and the development of a firm's procurement policies. These effects are compounded when the purchase cost of the goods is also subject to a discount schedule of some kind, be it of the all units (AUD) or incremental quantity (IQD) type. Sometimes, discounts are not enough to induce the buyer to place larger than anticipated orders, since the demand for the product, even if price-dependent, may not be elastic enough. Under these conditions, it may still be beneficial for the firm to avail itself of the special order if there exists a short-term secondary market where unwanted inventory may be disposed of, albeit at a loss, at a price below market but large enough to cover the variable costs. It is the purpose of this paper to examine the effect of various freight structures on a firm's inventory decisions, when purchase discounts and/or disposals and/or price dependent demand rates are possible.

This paper builds upon earlier work carried out by the authors (Arcelus and Rowcroft 1989a, 1989c, 1990) in an effort to integrate various well-known areas of research, which have usually been treated separately. Included here is the effect on inventory policies of freight structures (e.g. Knowles and Pantumsinchai 1988; Lee 1986; and Roy and Delorme 1989); price dependent demand (e.g. Sethi 1984), various optimizing objectives (Arcelus and Rowcroft 1989b; Arcelus and Srinivasan 1987; Schroeder and Krishnan 1976) and quantity discounts (e.g. Das 1988; Silver and Peterson 1985).

The analysis is carried out in three sections. For ease of exposition, the main elements of the problem are analyzed in the first section, for the case where both freight and purchasing rates allow for only one price break. This will yield a combined freight-purchase break structure consisting of three cases, for each type of freight structure identified. The second section extends the model to a set of price breaks Q_1, Q_2, ..., Q_n and a general price structure is introduced which covers various sets of price and freight discounts. Using this structure, an appropriate solution algorithm is described. Then, in the next section, the results of a number of simulations are reported. Here, the sensitivity of order volumes to changes in freight charges and structures is examined for various price discount schemes. The most important results are summarized graphically.

II. Single-Break Analysis

To simplify the exposition, this section presents the main elements of the model for the case of one freight-break and one purchase discount, of either the AUD or the IQD type. Even if restrictive, this assumption is not unreasonable, as it has been shown to be applicable to homogeneous, lot-sizing firms, with downward sloping demand functions (e.g. Dolan 1987, Moorty 1987). The multiple break extension is left for the next section.

We start by considering a yearly demand rate, z_i, which is a function of the unit price, p_i, for alternative i=1, 2 through

$$z_i = z_o p_i^G \qquad G \leq 0,\ z_o > 0, \qquad i = 1, 2 \tag{1}$$

where G is the price-elasticity of demand. The unit price p_i is defined as a markup, m_i, on unit cost, c_i, for each alternative, i.e.

$$p_i = m_i c_i \qquad m_i \geq 1,\ c_i > 0, \quad i = 1, 2 \tag{2}$$

Units not sold at the regular price of p_i per unit may be disposed of at a unit rate of $\bar{c}<p_i$.

The profit function for each alternative consists of four components, namely the revenues from sales and the costs of purchasing, ordering and holding inventory. Tables 1 and 2 list the appropriate expressions for the AUD and the IQD policies, respectively.

Consider the profit components for AUD in Table 1. The alternatives represent the existence (alternative 2) or lack (alternative 1) of the disposals option. Note that the costs of ordering are affected by the freight rate structure adopted, whereas the other three components are affected by the type of purchasing discount. With respect to the freight rates, three cases are identified. The first is characterized by a fixed cost per order, j_1 or j_1', $j_1 \leq j_1'$ and a freight unit cost of $b_1 > b_1'$ for all units purchased, with Q_1 as the break point. The second case places an upper limit on the freight costs. Beyond Q_2 units, the ordering costs are constant. For any order below Q_2, the policy is similar to that for case 1. The third case contemplates a flat minimum fee designed to discourage small orders and the regular fee pattern, afterwards.

The other three profit components are affected by the purchasing policy adopted. Revenues are obtained only from regular sales under alternative 1, to which the proceeds from disposals must be added for alternative 2. Purchasing costs equal the cost per unit times the number of units placed in the order. Finally, the holding costs are computed as a constant proportion, h, of the value of the average inventory on hand. For alternative 2, the proceeds from disposals must be subtracted from the purchasing costs to compute the value of the on-hand inventory.

Combining the various profit components, it can be easily shown that the profit functions may be written as follows:

AUD Policy

Alternative 1: No disposals

$$PR(q_1) = (p_1 - g_1)z_1 + hg_1q_1/2 - f_1z_1q_1 \tag{3}$$

Alternative 2: Disposals

$$PR(q_2) = z_2(p_2-\bar{c})-z_2[f_2+(g_2-\bar{c})Q]/q_2-h[(g_2-\bar{c})Q+\bar{c}q_2/2 \tag{4}$$

where the values of g_1 and g_2 can be readily obtained from Table 1.

For the IQD policy, it should be noted that disposals are never optimal since only the extra units qualify for the discount. Instead, as shown in Table 2, the alternatives reflect the differences between Q_p and Q_c, the freight and the purchasing quantity breaks respectively. The ordering costs per order follow the same format as for the AUD case and require no further explanation. The purchasing costs for alternative 2 reflect the special characteristics of the IQD policy in that only the units exceeding the break quantity qualify for the discount. Finally, the total revenues reflect only regular sales and no disposals.

Combining the revenue and cost components of Table 2, it can be easily shown that there are only three possible profit alternatives all with the same functional forms as follows:

$$PR_{sc} = z_s[p_s - x_{sc} - y_s q + v_{sc}/q] \tag{5}$$

where (i) s = 1, 2 corresponds to the two scenarios obtained from the difference between Q_p and Q_c; (ii) c = 1, 2, 3 represent the three

TABLE 1: Total Profit Functions for the Single-Break AUD Case

Quantity Break Point	Alternative	Case 1 Q_1	Case 2 Q_2	Case 3 Q_3
Profit Elements/order				
Purchasing costs	1		c_1q_1	
	2		c_2q_2	
Ordering costs	1	$j_1+b_1q_1$	$j_2+b_2q_1$	$j_3+b_3Q_3$
	2	$j_1'+b_1'q_c$	$j_2+b_2Q_2$	$j_3+b_3q_c$
Holding costs	1	$hc_1q_1/2$		
	2	$hq_2[c_2q_c-\dot{c}(q_c-q_2)]/2q_2$		
Revenues	1	p_1q_1		
	2	$p_2q_2+\dot{c}(q_c-q_2)$		
Number of orders/year	1	z_1/q_1		
	2	z_2/q_2		
Number of units ordered/year	1	z_1		
	2	z_2q_c/q_2		

TABLE 2: Total Profit Functions for the Single-Break IQD Case

Part a: Cost elements for the various IQ cases

	Purchasing Costs per Order	Total Holding Costs
Quantity Break	Q_p	Q_p
Alternative 1: $q \leq Q_p$	c_1q	$hc_1q/2$
2: $q \geq Q_p$	$c_1Q_p + c_2(q-Q_p)$	$[c_1(Q_p/q) + c_2(q-Q_p)/q]hq/2$

Ordering Costs per Order

	Case 1 Q_1	Case 2 Q_2	Case 3 Q_3
Quantity Break: Q_c			
Alternative a: $q \leq Q_c$	$f_1 + g_1q$	$f_2 + g_2q$	$f_3 + g_3Q_3$
b: $q \geq Q_c$	$f_1' + g_1'q$	$f_2 + g_2Q_2$	$f_3 + g_3q$

Part b: Functional forms of the total profit functions

Cost Alternatives from Part a

Scenario	Q_p vs Q_c	Range for q	Purchase & hold	Order	Total Revenues
1	$Q_p \leq Q_c$	$0 \leq q \leq Q_p$	1	a	$P_{11}z_{11}$
		$Q_p \leq q \leq Q_c$	2	a	$P_{12}z_{12}$
		$Q_c \leq q$	2	b	$P_{13}z_{13}$
2	$Q_p \geq Q_c$	$0 \leq q \leq Q_c$	1	a	$P_{21}z_{21}$
		$Q_c \leq q \leq Q_p$	1	b	$P_{22}z_{22}$
		$Q_p \leq q$	2	b	$P_{23}z_{23}$

freight discount cases; and (iii) a = 1, 2, 3 identifies the three combined freight-purchasing discount structures. The values of the various parameters p_{sa}, x_{sca}, y_{sa} and v_{sca} can be easily obtained from Table 2.

In addition to profit, another objective, common to retail merchandising firms among others, is the maximization of return on the investment (ROI) in inventory. ROI is defined as the ratio of the total profit to the value of the average inventory on hand. Then, the firm's decision is to select the order size and the markup on unit cost that will maximize either ROI or PR. Note further, that both PR and ROI are at least quasi-concave functions of m and q. This property lies at the core of the algorithm needed to solve the multiple break case. This is the subject to which we turn next.

III. Modelling the n-break Problem

In this section the single break case is extended to a system of intervals such that the purchase price or the freight cost changes at each break point, Q_i. The multiple-break extensions of cases 1, 2 and 3 are illustrated in Figure 1. Again the AUD and IQD cases are analyzed separately. Proofs are omitted for brevity but are available upon request.

(a) All Units Purchasing Discount.

Here the cost of purchase and shipping quantity q given by:

$$f_i + g_i q \qquad \text{for } Q_{i-1} \le q \le Q_i,\ i = 1, \ldots, n \tag{6}$$

As before, any unwanted units may be sold at price $\hat{c}$ per unit, where $\hat{c} \le g_i$, for all i, which is sufficient to prevent disposal for direct profit. Demand within each break, z_i, is defined as in (1) with i = 1, 2, ..., n. However it should be noted that z_i may be represented by any downward sloping function with an elastic region to fulfil the second order requirements for optimal pricing. Fixed demand may also be considered a special case, where profit maximization corresponds directly to the minimization of total cost.

The algorithm is presented in two stages. Stage 1 presents the solution for the generalized all-units discount structure in schedule (6), when disposals are not allowed. This latter restriction is relaxed in Stage 2, where the additional step needed to include disposals is introduced.

Stage 1. For freight rates covered by cases 1 and 2, f_i does not decrease with the size of the order, that is $f_{i+1} \ge f_i$. Thus, the price breaks in (6) are only meaningful if each interval represents a reduction in total order cost. Equivalently:

$$f_{i+1} + g_{i+1} q \le f_i + g_i q \qquad \text{for } q \ge Q_i \quad i = 1, \ldots, n-1 \tag{7}$$

This requirement is less restrictive than it appears since any Q_i for which it is untrue can be adjusted upwards until (7) is satisfied, or dropped altogether if this is impossible.

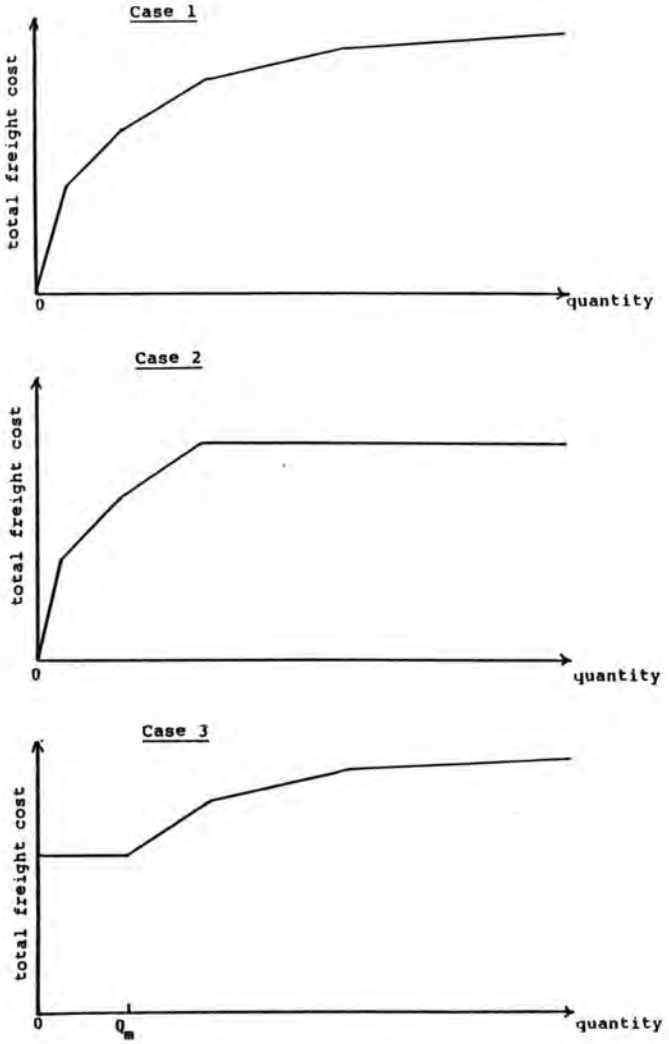
The algorithm now generalizes that given in Das (1988) for the price discount case. Specifically it consists of three steps:

Step 1. If demand is variable compute the optimum markup m_i for each i.

Step 2. Compute the optimum order quantity q_i for each class. Then determine q_i^* such that:

$$q_i^* = \begin{cases} q_i & \text{if } Q_{i-1} \le q_i < Q_i \\ Q_{i-1} & \text{if } q_i < Q_{i-1} \\ Q_i & \text{otherwise} \end{cases}$$

FIGURE 1: Multiple Break Freight Rate Schedules



Step 3. Compute PR (or ROI) for all q_i^* for which $q_i^* \neq Q_i$ and for the largest value of j for which $q_j^* = Q_j$. Choose the value of i or j for which the objective function is largest.

Condition (7) can be strengthened such that each interval dominates the interior of the previous one, i.e.

$$f_{i+1} + g_{i+1}q \leq f_i g_i q \qquad \text{for } q > Q_{i-1} \qquad i = 1, \ldots, n-1 \quad (7')$$

Expression (7') is necessarily true if f_i is constant for all i, and if g_i increases with i as it may be for freight rates under case 3, then condition (7) implies (7') for any f_i. Under condition (7) step 3 simplifies considerably to step 3' below.

Step 3'. Let s be the largest value of i for which $q_i^* > Q_{i-1}$. If s=n then q_0^* is optimal. Otherwise recompute m_i if necessary and find PR (or ROI) for i=s, s+1, ..., n. Choose the value of i for which the objective function is largest.

Stage 2. For disposal we note that no value of $q \geq Q_i$ can be optimal but that it is conceivable that it may be profitable for a firm to obtain a quantity $q < Q_i$ by purchasing $q' \geq Q_{i+1}$ and disposing of the surplus at price $\hat{c}$. Hence we have:

Step 4.
$$q_i^* = \begin{cases} q_i & \text{if } q_i < Q_i \\ Q_i & \text{otherwise} \end{cases}$$

Compute PR (or ROI) for all i such that $q_i^* < Q_i$. Find the largest value and compare it to the optimum without disposal. If no such i exists then no disposal solution is optimal.

The possibility of redundant intervals may be excluded by assuming that for schedule (6) there is no cheaper way of obtaining quantity Q_i than by buying that exact amount, i.e.

$$f_i + g_i Q_{i-1} \leq f_{i+1} + g_{i+1}Q_i - \hat{c}(Q_i - Q_{i-1}), \qquad i = 1, \ldots, n-1$$

which may be re-written as:

$$f_i + (g_i - \hat{c})Q_{i-1} \leq f_{i+1} + (g_{i+1} - \hat{c})Q_i \qquad (8)$$

This is an extension of the condition used by Sethi (1984).

An immediate consequence of the extended 'Sethi Condition' is that disposal is never optimal when $q = Q_i$ for any i. Thus any interval for which the optimal order quantity is infeasible or lies on a boundary of the class may be ignored. This result simplifies the search for a possible optimum considerably and Step 4 may be restated as:

Step 4'. Compute PR (or ROI) for all i such that $Q_{i-1} < q_i^* < Q_i$. Find the largest value and compare it with the optimum without disposal. If no such i exists then the no disposal solution is optimal.

Condition (8) can be strengthened to the original form used by Sethi (1984) as follows:

$$(g_i - \hat{c})Q_{i-1} \leq (g_{i+1} - \hat{c})Q_i \qquad (8')$$

This is of course identical to (8) if f is constant or decreasing as it may be in case 3. Under condition (8') PR_i^* and ROI_i^* both decrease

as i increases whence only the first of the intervals in step 4' need be examined. Specifically step 4' becomes:

Step 4". Starting at i=1, compute the optimum order quantity q_i. If $Q_{i-1} < q_i < Q_i$ then stop. Compute PR_i (or ROI_i) and compare it with the optimum without disposal. Otherwise continue. If no q_i satisfies this condition then the no disposal solution is optimal.

(b) Incremental Quantity Purchasing Discount.

The IQD analysis follows similar lines to that of the previous section, although, as mentioned before, disposals are never optimal. However certain dominance properties enable the solution algorithm to be simplified in particular cases. Cost minimisation provides an illustration and is equivalent to the fixed demand profit maximisation case in the previous section.

In general, the single-break cases of the previous section are extended to the situation in which there are r incremental quantity discounts on the purchasing price and s reductions in freight rates, for a total of n = r + s breaks. Thus, the problem consists of a set of intervals (Q_{i-1}, Q_i), i = 1, ..., n, such that when q belongs to the i-th interval, we have an incremental purchase price of p_i per unit and a freight cost for q units of $f_i + g_i q$. Except by coincidence, only one of the purchase price and the freight rate will change at each break point. However the algorithm is able to treat all intervals in the same way. Referring to part (a) above, step 1 is unnecessary and step 2 is unchanged. For freight rates of type 1 or 2, steps 3 and 4 are replaced by:

Step 3i. Find the total cost $TC_j(q_j^*)$ for all j such that $q_j^* = q_j$
j = 1 if $q_1 < Q_o$
j = n if $q_n > Q_n$
Choose q_j^* for which $TC_j(q_j^*)$ is least.

Case 3, in which the order cost is constant up to a minimum quantity requires some separate consideration. As before, the f_i's are decreasing functions of the interval i, but only for i > m, where m is the interval for which the first freight break is the upper limit. For $i \leq m$, the freight cost is a constant, and thus independent of the quantity purchased. However, the optimal ordering policy may be found by adroit use of the algorithm and step 3i is augmented by one further calculation, that of $TC_m(q_m^*)$.

IV. Numerical Examples

To illustrate the properties of the models discussed so far, some sensitivity analysis was conducted to ascertain the effect of the parameters on the optimal policies. The freight rate data were based on truck rates for rubber tires from Moncton, N.B. to Montreal, P.Q., as provided by the Atlantic Provinces Transportation Commission. This data was augmented by information from private sources in the automobile industry. Due to its wide applicability the example used in the ensuing discussion is AUD, and is based upon the following parameter values: $z_o = 1.525879 \times 10^{14}$; G = -5; h = .25; $f_1 = f_2 = \ldots = f_n = 400$; and c = 100, unless stated otherwise.

Table 3 illustrates the optimal policy for a situation with only a freight rate quantity discount and a unit cost of c = 111 per unit. The '+' signs under b(i) indicate that the left hand side of expression (8') is increasing throughout and hence only the first feasible q_i^* need be considered for the disposal option.

In Table 4 an AUD price discount has been added reducing c to 105 for $q \geq 250$ and to 100 for $q \geq 500$. Here the Sethi condition (8') is violated and step 4 is used in its full form. Observe that the optimal ROI policy results in lower optimal order sizes, more orders

TABLE 3 : Optimum Policy with Variable Demand and No Cost Discounts

h	f	c	Z	G
.25	400	100	1.525879E+14	-5

CL	LIM	UNIT COST	S-VAL	DISPOSAL				NO DISPOSAL			
I	Q(I)	g(I)	b(I)	q	q*	m	profit	q	q*	m	profit
1	20	114.12		503				260	20	1.47	38346
2	40	113.81	+	586				262	40	1.36	52628
3	100	113.19	+	771				267	100	1.29	64860
4	200	112.53	+	998				272	200	1.27	69836
5	250	112.34	+	1091				273	250	1.27	70655
6	300	112.34	+	1171				273	273	1.27	70685
7	400	112.21	+	1316				274	300	1.26	71000
8	500	112.17	+	1443				274	400	1.26	70597
9	600	112.17	+	1542				274	500	1.26	69736
10	900	111.91	+	1803				276	600	1.26	69431
11	1200	111.66	+	2019				278	900	1.25	66582
12		111.65						278	1200	1.25	62740

Optimum Order Quantity is 300 profit = 71000.04 no disposal

I	Q(I)	g(I)	b(I)	q	q*	m	roi	q	q*	m	roi
1	20	114.12		23				11	11	1.65	39
2	40	113.81	+	34	34	1.41	24	11	20	1.47	34
3	100	113.19	+	63	63	1.4	13	11	40	1.36	24
4	200	112.53	+	111	111	1.4	7	11	100	1.29	12
5	250	112.34	+	136				11	200	1.27	6
6	300	112.34	+	159				11	250	1.27	5
7	400	112.21	+	207				11	300	1.26	4
8	500	112.17	+	256				11	400	1.26	3
9	600	112.17	+	299				11	500	1.26	2
10	900	111.91	+	433				11	600	1.26	2
11	1200	111.66	+	572				11	900	1.25	1
12		111.65						11	1200	1.25	1

Optimum Order Quantity is 11 roi = 38.59 no disposal

Profit when q=q(roi) = 24218.55 prc = .34
ROI when q=q(profit) = 4.22 rop = .11
Maximum Profit without disposal/Maximum Profit with disposal (pn/pd) = 1
Maximum ROI without disposal/Maximum ROI with disposal (rn/rd) = 1

TABLE 4 : Optimum Policy with Variable Demand and Cost Discounts

h	f	c	Z	G
.25	400	100	1.525879E+14	-5

CL	LIM	UNIT COST	S-VAL	DISPOSAL				NO DISPOSAL			
I	Q(I)	g(I)	b(I)	q	q*	m	profit	q	q*	m	profit
1	20	114.12		503				260	20	1.47	38346
2	40	113.81	+	586				262	40	1.36	52628
3	100	113.19	+	771				267	100	1.29	64860
4	200	112.53	+	998				272	200	1.27	69836
5	250	112.34	-	841				273	250	1.27	70655
6	300	106.34	+	894				323	300	1.27	89011
7	400	106.21	+	998				324	324	1.26	89492
8	500	106.17	-	603				325	400	1.26	89450
9	600	101.17	-	591	591	1.26	109851	376	500	1.26	109294
10	900	100.91	+	605	605	1.26	109475	379	600	1.26	109850
11	1200	100.66	+	657	657	1.26	108099	382	900	1.26	108303
12		100.65						382	1200	1.25	105104

Optimum Order Quantity is 591 profit = 109851.2 with disposal

I	Q(I)	g(I)	b(I)	q	q*	m	roi	q	q*	m	roi
1	20	114.12		23				11	11	1.65	39
2	40	113.81	+	34	34	1.41	24	11	20	1.47	34
3	100	113.19	+	63	63	1.4	13	11	40	1.36	24
4	200	112.53	+	111	111	1.4	7	11	100	1.29	12
5	250	112.34	-	76	76	1.48	11	11	200	1.27	6
6	300	106.34	+	87	87	1.48	9	11	250	1.27	7
7	400	106.21	+	111	111	1.48	7	11	300	1.27	6
8	500	106.17	-	36	36	1.57	22	11	400	1.26	4
9	600	101.17	-	34	34	1.58	23	12	500	1.26	4
10	900	100.91	+	36	36	1.58	22	12	600	1.26	4
11	1200	100.66	+	44	44	1.57	18	12	900	1.26	2
12		100.65						12	1200	1.25	2

Optimum Order Quantity is 11 roi = 38.59 no disposal

Profit when q=q(roi) = 24218.55 prc = .22
ROI when q=q(profit) = 3.68 rop = .1
Maximum Profit without disposal/Maximum Profit with disposal (pn/pd) = 1
Maximum ROI without disposal/Maximum ROI with disposal (rn/rd) = 1

and lower yearly demand rates as compared to the PR counterpart. As a result, an ROI firm uses a higher markup and is less likely to adopt a disposal policy. These results still hold in the presence of purchase cost discounts, even if larger order sizes result, even to the point, in the PR case, of selecting the disposals option.

The different magnitudes of the freight and cost discounts here suggest the importance of examining the size of the freight component in total cost. Figures 2 to 5 illustrate the effect of scaling the freight rates by a factor k from k = 0.2 to k = 5. In Figures 2 and 3 total demand Z is shown to decline as cost is increased through k. The downward slope is greater for more elastic demand, as might be expected. These results are in contrast with the corresponding order quantities shown in Figures 4 and 5. Here increasing the freight component of cost has little effect on order quantity over large ranges and otherwise generally serves to increase rather than decrease q. As before, the lower order sizes for the ROI firm make it much less sensitive to rate changes.

V. Conclusion

Deregulation of freight rates has placed considerably more discretion in the hands of the carrier. A simple analysis might suggest that, if freight rates are raised, the volume of freight transportation demanded will fall or remain approximately the same depending upon the ultimate market for the product being shipped. Often goods are shipped for placement into inventory and thus the firm's inventory policy may exert an important influence on its shipping decision and its response to changes in freight rates.

This paper examines the effect of various freight rate structures on a firm's inventory decisions in a variety of realistic cost environments. In addition to freight rate discounts, two types of purchase price discounts are considered, namely all units discount (AUD) and incremental quantity discount (IQD). Also examined is the policy of deliberately over-ordering to take advantage of quantity discounts and then disposing of the surplus stock locally at a small loss.

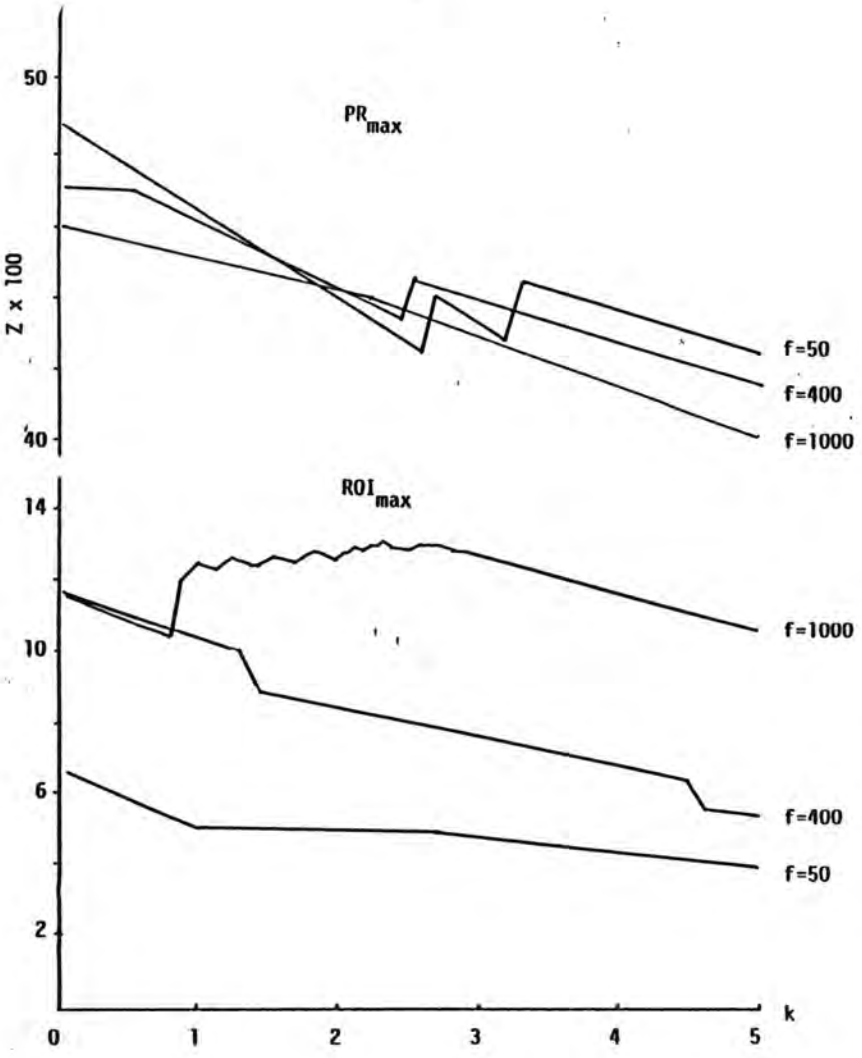
Different objectives for the firm are considered, particularly one leading to a significant reduction in inventory sizes which to some extent reflects the current concern with excessive stocks in a number of industries. Within this context the authors show that an increase in freight rates may lead a firm to increase the size of its shipments under some circumstances and, more commonly, to leave its order quantity unchanged in the face of large changes in shipping rates. Instead adjustment is likely to be made in the total annual volume shipped, that is the size of the shipment may not change but the number of shipments required in a year will go down. This may have important implications for a carrier considering a change in the rates charged to customers.

Specifically a rate increase may have little effect on capacity requirements on a day-to-day basis but reduce the overall utilisation of equipment throughout the year. In an extreme case a rate increase could raise the demand for capacity to handle larger loads while diminishing the utilisation of all equipment through decreased annual volumes.

Acknowledgements

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FIGURE 2: Demand with different fixed freight costs



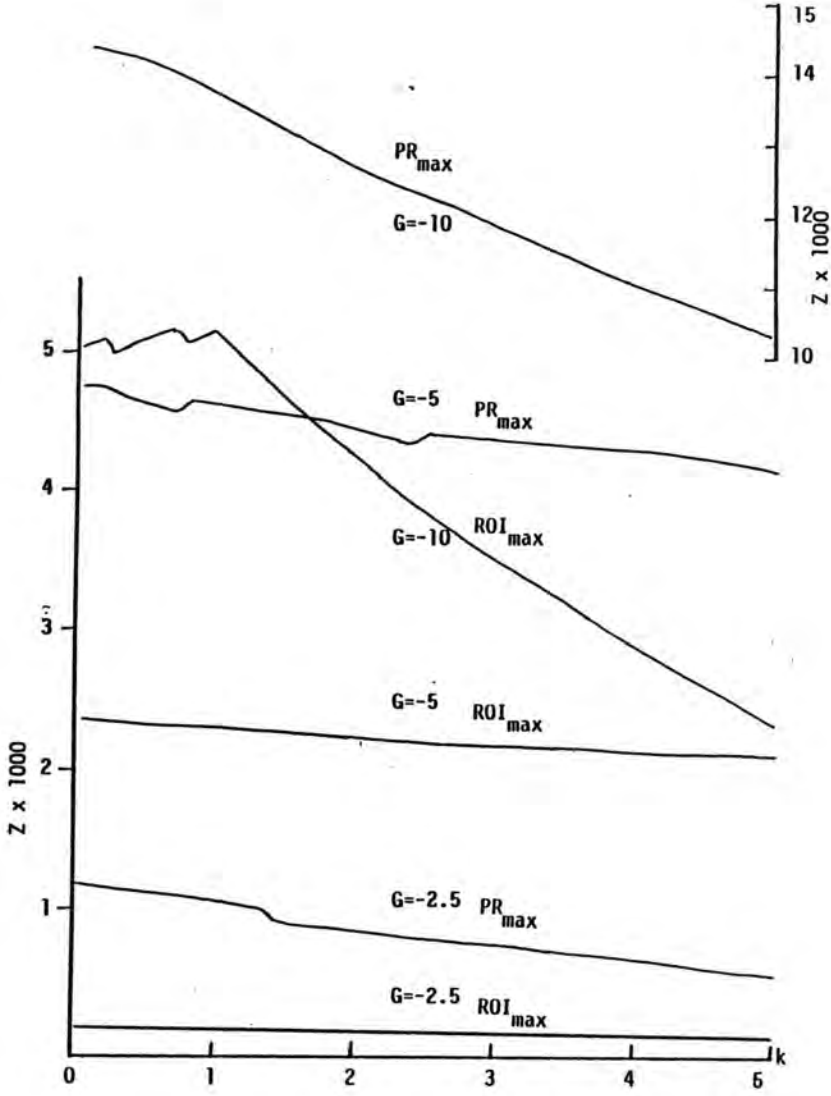


FIGURE 3: Demand with different elasticities

FIGURE 4: Order quantity with different fixed freight costs

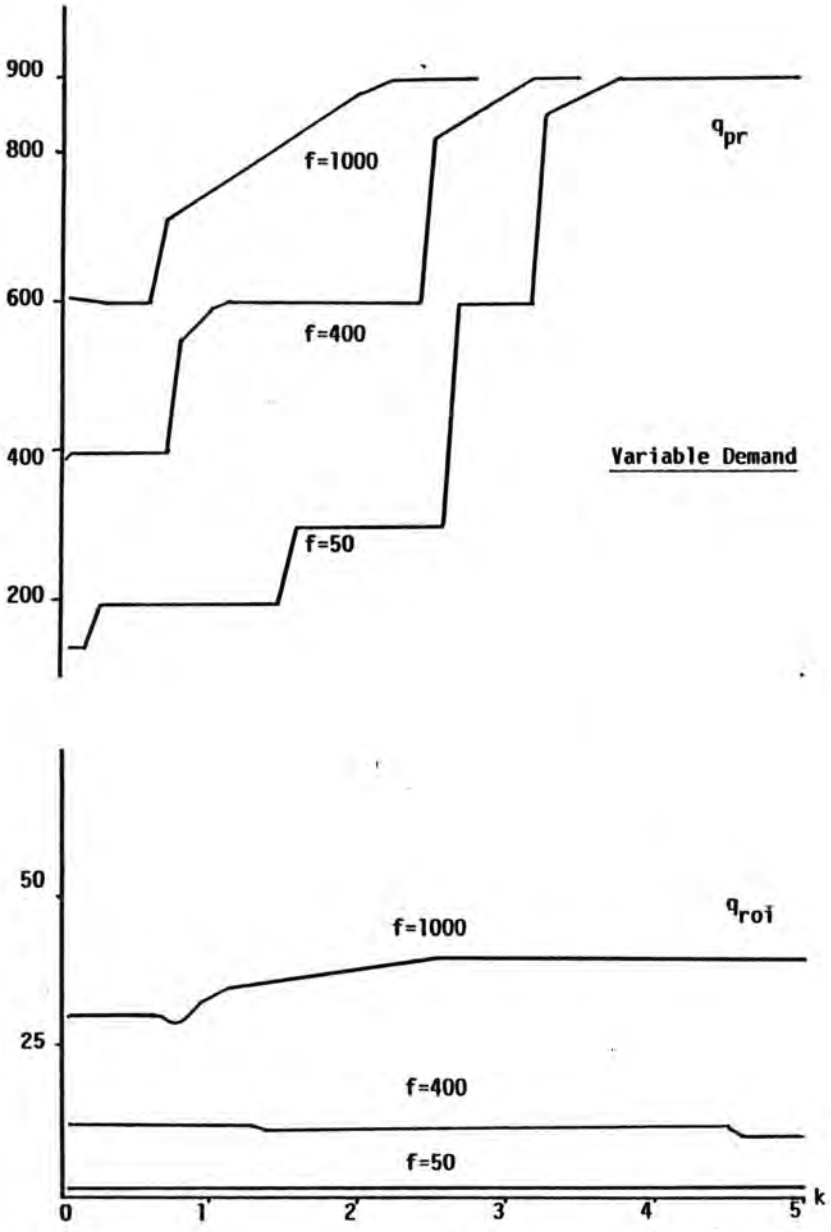
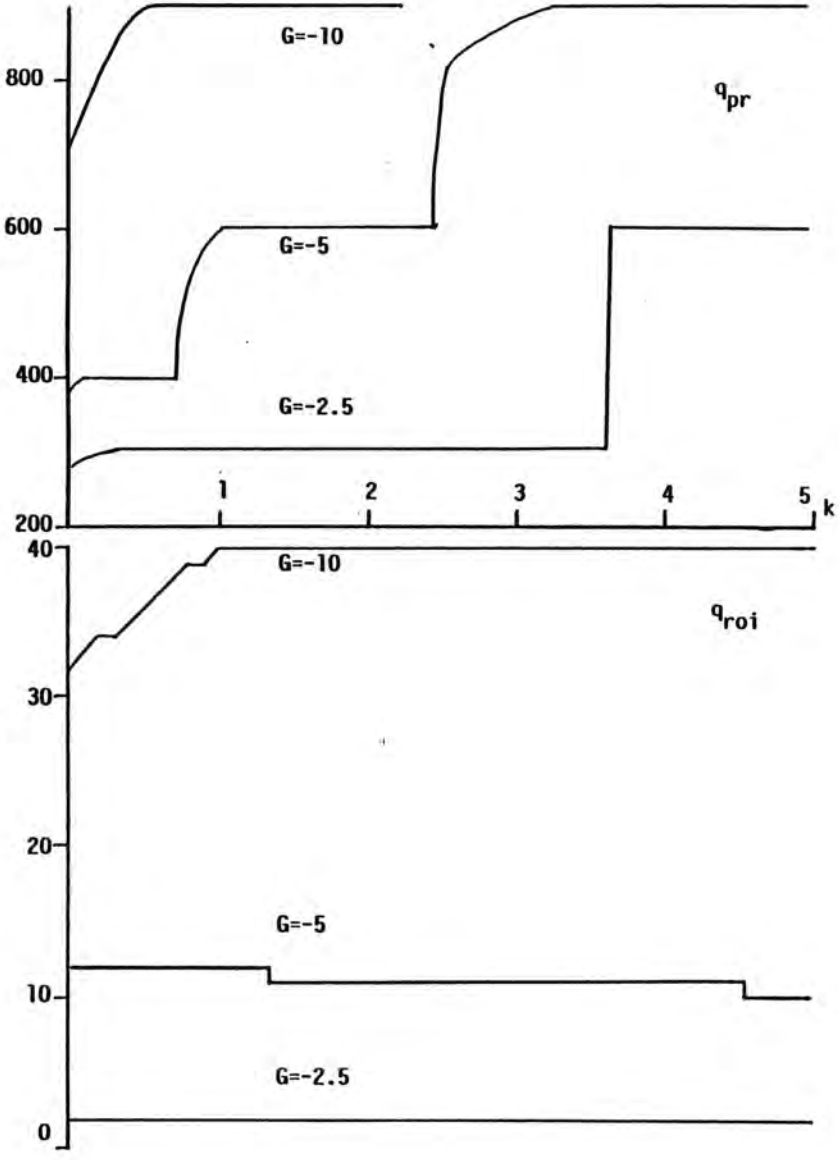


FIGURE 5: Order quantity with different elasticities



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FACTS, VALUES AND PASSENGER TRAINS: LESSONS FOR POLICYMAKING (1)

Dr. P. M. Bunting*

1. Introduction

Since the 1950's, the ills of Canada's passenger train system have been studied repeatedly, and various proposals have been made to improve service quality and reduce costs. Yet despite these efforts, and some improvements, the gains in service quality have been unimpressive, and the passenger service deficit seems as resistant as ever to all but the most drastic measures.

Given the attention to passenger train operations by successive governments, academics, consultants, VIA Rail, and freight railways, failure cannot be attributed to lack of effort. How then can failure be explained? Moreover, and of far greater interest, could an explanation contribute to more effective policymaking?

In this paper, I shall examine one of several possible explanations, specifically that professional advisors asked to study passenger transport issues have misconceived their role in decisionmaking processes, to the extent that important conditions for constructive change have not been met. Thus, there may have been opportunities for change and those pursuing change may have been competent and well-intentioned, but the process involved, and the responsibilities of key individuals in that process may not have been sufficiently well understood to ensure effective action.

In exploring this possibility, my objective is to determine how professionals, other experts and decisionmakers, when seeking, providing or receiving advice, can be more effective, by ensuring both that advice given is technically sound and that such advice is likely to lead to concrete action. I shall show that, to do so, they should pay greater attention to the value content of technical advice, including the complex of behavioural commitments that makes action possible (and which can also be a source of resistance to change). Also, I shall argue that action will be facilitated in an environment of mutual trust involving advisors, the immediate recipients of advice and the population affected by resulting changes.

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This account will be a brief sketch of a theory of advisory relationships and evaluative processes detailed elsewhere [2,3]. Following this sketch, I will show how it helps in interpreting the failure to rationalize Canadian passenger train services effectively, with specific reference to the attempt in 1976/77 to rationalize Western Canadian transcontinental services.

2. Advice and Advisory Relationships

Although experts are employed to perform many different functions, an understanding of their role as advisors is central to an understanding of policymaking effectiveness.

In giving advice, advisors implicitly claim special knowledge relevant to a problem under consideration. Therefore, it may be thought that advising is simply the providing of information (e.g., about effects of service changes on financial performance). If so, the technical soundness of advice should be judged using criteria applicable to factual statements (including such criteria as accuracy and comprehensiveness).

That this is not the correct view may become apparent after a senior official has laboured through an advisor's lengthy (factual) exposition of the background to a policy issue, and of the details and effects of various policy options. If this official is sufficiently senior to be handling many such issues, the response may well be, "This is all very well, but what should I do?". This may be expressed with some irritation, implying that the advisor has failed to appreciate that an action proposal was called for, not information. Thus, while professionals and other experts may be asked to provide information, they are acting as advisors only if they provide recommendations indicating what ought to be done.

However, to say that something ought to be done (e.g., terminate a transport service), or that it is the best available option, is to make value judgements. Such value judgements, a necessary part of the advisor's task, are not the same as factual judgements, as will be seen by the contrast contained in the following: "Trains ought to be run on-time (expressing a value judgement), but they are frequently late (a factual statement)".

It does not follow from this that factual judgements are irrelevant to the making of value judgements. In the example given, the desirability of running trains on time will depend both on the value of this particular aspect of service quality and on the facts concerning the feasibility and cost of running trains on-time.

Values are therefore an integral part of advice, hence the technical soundness of advice -- an essential part of policymaking effectiveness --must be

judged in terms of both facts and values, to which appeal will be made if advice is questioned. Given this result, the advisor who believes his recommendations are value-neutral is fooling himself. If, on the other hand, he eschews all reference to value, and supplies only facts, he is no longer acting as an advisor.

Despite this, two important objections must be considered. The first objection is that values are subjective, hence the professional cannot make value judgements without compromising standards of objectivity. Second, it may be argued that making value judgements is not the responsibility of professional advisors, but rather that of their masters, who, in a democracy, are ultimately accountable to an electorate.

An appropriate treatment of the first objection would go beyond the scope of this paper, this being a matter about which philosophers have argued for millenia. However, two points are worth making. First, it need not be assumed that standards of objectivity can only be satisfied through the provision of factual statements. What makes factual statements objective is that they are backed by good reasons, in this case physical evidence of one kind or another. However, if values can also be shown to supply good reasons for accepting value judgements, these judgements can equally be considered objective.

Second, it may be thought that values are similar to likes, dislikes and tastes, which are generally regarded as personal in nature, and hence not fit grounds for judgements affecting whole communities of persons. However, whether in the context of personal or community-level decisions, values function in a very different way than do likes, dislikes or tastes. For example, I may like fast sports cars, but buy a stationwagon, because it would be valuable for transporting a large family and its baggage. Here, the value of family mobility is a justifying reason for the purchase. To justify a sports car, I must appeal to some other value (e.g., increasing my happiness). It certainly does not follow from my liking sports cars that I ought to buy one.

Moreover, to the extent that I genuinely value family mobility, I am committed to acting on projects (e.g., the stationwagon purchase) which will enhance family mobility. I would be counted insincere if I claimed to value family mobility, but did nothing to give effect to this value. By contrast, likes, dislikes and tastes carry no such action implication. That I like sports cars in no way implies that I will purchase one.

The second objection is compatible with actions being objectively justified by appeal to values, but assigns the valuing part of action judgements to the political authority. According to this view, sometimes referred to as the politics-administration dichotomy, politicians are responsible for establishing relevant values or ends, and for deciding how these ends

(which often conflict) are to be weighed in particular cases. Professional advisors are responsible only for identifying technically feasible means for achieving ends established by their masters, and for supplying information needed by politicians to carry out the valuing part of the decision process.

This view presupposes the political authority's ability to identify relevant values and cope with the complexity involved in weighing such values. Yet decisionmakers may not be sure what values ought to be advanced or how to weigh competing values. If so, the call for help, "What should I do?", cannot be interpreted as a call for data on the effects of different policy options, but may require genuine advice, which will identify a limited number of options (often only one) as worthy of choice.

Professionals may be reluctant to provide such advice directly, since the advisor, in evaluating options, assumes greater responsibility for unfavourable outcomes. Moreover, they may not wish to be seen as usurping the politician's authority. This reluctance may be exhibited in the use of conditional statements, for example, "If you want to improve VIA's service quality, buy six additional trainsets." These statements do not serve to evaluate options, but merely report facts (that buying six trainsets will improve service quality) in a form that will appear to satisfy the request for advice. In this case, the responsibility for decision (e.g., to buy six trainsets) remains squarely with the political authority.

An alternative view of the advisory relationship is suggested by Galbraith's account of the technocracy, in which corporate directors and senior policymakers rubber stamp proposals made by technical professionals. [4] Since decisionmakers are rarely able to understand technical information in any detail, they often cannot decide which values are relevant, let alone weigh such values. In these circumstances, professionals and other experts are firmly in control. While the technocrat may use the language of advice, implying acceptance of a superior authority, the relationship is advisory in name only.

A third type of relationship, within which genuine advice could be provided, would involve the decisionmaker and advisor jointly establishing the values or ends which policies would serve, and perhaps also sharing the work of identifying suitable policy options. This 'decision-sharing' relationship will not always be apparent, as the advisor's evaluative effort may extend only to the rejection of certain options as infeasible or impractical, a judgement which would not likely be discussed with the decisionmaker. However, the advisor may well go further, depending on the specific reliance placed on him by the decisionmaker.

In advisory relationships of the third type, the advisor is responsible both for determining facts relevant to the evaluation of options and for evaluat-

ing these options, in terms of values expressed by the decisionmaker or independently determined. The recipient of advice also must decide whether to take advice. In a 'pure' case, this decision is based solely on the perceived competence of the advisor. However, in most cases the decisionmaker would both judge the advisor's competence and evaluate (to a limited extent) the content of the advice (i.e., the proposed action).

Of the three relationships discussed, the third most clearly requires that advisors make value judgements, which I had argued was a necessary part of technically sound advice. Therefore, for what follows, I shall assume this to be the appropriate model for advisory relationships.

3. Evaluations and Effective Advice

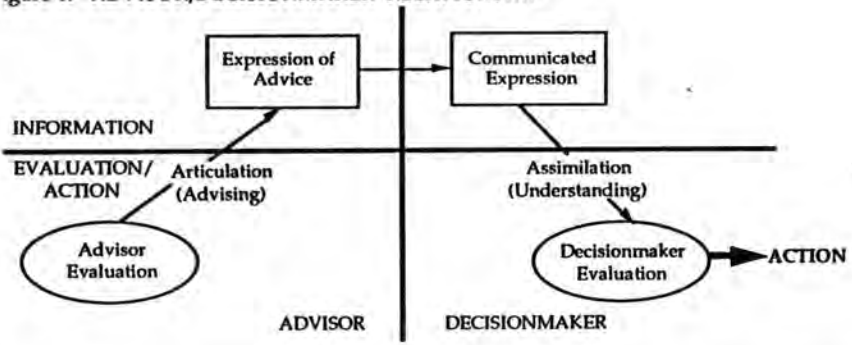
I shall suggest, without proof (but see Ref. 3), that good advice is both technically sound, meaning that its factual and evaluative basis can be adequately substantiated, and that it has some likelihood of being taken. (This would be the minimum required for advice to contribute to effective policy making, interpreted as the production of policies which have desirable characteristics and are acceptable).

This does not mean that advice which is ignored is bad advice, but that advisors, in developing and articulating policies, should consider the likelihood of consequent action. However, if advice must be judged in terms of its likely effectiveness, we need to know how advice, or the circumstances surrounding the giving of advice, can motivate action.

To explain the motivational character of advice, it must be recognized that actions result from evaluative processes of individual persons, and consequently that the advisory relationship entails two distinct evaluations and two distinct actions. The advisor evaluates various options, and acts by giving advice, normally expressed in oral or written statements. (See Figure 1). This advice, the communication of which is subject to the usual conditions and obstacles of information transfer, is received and assimilated by a decisionmaker. The recipient of advice must then judge (i.e., evaluate) whether to take the advice offered. The decision to act is then the direct product of the decisionmaker's own evaluation, and only indirectly results from the advice offered.

For both advisor and advised, there are two distinct modes of evaluation. One involves conscious deliberation about particular problems, leading to particular commitments (decisions) to act. The second involves the operation (often unconsciously) of general commitments (behavioural dispositions) to types of action considered valuable. These commitments do not guarantee action in the way that particular commitments do, but are developed patterns of behaviour which may (or may not) lead to action in particular instances.

Figure 1: *ADVISOR/DECISIONMAKER RELATIONSHIP*



The connection between the particular and general commitments which arise from the process of evaluation, and the way in which they work together to motivate action, are seen in the example of a carpenter framing a house. The behaviour of a good carpenter reflects a range of general commitments to carpentry practices, including materials selection, spacing of framing members, etc.. He cannot work effectively if he consciously thinks about these things whenever he positions and nails a stud in place.

A good carpenter also has the capacity to decide what to do in unusual situations (for example, nailing in an awkward corner), that is, he can deliberate (consciously) about how to respond to the new situation, and form a (particular) commitment to action. If these situations recur, the process of deliberation will eventually give way to a new general commitment to new carpentry practices (i.e., the carpenter will learn through 'experience' to deal with these new situations effectively by developing a pattern of behaviour which makes conscious deliberation unnecessary).

In the case of policy advice, it is almost always the case that changes are required in some pattern of behaviour (e.g., service operating patterns), hence there is something requiring special consideration. Therefore, the policymaking process, while reliant on certain standardized procedures (e.g., those of financial and economic analysis), will inevitably require a creative process of deliberation. Of course, for experienced advisors, 'embedded' patterns of evaluation (general evaluative commitments resulting from favourable or unfavourable outcomes of past decisions) will result in many policy options not being considered, and hence lead to more rapid evaluation than would otherwise be possible.

I have elsewhere [2] discussed general evaluative commitments and concluded that they form an evaluative complex roughly comparable with a series of geological layers, some more deeply embedded than others. Deeply

embedded commitments (e.g., strongly held values) facilitate rapid decisionmaking, but are also most resistant to change. Less embedded or 'superficial' commitments (e.g., operating practices) may be less resistant to change, but also less effective in motivating action. This evaluative complex exhibits logical and other relationships between 'layers'. For example, operating practices may be related to strongly held values (e.g., safety).

This account implies that changes in behaviour sufficient to give effect to new policies or programs, depend on a process which will form new behavioural commitments required for effective action. This process may be thought of as having three stages:

1. Evaluative 'Excavation' (problem analysis)

Commitments that underly inadequate performance (description of which usually constitutes the preliminary problem statement) must be identified. This is rarely easy, since deeply embedded commitments are often not immediately obvious. Failure to identify such commitments will likely result in continuing poor performance.

2. Founding New Commitments

Changes in behaviour require changes in commitments. New commitments (or 'principles') may be founded by argument, linking these commitments to more deeply held commitments (e.g., to fairness, economic welfare) or to favourable outcomes. Because commitments are often formed by repetition or increased familiarity, time will be required. Adequate justification to those affected, and efforts to make new commitments more familiar will reduce this time.

3. Rebuilding Related Commitments

Less deeply embedded commitments, dependent on the old 'foundational' commitment, may have to change. New foundations that minimize consequential changes, and/or efforts to make such changes clear and familiar, will ease implementation.

This model is applicable to a range of circumstances in which changes in behaviour are called for. In the case of the advisor proposing a new course of action, the general evaluative commitments of both advisor and recipient of advice must be considered. These commitments make it possible for both to do their work quickly, in the same way that commitments to carpentry practices allow efficient framing of houses. However, commitments of the advisor and decisionmaker need not be the same, and will not be the same if there are differing perceptions as to what is socially valuable.

Advisors and decisionmakers who know one another well, and share many commitments in common, are connected by a relation of trust. Awareness of shared commitments makes it possible for the decisionmaker to adopt the advisor's recommendations with little evaluative effort. If the relation of trust extends to both factual and evaluative content of the advisor's work, the decisionmaker can act quickly and confidently.

Similar considerations determine the effectiveness of the decisionmaker's efforts to motivate others. If commitments underlying the political authority's decision to implement a new policy are either consistent with commitments of the affected population (in which case the political authority may have their trust), or are well justified, little resistance to change need be expected. Unfortunately, these conditions of trust and adequate preparation for change are often not met.

4. Applying the Conceptual Model to Passenger Services

Thus far, I have concentrated on a conceptual model of advisory relationships that shows how advice can be an effective contributor to policymaking (and other decisionmaking) processes. I argued that this was possible where advice was technically sound, meaning that relevant facts and values were addressed, and was likely to be productive of action. I then suggested a three-stage change process which could be helpful in developing effective advice, and pointed to the importance of relationships of trust in further facilitating action. I shall now use this model to interpret the Canadian Transport Commission's efforts in 1976/77 to rationalize Western Canadian transcontinental service [5].

Before proceeding, a note of caution is in order. When cases are introduced to illustrate processes involving persons, they are usually introduced as successful applications of a model or procedure. The reason for this is obvious; people don't like their failings dramatized in print. Unfortunately, restricting oneself to successes does not always lead to useful insights. In the early days of the American space program, it was frequently repeated that progress was driven more by failure than by success. Failures often draw attention to specific weaknesses, which can then be corrected, while successes provide a sense of security (perhaps false), without suggesting where improvements should be made.

However, given a scientific interest in a case of ineffective evaluation and advice, one should perhaps select cases less susceptible to a prurient interest in personal wrongdoing, or otherwise deflect attention from such matters. In this case, the attempt to rationalize transcontinental services was part of a long history of unsuccessful attempts in the 1960's, 1970's and 1980's to modernize or otherwise rationalize services in the light of perceived market requirements. Therefore, any fault was of a systematic nature, not

necessarily attachable to specific personalities. Moreover, my analysis specifically addresses a problem of 'system failure', bypassing other potential explanations which might be offensive to particular persons. Finally, one may take comfort in the fact that I participated in the process in question, and can therefore share any residual blame!

This being said, consider the background to this case. In 1976, the Minister of Transport directed the Canadian Transport Commission (now the National Transportation Agency), which was responsible for decisions on specific services and for administering subsidies to CN and CP, to review and rationalize all services, beginning with the western transcontinentals. CN and CP services were to be integrated into a single service that would avoid duplication, hence reducing cost. This review, which took the better part of two years, resulted in some changes, but these were minimal compared to the effort expended to study these services.

The Commission's approach was to: appoint a panel of Commissioners to decide the matter; call public hearings across Canada; and form a Technical Support Group (TSG) to help plan the new service. A broad range of issues was discussed at public hearings held in 1976. (See Figure 2, which reproduces the table of contents of the hearing summary.[6]) These hearings were interpreted as supporting retention and improvement of service. With the TSG's help, the CTC then analyzed various route and service options, issuing a "preferred Plan" in April, 1977 [7], and, after a period for comment, a "Final Plan" (October, 1977, [8]).

FIGURE 2: *CONTENT OF SUMMARY OF FINDINGS*

Introduction

1. Hearing Process
2. Government Policy and Railway Attitudes
3. Attributes of Train Travel
4. Role of the Transcontinental Train
5. On-train Facilities
6. Off-train Facilities
7. Promotion and Pricing
8. Employees and Communities
9. Operations
10. Other Modes of Transport
11. Suggested Service Designs
12. Modernization of Service
13. Institutional and Financial Considerations

Appendices

A. Opening Statement
B. List of Appearances and Witnesses

During this period, VIA Rail had been incorporated, and it had been decided that VIA would assume responsibility for each service as it was rationalized by the Canadian Transport Commission (CTC). In the case of the western transcontinentals, the transfer was signalled by the issuance by the CTC of the Final Plan. There were a few follow-up meetings with VIA, but subsequent CTC involvement was mostly related to its regulatory role,

leaving VIA and the Ministry of Transport (who were paying VIA for the service through a new contracting procedure) to take over planning and operation.

The above account illustrates ineffective evaluation and advice, in that considerable efforts to study and modernize the service did not lead to commensurate action, and actions taken were of little worth in reducing deficits or improving service. How does my account of evaluation help explain this failure? Consider the principal components of that account:

(a) Facts and Values

By far the greatest effort, during the two-year review, was expended in determining facts, including service characteristics (mostly quantitative), availability of various options, and their costs and revenues. This work was performed by TSG professionals, most of whom had received a technical education at university, and could be expected to emphasize 'harder' quantitative facts over 'softer' qualitative values.

This avoidance of value judgements was apparent in the presentation to CTC Commissioners of considerable amounts of factual information. For most staff, the objective was to 'crunch' numbers required by the Commissioners. Senior staff were in a rather less clear position, since it would have been impossible to present all possible information about all possible options. The information load had to be cut, by (value) judgements of relevance and importance. These judgements significantly affected the hearing process, as advance information submitted to the public strongly emphasized changes in routes and service levels, rather than structural reforms to passenger operations. Such judgements also were important in the later preparation of summaries for Commissioners.

Of course, without judgements of relevance and importance, the review process would soon have collapsed. However, because the value content of these judgements was not explicit, the opportunity to develop team solidarity around agreed values and purposes was lost, with the result that consensus on specific issues was harder to achieve. Also, important matters (e.g., equipment and operating practices) were underemphasized or not considered.

These circumstances contributed to a sense of hesitancy, best illustrated by the avoidance in presentations to Commissioners of recommendations, in favour of qualified conclusions. This avoidance of overt value judgements had the effect of shifting the decisionmaking responsibility onto the shoulders of the Commissioners, while conveying a lack of confidence in analytical results. Because complexity arose not only from the vast array of facts about services, but also from the complex system of values that sup-

ported their operation, the Commissioners, unaided in their evaluative task, could hardly be expected to take an aggressive approach in sponsoring needed changes.

The emphasis on facts was evident also during public hearings, during which both the CTC and interveners concentrated more on service characteristics and less on public attitudes and values. Thus, there were frequent calls on CN and CP for operating details, financial data, and so on, invariably met by volumes of computer data, diagrams, etc.. By contrast, there was relatively little original information, either quantitative or qualitative, which would provide a 'feel' for the market for improved service or for public attitudes toward services or toward the subsidies their operation entailed.

These hearings may be usefully contrasted with those held a decade earlier, in connection with the discontinuance of the CPR's 'Dominion' transcontinental train. Although use of trains was declining, railways were still a large part of the Canadian way of life. Under these conditions, one would expect more opposition to discontinuance, and more explicit reference to values (behaviour patterns) sustained by train service.

This is borne out, more or less, by transcripts from these hearings [9]. While the CPR focussed on facts about the macroeconomic impact of financial losses, opponents appealed to values of national unity, maintenance of western lifestyles, and employment. The significance of financial losses was largely dismissed by (moral) claims that the CPR 'owed' service to Western Canada. While opponents of discontinuance may have been less than genuine in justifying parochial interests by reference to values, they did not see facts about the service as the only relevant consideration, but expressed themselves in terms of what they took to be widely held values.

The CPR succeeded in discontinuing the 'Dominion', while the later hearings limited the extent of service cuts. To opponents of discontinuance this would seem to justify the 'analytical' orientation of the 1976 hearings. However, given the subsequent failure to modernize service and recent service cuts, the victory seems Pyrrhic. Since little attempt was made to review (value) commitments which underlay both the desire for service and train operating practices, the opportunity to design service to met real public needs and to address problems in operations and management was lost.

(b) Evaluative commitments

An important factor was the apparent reluctance of the major actors to introduce significant change. This unwillingness to change can be attribut-

ed to deep-seated commitments to existing ways of managing and operating passenger services, and to the retention of rail services, when alternatives might better serve the public (and the taxpayer).

I have argued that effective evaluation and advice requires three types of activity: excavating the superficial layers of commitment, to uncover underlying patterns of behaviour that impede effective change; founding new commitments to improved practices; and building new consequential practices, that follow from, or depend on, foundational commitments. Because deeply-held views about the way railways should be run and about provision of service were not examined critically, little effort was made to change a complex of commitments that continues to sustain an outmoded system of transportation.

Although some structural issues were examined, their analysis was seen as largely peripheral to the task of adjusting routes and levels of service. For example, new equipment was considered, but not in the context of a larger strategy of redefining service in light of present-day travel markets. Little was done to improve labour productivity and outdated operating practices or to define new management requirements.

Given the inability or reluctance to tackle deeper problems, there could be little talk of refounding the basis for railway passenger operations. Where changes were identified, the lack of sustained follow-up by the CTC, the Ministry of Transport or VIA resulted in a failure to build consequential commitments that would enable concrete action. Publication of the Final Plan was not enough.

(c) Advisory Relationships

Although Commissioners were the immediate client for advice, there were implicit clients, whose agreement with the Final Plan would be crucial to success, including the public, the railways and the Ministry of Transport. Effective action would require their commitment to a coordinated attack on the problem. Similar coordination of commitment would be necessary within the Technical Support Group, if coherent advice was to be provided.

In Figure 1, I outlined the process by which evaluations of advisors lead to evaluations and consequent actions by decisionmakers. In this model, it is not sufficient for the advisor to transfer information to the decisionmaker, but there must be either a transfer of value content, by careful justification, or an environment of trust between advisor and client, constituted by awareness of shared values.

Because value content was not emphasized, an environment of trust would have been essential to coordinated action, yet there was every evidence in

this case of a lack of trust between participants. Members of the public, especially in Western Canada, were distrustful of the federal government and the railways. There also was insufficient trust within the CTC and the TSG. The TSG comprised a diverse group of professionals, collected rapidly from the Railway Committee and Research Branch of the CTC, and from the Ministry of Transport. (Additional expertise was supplied by CN and CP.) These professionals held diverse, and sometimes strongly held, views about passenger services, a circumstance which did not contribute to cooperation and trust. This diversity was not helped by the physical separation of participants in different parts of Ottawa, with contacts formal and few.

Moreover, TSG members drawn from units within the CTC were wary of internal institutional boundaries, a circumstance which impeded the internal flow of information and limited open and informal discussion. That these conditions discouraged the development of trust, which I have argued is vital to effective action, is suggested by the hesitance of staff to commit to firm recommendations, and the hedging of conclusions with sensitivity analyses and references to assumptions.

Finally, it is worth mentioning the failure to develop public support for the CTC's plan, or to secure the commitment of operators and government to effective follow-up action. VIA was formed during the review, and, without a clear mandate and commitment from the federal government to its success, could not be expected to be a strong force in engineering important changes. VIA had not developed a strong corporate identity, and had not, as a result, developed the commitments (values) that would make the Final Plan practical. The CTC and Ministry of Transport could have helped a great deal in this, the CTC by maintaining an active involvement in changing structural (regulatory) conditions for conduct of railway operations and by 'selling' the Plan to CN, CP and the public; the Ministry of Transport by making clear policy statements, backed as necessary by legislation and new management practices.

5. Lessons for Policymaking

What can we learn from the above case? First, problem analyses should identify commitments and values that underlie the operation of existing transport services, and the design of new services should include specific activities to develop commitment to new modes of behaviour, including structural changes, such as new regulations or institutions, adaptation of existing arrangements for service, and careful explanation and justification.

Second, given the variety in type and strength of commitments, ranging, for example, from broadly and strongly-held community values to very specific and perhaps less embedded operating practices, different types of activities

will be required at different stages of the change process. Thus, effective action will likely depend on the concerted efforts of a range of institutions, including not only those responsible for broad policy initiatives (e.g., Transport Canada) and for detailed implementation (e.g., operators), but also intermediate institutions (e.g., regulatory agencies) capable of bridging the gap between these quite different activities.

Finally, advisors have an important role to play, both in identifying relevant values, and in showing whether proposed changes can be justified by reference to those values. In making value judgements, advisors are not necessarily usurping the authority of the political process, but adding to the capacity of that process to cope with evaluative complexity. In doing so, the advisor becomes a partner with the policymaking authority, and hence jointly responsible for the policymaking process and for actions taken on the strength of advice. In this role, the advisor and client must have trust in one another, or at least an understanding of each other's value commitments, if effective action is to result.

A consequence of this partnership role is that greater attention should be paid to relationships within review teams and between such teams and other participants. Moreover, those in positions of authority and others calling for advice from such teams have a responsibility to encourage informal contacts, challenge team members, and avoid misusing the results of their work. By developing advisory relationships in this way, analysis proceeds quickly and commitment to follow-up action remains after the immediate review is completed.

In the case of western transcontinental services, the change process might have been enhanced in several ways. Initially, more effort might have been directed to the problem analysis stage, during which attention would have been concentrated on the commitments of various interest groups (users, operators, unions, taxpayers, etc.) to existing service patterns and operating practices. This work would have provided a broader appreciation of the dimensions of the problem, and of the likely difficulties in inducing change. It would also have identified the key values or commitments which would have to be respected in designing alternatives, and which would provide the basis for evaluation.

This perspective would have underlined the need for alternatives which focussed not only on the desired end result (e.g., a single train service), but which went further in identifying a transition program for making required changes in operating patterns and practices, for adapting institutional rules, for justifying the change to the public, and for making the result more familiar to users as a logical, continuous change from existing services.

In recognizing the rationalization process as one not only of identifying desirable results but also of motivating changes in behaviour, the CTC, in

consultation with the Ministry of Transport, would likely have provided for an extended 'hand-over' of service to VIA, involving technical support, encouragement, regulatory or policy direction to VIA and other parties, political support in selling change to interest groups, and help in changing government rules and procedures and operator practices.

The TSG's support function could have been enhanced by more explicit attention to initial team building and objective-setting. This would have entailed locating key personnel in closer proximity, thereby providing greater opportunities for professional and social contact, and arranging a full-time commitment of staff (i.e., a more intensive effort over a shorter period). Also, more time could have been spent assessing the perceptions, attitudes and values of candidates for the TSG, either to ensure a more homogeneous value base attuned to the objectives of the rationalization program, or to ensure that divergent opinions became an explicit part of the TSG's study agenda. This approach, by encouraging frankness, understanding and trust, would have made it easier for technical advisors to tackle passenger service problems at their root and for senior decisionmakers to act with assurance and authority.

NOTES

1. Based on research at Queen's University, Philosophy Dept., supported by Transport Canada's Transport University Programs (TUP), and at Cole, Sherman & Associates.
2. Bunting, P.M., Evaluation and Evaluative Failure, MA Thesis, Philosophy Dept., Queen's University, Kingston, Canada, July, 1985.
3. Bunting, P.M., Experts, Advice and Action, PhD Thesis, Philosophy Dept., Queen's University, Kingston, Canada, Oct., 1988.
4. Galbraith, J.K., The New Industrial State, Houghton Mifflin, Boston, 1967.
5. It may be objected that this is regulation, not policymaking. Even if these activities can be usefully distinguished, the case displays features of studies conducted for policymaking purposes. Also, since the CTC was asked to review services by the policymaking body, the CTC could be treated as fulfilling a policy function for that authority.
6. CTC, Railway Committee, Transcontinental Passenger Train Hearings: Summary of Findings, Sept. 1976.
7. CTC, Railway Committee, Preferred Plan: Western Transcontinental Passenger Train Service, Apr. 1977.
8. CTC, Railway Committee, Final Plan for Western Transcontinental Passenger Train Service, Oct. 1977.
9. Selections appear in Bunting, op. cit. (note 2).

Canadian Regional Railway Passenger Services

WAS THERE EVER ANY POTENTIAL FOR FINANCIAL IMPROVEMENT?

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1. INTRODUCTION

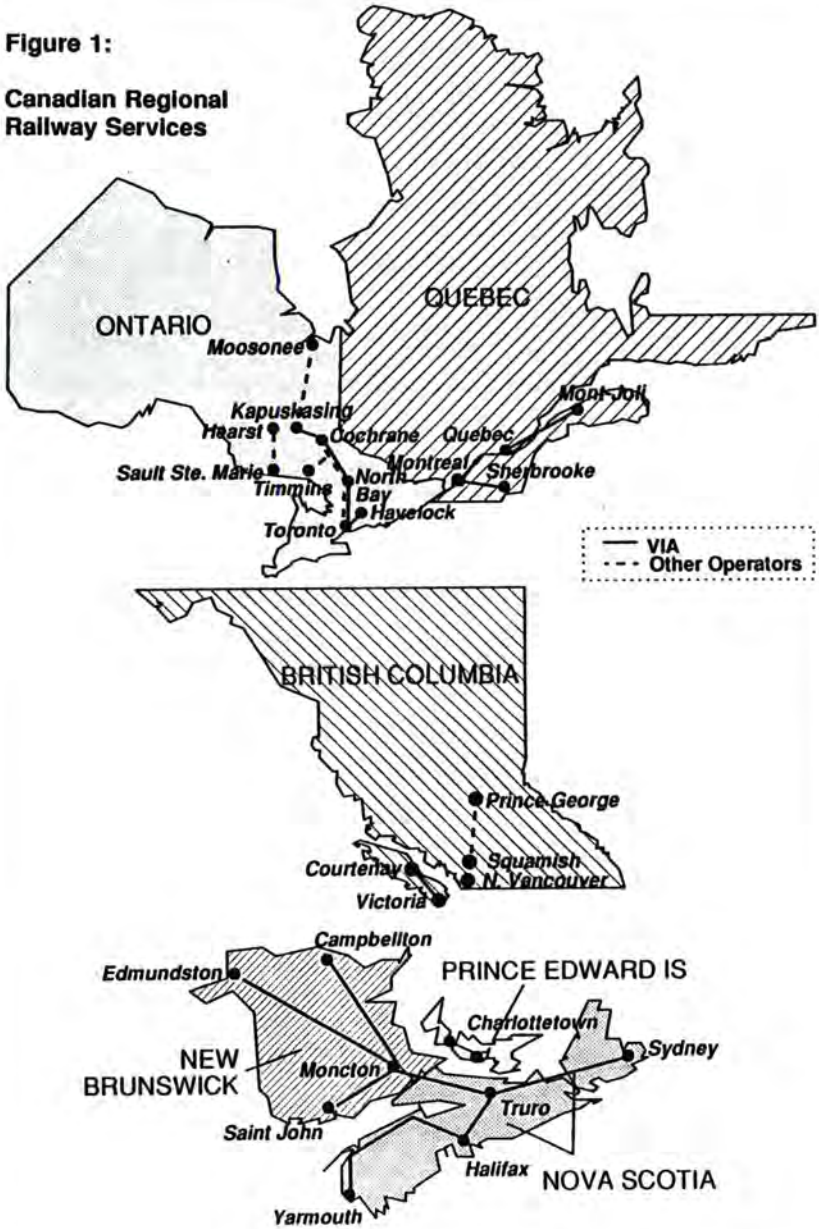
The recent cuts to VIA Rail all but eliminated VIA's regional rail services. As a result, Canada now has only a handful of regional passenger rail services operated by VIA, the Ontario Northland Railway, the Algoma Central Railway and the British Columbia Railway. At the same time, the 1980s were a period of expansion and/or consolidation for regional rail services in other countries, both in Europe and North America. In this paper we explore the following questions:

- How have regional passenger services performed in the United States, Britain and France compared to Canada?
- What are the reasons for differences in performance between Canada and these other countries? Are the differences due to socio-geographic, policy or managerial factors, or a mix?
- Assuming that we can do little about socio-geographic differences, what policy or managerial changes would have been needed in Canada to improve the performance of regional passenger rail services? And what would have been the likely effects on the level of service and the subsidy requirements of the former VIA regional services?

At first glance, this may appear to be an academic--some may even say mischievous--exercise. However, the experience of the Pepin cuts of 1981

Figure 1:

Canadian Regional Railway Services



indicates that the lure of the ballot box can be almost irresistible, and that services which were thought to be dead can be decreed back to life. The purpose of this paper is to suggest what could reasonably be achieved, and what it is unrealistic to expect, from regional passenger rail services in Canada. Our aim is not to say yea or nay, but to provide food for thought.

We begin by defining 'regional services'. We then compare and contrast the performance of Canadian regionals with those operated by Amtrak, British Rail (BR) and French National Railway (SNCF), looking at the organization of the services, the level of service, the utilization of the service and financial performance. Finally, we explore avenues to reduce the gap in utilization rates and revenue:cost ratios between Canadian and foreign regional services.

2. CANADA'S REGIONAL SERVICES

VIA operated 13 regional rail services prior to the cuts. They generally provided daily service linking smaller towns to regional centres in BC, Ontario, Quebec, New Brunswick and Nova Scotia. Most operated with one to three self-propelled rail diesel cars (RDCs). The regional sector included a network of trains in Atlantic Canada; a series of trains from Toronto to Northern Ontario operated in conjunction with ONR's passenger services; two semi-commuter trains, one feeding Toronto and one feeding Montreal; plus services on Vancouver Island and the Quebec South Shore. In addition, VIA operated a number of Corridor trains with characteristics similar to the regionals. Other regional services are operated by the Algoma Central Railway, the British Columbia Railway and the Ontario Northland Railway. Running speeds, frequency and pricing are similar to the former VIA services. These services are illustrated in Figure 1.

3. COMPARISONS OF PERFORMANCE

The four countries under comparison form two groups:

- **France and UK:** characterized by compact land mass, high population density, lower car ownership, and higher car operating costs;
- **Canada and the United States:** characterized by large land mass, lower population density, higher car ownership, and lower car operating costs.

Not surprisingly, intercity passenger rail travel volumes are much higher in Britain and France than in Canada and the United States, both in absolute terms and in terms of travel per capita, as Table 1 shows.

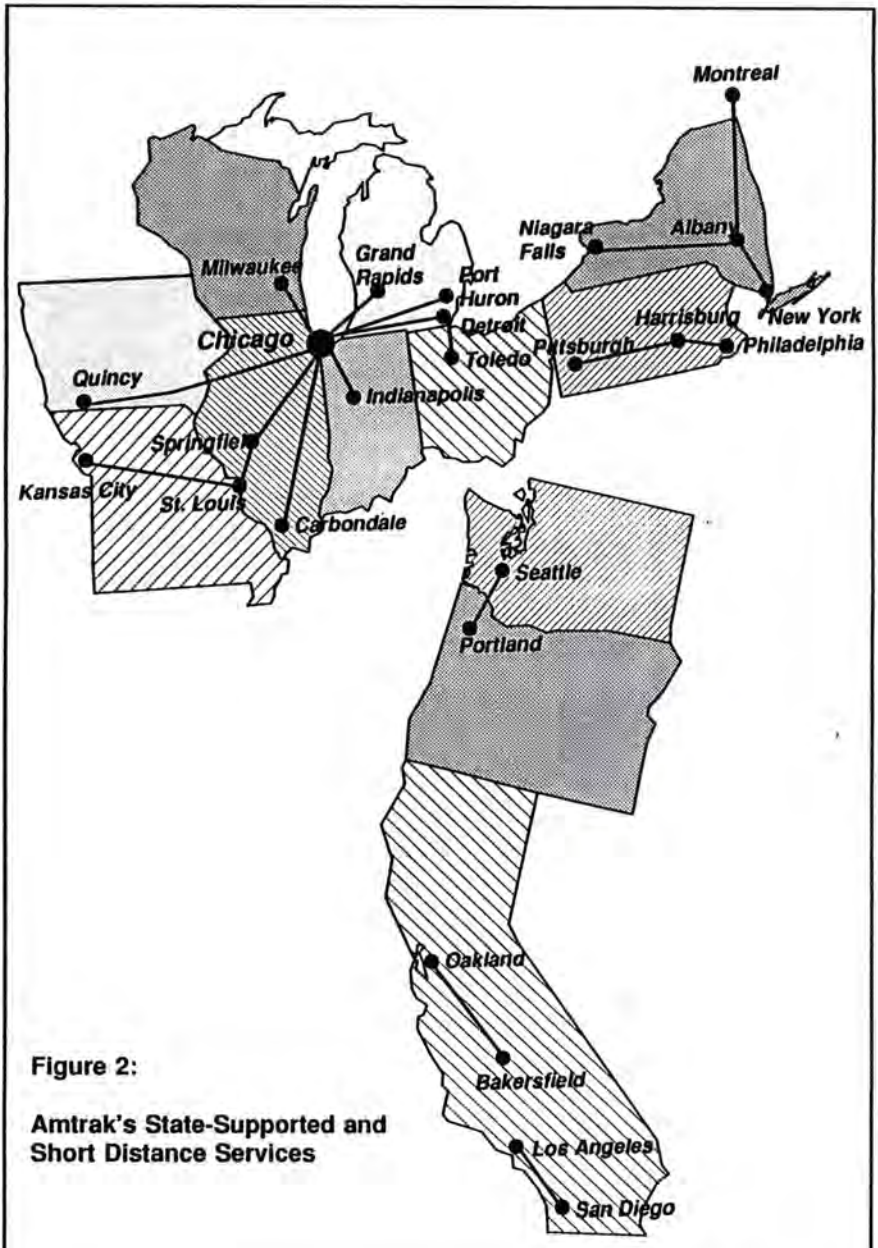


Figure 2:

Amtrak's State-Supported and Short Distance Services

Table 1: Rail Travel by Country, 1988

Country	Population (Millions)	Trips* (Millions)	Annual Rail Trips/ capita	Pass.-km/ capita
France	55	300	5.5	980
U.K.	56	285	5.1	345
U.S.A.	241	21	0.1	35
Canada	26	7	0.3	95

* French and British rail trips exclude Paris and London suburban trips.

Regional rail services in the European countries differ significantly from those in North America, offering much more frequent services over a more extensive network, and consequently generating more traffic (see Table 2). For example, British Rail's Provincial services consist of provincial express services offering moderately fast service (using new self-propelled equipment) on lines which serve smaller markets than BR's InterCity services; high-frequency (hourly or more) services in the industrial conurbations of West Yorkshire, the West Midlands and similar regions; and low speed, low frequency (less than four trains *per day*) rural services. The service pattern is broadly similar in France.

Amtrak's short-distance and state-supported services bear greater similarity to Canada's. They cover only parts of the country, the level of frequency is low, trip times are relatively slow and route lengths are in the 200-500km range. One major difference is the much higher population which is within the catchment of the Amtrak services: more than four times the population served by Canadian regionals. The main hubs of VIA's regional network were Halifax and Moncton; Chicago is the hub of Amtrak's main regional network (see Figure 2). Table 2 indicates that despite the much lower catchment population, Canada's regionals have achieved somewhat higher trip generation rates than Amtrak's.

Table 2: Regional Rail Ridership

Country	Extent of Network	Catchment Population (Millions)	Average Number of trains/day	Pass.-km/ Capita
France	National	up to 40	4+	165+
U.K.	National	up to 40	4+	145+
U.S.A.	12 states	35-40	1-7	27-30
Canada	5 provinces	8-10	1	10-12

Table 3: Financial Results: Regional Rail Services
(All data converted to 1988 Canadian price levels)

	BR	SNCF	Amtrak	VIA
Passenger revenues *($ million)*	494	503	117	8.6
Operating costs *($ million)*	1,441	1,229	230*	46.2
Operating subsidies/Loss *($ million)*	947	726	113*	37.7
Revenue/passenger-km *(cents)*	9	8	11	9
Operating cost/passenger-km *(cents)*	26	19	22*	46
Subsidy/passenger-km *(cents)*	17	11	11*	38
Revenue:cost ratio	0.34	0.41	0.51 *	0.19

* Estimates based on historic ratios of short-term available cost to fully allocated costs for Amtrak's short-distance services.

If trip generation rates are a proxy for the effectiveness of regional services, the ratio of revenues to operating costs measures their efficiency. None of the regional networks we studied came close to self-sufficiency. However, VIA's regional services achieved by far the lowest revenue:cost ratio, as indicated in Table 3 (published data was not available for the other Canadian services).

4. COMPARISONS OF POLICY ENVIRONMENT

On most of the criteria which were used to compare the performance of regional services, VIA's regionals did not perform well. In part, this is attributable to the familiar problem that "Canada has too much geography". While this can help to explain differences at one point in time, it cannot explain differences in performance over time. For example, while the financial performance of the VIA regionals showed little change from year to year, that of the BR and Amtrak regionals showed steady improvement over the 1980s (we had no time-series data on the French regionals). The ratio of passenger revenues to operating subsidies for the BR Provincial sector improved significantly in the 1980s. 10 out of 16 Amtrak short-distance services reduced or eliminated their short-term avoidable losses from 1981 to 1987. In that year, five services more than covered their short-term avoidable costs. Average train loads increased by 30 percent over the decade.

Similarly, while ridership on the VIA regionals was static or decreased in the 1980s, ridership on the British and French regionals increased, reversing a long-term decline dating back to the 1950s, and attributable to bus competition and the spread of car ownership.

One critical difference between Canada and the other three countries is the policy context for regional services. France, Britain and the United States have all introduced cost-sharing mechanisms, whereby decision-making about the level of regional services. In Britain, regional transport plans are developed by Passenger Transport Executives in consultation with British Rail. These set targets for the level of service, determine the capital investments required to implement transport plans; they have also authorized the reopening of stations which had been closed since the 1960s. The French approach is also based on agreements between the SNCF and the region. SNCF assumes responsibility for the operating deficit which existed for the ex-ante level of service. The region is responsible for operating deficits which are created as a result of service improvements. In the United States, services in six states are financially supported under Section 403(b) of the Rail Passenger Service Act.

The merit of these arrangements is twofold. From the perspective of the central state, they reduce the burden of financing services which play a regional, rather than a national, role. Service extensions are financed primarily by those who derive the most benefit from them--travellers through the fare box and local taxpayers. But if it were simply a question of shifting the subsidy burden from the national to the local taxpayer, it is doubtful that the system would have proved acceptable to regional interests. The second merit is that regional participation in the management of regional train services can promote a greater sense of identity with the services. This can take a number of forms: competitions at schools to design logos; equipment painted in a regional livery; patronage targets for reopened stations; advertising which is targeted to the region. As a hypothesis, let us suggest that the existence of a regional authority with some decision-making power promotes decentralization of the passenger railway company: a hypercentralized rail company would be ill-equipped to make power-sharing work.

The policy environment in Canada has not favoured decentralization of regional rail services. Cost-sharing bears the connotation of federal shirking of responsibilities. With the exception of the two provincially-owned railways and the Toronto and Montreal commuter systems. other levels of government are not involved in passenger rail. The unfortunate corollary has been that there has been little or no incentive either for VIA to expand regional services in response to local demands or for those in the regions to press for improved efficiency in the delivery of their rail services; the deficit was not their responsibility. It is true that regional initiatives to promote specific services have occurred: the Vancouver Island service has always benefitted from strong community support, while the Annapolis Valley train was actively promoted in the early 1980s. However, these initiatives existed despite the policy environment, not because of it. If VIA's regional rail services are ever revived, whether under VIA's auspices or through other operators, the decentralized approaches followed in Britain, France and the United States are worth looking at closely.

5. POTENTIAL FOR FINANCIAL IMPROVEMENTS OF VIA SERVICES

As noted in Table 3, VIA reported an operating loss for its regional services in 1988 of 38 cents per passenger-km or $78 dollars per passenger. Revenues amounted to 8.4 cents per passenger-km, indicating that only one-fifth[1] of the costs were being recovered from the farebox--a much lower percentage than is being achieved elsewhere. At the individual service level, there is considerable spread in the Canadian regional service financial performance. The Toronto-Havelock and the Vancouver Island routes appear to have done about twice as well financially as the Regional average; nearly all other routes are below the average--some significantly.

In its 1989 Review of Passenger Services, VIA forecast significant improvements in the financial performance of its regional service sector. Over the period 1990-2010, aggregate revenues were expected to increase by twelve percent while operating costs were expected to drop by seventeen percent--resulting in a thirty-five percent reduction in losses to $43 per passenger. The revenue:cost ratio changes from 0.20 to 0.30--a respectable improvement, but a still a low level of cost recovery.

How did VIA expect to achieve this improvement? There are a variety of factors at work:

- Replacement or rebuilding of the rolling stock devoted to the regional services. The new equipment would cost less to maintain and be more fuel-efficient.

- Reductions in train crews. For routes using new self-propelled vehicles (SPV), VIA has assumed a one-man crew plus on-board-service (OBS) staff. For locomotive-hauled trains, an engineman and one or more trainmen are assumed to be eliminated.

- A "general productivity improvement" in operating costs of one-half a percent per year starting in 1994. VIA states that this improvement allows for further improvements in crewing and other potential labour savings in maintenance and headquarters staff.

- A small (7.5%) increase in revenue attributable to the use of new, more reliable rolling stock with a better passenger ambience. Part of this is realized through increased ridership and part through

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[1] A twenty percent level of cost recovery is based on VIA's use of fully allocated costs. Most of the previous reports of passenger cost recovery have been based upon "specific" costs of individual train services. VIA's overheads were ignored in these recovery figures.

improved yields. The balance of the net improvement in regional revenue was driven by a forecast improvement of 50 percent in Toronto-Havelock ridership and a 42 percent on Vancouver Island. Little or no ridership growth potential was seen for the remaining eleven regional services; some may even experience a net decline given improvements in parallel highway systems.

The financial improvements projected by VIA would have required an investment of $155 million. If these are incorporated directly into the operating projections, e.g. by treating them as an annual capital charge, VIA's financial projections change significantly. Allowing a credit for the useable equipment life of thirty years, the annual capital charge at VIA's five percent discount rate would be approximately $8.6 million. This increases the reported loss per passenger by one third to $58 in 2010 and implies a full revenue:cost ratio of less than 0.24 rather than the 0.30 reported value.

What other improvements might be made?

Despite a forecast 25 percent reduction in the total operating loss and a 35 percent reduction in the loss per passenger, the government choose to eliminate regional services citing a need to reduce VIA's funding drain on the public purse. It is not clear what financial decision variable was used--the total operating losses, the capital requirements, the operating loss per passenger (or per passenger-km), the revenue:cost ratio, or some combination?

Whatever decision variable was used, the projected financial performance was obviously not acceptable to government. Some VIA supporters have argued that regional services should have been retained despite the financial performance; others have argued that the cuts were 'premature' in the sense that a better financial performance could have been achieved. Our purpose is not to examine the former claim, but to identify what circumstances could have led to a **substantial** further improvement in the regional services. Had VIA projected a revenue:cost ratio of say, 0.60 rather than 0.30 and a loss per passenger of $23 rather than $43, the decision dynamics may have been different.

We examine a number of measures which are frequently advocated as means of improving the financial performance of passenger rail services. These include:

- reducing CN/CP charges;
- cutting VIA overheads;
- improved equipment utilization;
- reducing labour costs, e.g. paying regional rail employees the same wages as bus employees;
- improving service, e.g. better on board services;
- cutting fares in the off-peak period.

CN/CP Charges: The level of charges by the railways--and the inclusion of their administrative and other overheads--has long been seen as an impediment to the financial health of Canada's rail passenger system. In the early years, as much as two-thirds of VIA's costs involved payments to the railways. With the gradual transfer of stations, equipment maintenance, crewing and other functions, VIA has internalized many of these costs--and the overheads associated with them. Most payments now made to CN/CP are for the use of track. For regional services, we estimate railway charges to be at most $2 per train-km. This is less than fifteen percent of VIA's forecast total regional operating costs. If the NTA were suddenly to revise the Costing Regulations so as to exclude half of the railway charges, this would translate into a two percentage point improvement in the revenue:cost ratio and a $2.3 million annual saving on a deficit of $25 million.

The present method of using system averages per train-km and per gross tonne-km and including all cost components leaves a lot to be desired. However, a more specific cost attribution system could prove to be a double-edged sword. It would likely result in a lowering of CN/CP charges **on some regional routes.** There would be a significant downside risk for others. Railway charges could double or triple on routes where VIA is a major user and it is the passenger service that contributes disproportionately to the need to maintain operating speed and track quality and to undertake more frequent patrols. On the Halifax-Yarmouth route for example, the VIA forecasts show that the added cost of maintaining the Kentville-Yarmouth section for passenger service--excluding corporate overheads and capital--accounts for more than one-fifth of the annual operating loss. Funding of capital expenditure required to acquire the line--at net salvage value--would represent a further seven to eight percent increase in the annual loss, already at $66 per passenger. **For the regional sector as a whole, we cannot see more than a net one million dollar savings per annum in railway charges for track usage.**

VIA overheads: At the same time that the importance of CN/CP overheads has been declining, VIA's own overheads have been becoming increasing larger. VIA attributes an $11.7 million "share of common [overhead] costs" to the regional services in the year 2010. This is equivalent to fifty cents overhead per dollar of direct expenses and represents nearly half of the projected $25 million annual operating loss. There are two major issues at stake. First, there is the general level of overheads. Second, is the method by which overheads are allocated.

In total, VIA is projecting overheads--which includes the operation of facilities which are shared among a number of train services--to be $209 million by the year 2010. This represents a fifteen percent improvement in over the present situation. On $426 million in direct expenses, the overheads are still significantly higher than those experienced by other railways and the trend is different from that experienced by CN and CP in recent years. An examination of VIA's employee statistics and other data suggests that a further ten to twenty percent

reduction in might have been achievable. One of the sources of any potential savings lies in the fact that with new equipment in place, employee transfers completed and so on, VIA should have reached a mature status by the late 1990s. Much of the present overhead cost is not related to day-to-day operation of a passenger system but to the transition to a mature system.

In its costing, VIA has allocated all overheads to all services in a fixed proportion --of approximately fifty percent--to direct costs. Is such an cost allocation system appropriate? It the opposite of methodology that has been developed in the industry over the last thirty years whereby overheads are examined by function on the basis of resources consumed. Detailed breakouts of overheads are not available, thus a recalculation of the regional "share of common cost" is not possible. Given the direct costs of one- or two-car regional trains and the type of services offered, it is unlikely that the regional's overhead share should be as high as it is. From what little cost data that exists, we do not believe that the distortion is serious for the regional network as a whole. **On balance, we would expect that a decrease in the common costs on the order of $2.5 million could have been possible, but only if VIA were able to "bite to bullet" as CN, CP and a number of the larger U.S. railroads have done.**

Improved equipment utilization: VIA currently achieves low utilization on its fleet of Rail Diesel Cars (RDC) used for regional services. Improving the utilization would result in lower capital and maintenance costs per-km. One of the expectations of new equipment is better availability and improved utilization. Yet for VIA's regional services, there seems to be little opportunity for improvement, even with new equipment. The regional network is characterized by single round-trips per day with morning departures towards major centres and late afternoon or early evening returns. Equipment is tied-up overnight at the outlying terminal. Unless schedules are significantly altered--to say, one of leaving the major centre in the early morning or mid-afternoon and returning immediately--there is no way to attain long-term utilization rates that are anything but marginally better than at present. Such schedules, while operationally "efficient" provide a service which is opposite of what the market requires. **The only way to improve utilization substantially is through increased train frequencies (the approach BR has followed with its Sprinter equipment), but demand projections do not support additional trains.**

Improved load factors: Passenger load factors on the regional trains are relatively low: less than thirty percent of the seat-kms produced are occupied by passengers. Improving the load factor--by offering fewer seats or filling the empty seats--is a typical method of improving financial performance. Except as discussed in relation to equipment selection below, there appears to be no potential to reduce costs by reducing the number of seats provided. Most trains are at a minimum size of one or two cars. There simply is not a sufficient market to make full use of most trains except at peak periods when they are already

approaching capacity. A second reason for the low load factors is the very nature of the regional transportation market. Many trains--for example the Havelock-Toronto service--tend to leave the regional terminal with few passengers but fill up as they approach the major centre. With such a market demand, a forty to sixty percent load factor represents a full train.

Increased ridership: Experience from regional services in other countries suggests that a decentralized approach to marketing is more likely to be successful, one which draws on local support networks and focuses on local print media and household distribution of schedules. The ridership forecasts developed by the Review of Passenger Transportation probably represent the best which could be achieved under a centralized framework. In many cases, the population base upon which the regional services must draw is declining while road alternatives are improving.

No doubt there is latent rail ridership in many of the regional routes. But what would it take to attract this ridership? The same features that attract corridor ridership: visible improvements in trip times, greater frequencies, more amenities, all of which would require significant expenditures. It is unlikely that additional revenues--sufficient to generate a **net** financial improvement--could be generated in the regional markets.

Payment of lower crew rates: Another approach is to argue that on financially troubled lines, employee wages should be reflect those of the competition, the bus industry. Based on the 1987 data this essentially affects the train crews and various administrative and general service employees, who are paid about 20 percent more than their bus counterparts.

Bearing in mind that VIA has already assumed crew reductions and general productivity improvements, this would yield savings in operating costs of about $1.5 million per annum. The net effect could be a higher, if one also assumes higher productivity levels, the use of more part-time employees and the sharing of functions, as part of the same overall labour package. However, these savings exclude any costs incurred to implement such a measure, which is difficult to envisage in practice.

Fare increases: The experience of 1985-86 suggests that the potential for improving revenues through **general** fare increases is poor, at least as long as rail service levels are no better than, and in some cases worse than, the bus. VIA's current approach of offering off-peak discounts may prove more successful: the critical factor is the extent to which **new** ridership will be generated; the danger is that of 'cannibalising' part of the existing full-fare ridership. As an indication of the potential in this area, consider that **a ten percent decrease in the operating loss would require a twenty-five percent across the board increase in ticket prices, assuming no loss in ridership.** Yet every

investigation of the regional transportation markets indicates a moderate degree of price sensitivity. The bus companies would certainly have welcomed such a twenty-five percent increase in train fares.

Different equipment: One of the more interesting questions with respect to VIA's projections is: *Why, assuming the deployment of new equipment, are costs not forecast to drop further than they have?* For years, the woes of passenger have been partially blamed on old, high-cost equipment. If only the government would allow the purchase new cars, there would be an improvement. Yet we see only a seventeen percent improvement in direct costs--over half of which is the result of the general post-1994 productivity assumption.

Part of the answer lies in the choice of equipment. One of the features of VIA's projections for the regional services is the use of new motor-trailer SPVs. These cars must be operated as pairs rather than as single cars. The smallest train is two cars rather than the one car which is typical of many regional departures. Thus there is a twenty-six percent increase in car-kms, significantly less than the nine percent in passenger-kms. Some increase in car-kms can be attributed to fewer seats per car and some to the increased ridership on the Havelock and Vancouver Island services. Most of the increase, however, is appears to be the result of the technological limitations of the proposed equipment. **Operation of the extra car-kms consumes as much as one to one-and-a-half million dollars of the potential savings of the new cars.** Use of a more flexible car would reduce the operating losses and allow some savings in the number of units required for regional services. What is not clear is whether such a strategy might not result in higher costs for corridor trains which draw upon the same equipment pools.

Other suggestions have included the use of a railbus--or other light rail vehicle. Such equipment consumes somewhat less fuel and requires less maintenance than "conventional" self-propelled equipment. They also are slower, less comfortable and have a shorter life. VIA conducted operationally successful tests of a British railbus three years ago, yet concluded that the vehicle was not suited to the market requirements of many regional services. The investigation, was academic. however, since the product was withdrawn from the market in favour of a more conventional SPVs before VIA could even make a decision.

Elimination of "frills": In comparison to a number of the existing bus alternatives, VIA regional rail services offer a number of what one might considered frills such as accessible toilets, uniformed employees, snack-bar and beverage service, reservations, credit card purchases, larger and more comfortable stations and so on. Such features add to the cost of the rail mode but also contribute directly and indirectly to revenues. It is hard to tell where to draw the line, but there are savings that could be made in this area, but such savings would not be conducive to maintaining ridership and revenue.

6. CONCLUSIONS

The main conclusions which can be drawn from this comparative study are as follows:

1. Canada's regional services had become considerable more 'marginalized' than those of France and Britain. This is partly attributable to the lower population density of Canada, partly to the fact that mass car ownership in North America developed earlier and is more widespread than in either France and Britain.

2. However, the biggest contrast is on the cost side. Costs per passenger-km are considerably higher for VIA than for the other railways, because of over-staffing, low equipment utilization, the cost of operating and maintaining old equipment, and high overheads.

3. The implementation of the measures discussed above could narrow the gap substantially between VIA and the other railways, so that the regional services might cover as much as forty to forty-five per cent of total operating costs. It then becomes a policy question as to whether the benefits derived from the regional services are worth that level of public support plus the initial investment of well over $100 million.

4. Even though further improvements might have been made in the financial performance of VIA's regional services **as a whole,** there would be a wide range between the losses experienced on individual services.

5. Based on the experience in other jurisdictions, one of the most effective ways that a national railway has of improving the financial performance of regional services may not be in reducing costs or increasing ridership, but rather in extracting some of the operating loss from junior levels of government. This is a strategy that does not appear to have been considered in Canada

Joseph Jones and Charles Schwier have spent much of the last number of years studying both corridor and regional passenger services. Much of this research was sponsored by VIA Rail Canada. The opinions expressed herein are those of the authors and do not necessarily represent the views or policies of VIA. The analysis in this paper has been carried out using data within the public domain.

Introducing Honour Self-cancellation of Tickets: Some Strategic Considerations

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1. Introduction

Introducing an honour system of ticket self-cancellation by passengers can reduce the costs of providing transportation services. The major problem with the honour system is the possibility of fare evasion.

The objective of this paper is to propose the theoretical framework to analyze the problem of fare evasion that would fully account for the strategic interaction between potential evadors and the bus (transit) company. Given that bus travellers and the bus company cannot make legally binding contracts that would eliminate the possibility of fare evasion, the analytical framework chosen is that of noncooperative game theory. The advantage of the proposed framework is that it clearly identifies the variables that will affect the equilibrium evasion rate (for an alternative framework see for example Boyd *et al.* (1989)). In addition, the issue of how imperfect and asymmetric information may affect the results of the model is addressed.

2. The Model - the Case of Perfect and Symmetric Information

The following is the strategic form representation of a noncooperative game between a transit company (firm) and a customer who is a potential evador. The players have perfect and symmetric information about each other characteristics and the payoffs.

		Firm	
		Detect	**Not Detect**
Customer	**Evade**	$-p\ ;\ p - IC_H$	$0\ ;\ 0$
	Not Evade	$-f\ ;\ f - IC_H$	$-f\ ;\ f$

The meaning of the symbols in the payoff matrix is as follows: 'f' is the fare, 'p' is the penalty for cheating which is some multiple of 'f' ($p > f$), and 'IC_H' is the inspection cost that guarantees that all cheaters are apprehended. IC_H depends on the number of the required inspectors and their wages. If one assumes that the required wage rate is determined by competitive markets and is given to the firm, and that the relationship between the probability of detection of an evador and the number of inspectors is linear, then the analysis can be simplified by considering only IC_H and the equilibrium probability of detection, rather than the actual number of employed inspectors. Once the equilibrium probability of detection (π_e) is found, the actual required expenditures on detection ($AIC_H = \pi_e * IC_H$) and the number of inspectors can be easily calculated.

The firm has two pure strategies: to have the inspectors audit all passengers (Detect) and to rely on customers' honesty and not to perform an audit (Not Detect). The customer can either Evade or Not Evade paying the fare. This game, however, has no equilibrium when only pure strategies are concerned. [1] To see this, suppose that the firm plays Detect, the optimal strategy for the customer is then to play Not Evade ($-f > -p$). However, when the customer plays Not Evade, Detect is no longer an optimal strategy for the firm ($f - IC_H < f$). Thus, there is no stable outcome of the game if we restrict our attention to pure strategies.

However, even when there is no equilibrium in pure strategies, mixed strategies equilibrium, where players randomize their choices, always exists (Friedman, 1988). Mixed strategies equilibrium is defined as a set of strategies with probabilities attached to players possible actions, such that given the choice of strategies of one player, the other player has no incentive to change his strategy. Given that there is no pure strategies equilibrium in this game, and that mixed strategies equilibrium always exists, it is apparent that an introduction of an honour system of fare payment leads automatically to some cheating and requires random inspection on the part of the firm.

Consider a market for bus (transit) services with 'n' customers. Let us assume that the demand function is very simple and given by:

$$\text{If } f > f_0, \quad Q_D = 0$$
$$\text{if } f \leq f_0, \quad Q_D = Q_0.$$

The long run marginal cost curve when the full audit system is used is equal to $LRMC_{FA}$. Introduction of the honour system can reduce cost of providing the services to $LRMC_H$. However it is expected that some fare evasion will take place. If the company is to conduct random checks, the effective cost of operating the system will increase to $LRMC_{HA}$. As a result of evasion, the number of fare paying customers reduces from Q_0 to Q_1 (Figure 1).

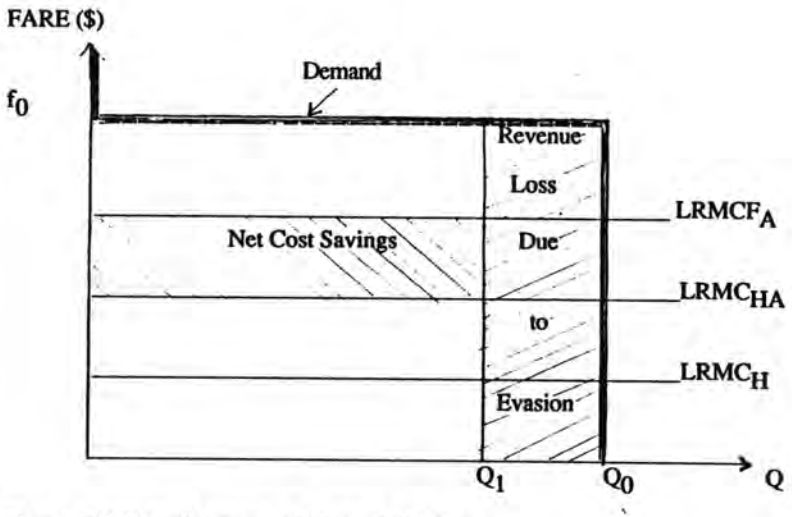


Figure 1: Full Audit versus an Honour System.

Introducing the honour system will be only economical to the firm if the net cost savings plus revenues from fines exceed the revenue loss due to fare evasion. In the assessment of the two systems it is critical, therefore, to identify the factors that will determine both the amount of fare evasion and the inspection cost. In order to do that, it is necessary to calculate the mixed strategy equilibrium of the game. The game where the players are allowed to randomize their choices is shown below.

		Firm	
		Detect (π)	Not Detect ($1-\pi$)
Customer	Evade (b)	$-p$; $p - IC_H$	0 ; 0
	Not Evade ($1-b$)	$-f$; $f - IC_H$	$-f$; f

(where 'b' is the probability of Evade and π is the probability of Detect. (1-b) and ($1-\pi$) are then the probabilites of Not Evade and Not Detect, respectively).

To find mixed strategies equilibrium we proceed as follows:

First, to identify π_e, we find π such that the customer is indifferent between either of his strategies :

(1) V_C(Evade) = $-p\pi + (1-\pi)\, 0 = -p\pi$

(2) V_C(Not Evade) = $-f\pi + (1-\pi)\,(-f) = -f$

by setting V(Evade) = V(Not Evade) we obtain $\pi = f/p$.

The equilibrium b_e , in turn, is found by setting V_F(Detect) = V_F(Not Detect) and solving for b.

(3) V_F(Detect) = $b\,(p-IC_H) + (1-b)(f-IC_H) = bp - bIC_H + f - IC_H - bf + bIC_H = bp - bf + f - IC_H$

(4) V_F(Not Detect) = $b\,0 + (1-b)\,f = f - bf$

By setting $bp - bf + f - IC_H = f - bf$ we find that $bp = IC_H$ and $b = IC_H/p$)

Thus, the equilibrium mixed strategies are as follows:

For the traveller : Evade with the probability $b_e = IC_H/p$ and Not Evade with the probability $(1-b_e) = 1 - (IC_H/p)$;

and for the firm: Detect with the probability $\pi_e = f/p$, and Not Detect with the probability $1 - \pi_e = 1 - (f/p)$.

The probability of evasion is therefore defined by the ratio of the detection cost to the penalty. Other things equal, b_e increases as the detection costs increase, and is negatively related to the value of the penalty. The equilibrium probability of detection, π_e , in turn, is uniquely determined by the ratio of fare to penalty.

The first important result of this model is that the level of actual expenditures on random checks $AIC = IC_H * \pi_e$ (and the number of employed inspectors) is <u>not</u> a true strategic variable that is at firm's disposal, but instead is entirely dependent on the f/p ratio. The <u>only</u> strategic variables that affect the levels of cheating and enforcement effort are the fare and the penalty. Even though the cost of enforcement , IC_H , affects the equilibrium value of the evasion rate, it is not a strategic variable to the degree that wages of inspectors and other related costs are beyond the control of the transit firm. Should there be, however, an increase in the inspection costs, the model predicts the corresponding increases in the evasion rate ($\partial b_e / \partial IC_H = (1/p) > 0$).

Given the equilibrium probabilities of evasion and detection, b_e and π_e , the firm profit function is given by

(5) $P = \alpha f + (n - \alpha)\{ b_e \pi_e (p - IC_H) + b_e (1-\pi_e)\, 0 + (1-b_e)(1-\pi_e) f + (1-b_e) \pi_e (f - IC_H) \} - F - c\,n$

(where α is the number of intrinsically honest passengers who do not respond to economic incentives to cheat, F is the fixed cost and c is the variable cost),

which simplifies to

(6) $P = n f - (n - \alpha)[f(IC_H/p)] - F - c\,n$ (calculations are given in an Appendix).

By differentiating (6) with respect to p, we obtain:

(7) $\partial P/\partial p = (n-\alpha)\,[f\,(IC_H)/p^2] > 0$ (since $n > \alpha$).

From (7) it follows that to maximize profit the firm should set the penalty for cheating at the maximum socially acceptable level. Since b_e ($b_e = IC_H/p$) is inversely related to the level of penalty, high penalties, as expected, result in lower evasion. In addition, given that $\partial AIC/\partial p = \partial (IC_H{*}\pi_e)/\partial p = -(IC_H)(f/p^2) < 0$, the actual inspection costs decrease with the level of penalties[2].

3. Incomplete and Asymmetric Information

Game theorists make distinction between imperfect information and incomplete information. A player has imperfect information when he does not know what the other players have done beforehand. Incomplete information, on the other hand, means that a player does not know the other players precise characteristics. A game with incomplete information can be transformed into a game with imperfect information by introducing an additional player - Nature. In the description of the game, Nature chooses the type or the characteristics of the players. The players, other than the particular one in question, are not informed about the choice made by Nature (Tirole, 1989).

Let us consider now the following complication: the customers do not have complete information about the firm type. That is, they consider the possibility that the firm is not serious about detecting the cheaters[3]. For example, there may be transaction costs of collecting fines, going to courts, etc., that make prosecution of caught evadors not profitable, and hence the dominant strategy for firm may be Not Detect. Such uncertainty can be described by introducing an additional player - Nature which moves first and selects the type of the firm. Only the firm, but not the customers, is informed about the Nature's choice. The game in the reduced form is shown below.

		Type I (m)		Type II (1-m)	
		Firm		Firm	
		Detect (π)	Not Detect (1- π)	Detect 0	Not Detect 1
Customer	Evade (b)	$-p$; $p - IC_H$	0 ; 0	$-p$; $p - IC_H - \Delta TC$	0 ; 0
	Not Evade (1-b)	$-f$; $f - IC_H$	$-f$; f	$-f$; $f - IC_H$	$-f$; f

(where ($p - IC_H - \Delta TC$) < 0).

The firm knows its own type, but the customers are uncertain about it. The best they can do is to assign probabilities 'm' and '1-m' to the two possible outcomes. Those probabilities are determined by the customers' subjective beliefs. (One possible set of beliefs is that the two possibilities are equally likely or m=0.5. The model is not designed to explain how those probabilities are formed. In a dynamic model, the possibility that players adjust their beliefs on the basis of new information can be introduced.)

To find mixed strategies equilibrium in this game we proceed as follows:

First, to identify π_e, we need to find π such that the customer is indifferent between either of his strategies. The problem is that the customer does not know the type of the firm with certainty. Consequently, consumer's payoffs have to be calculated as expected values given his subjective beliefs.

(8) $V_C(\text{Evade}) = m\{-p\pi + (1-\pi)\,0\} + (1-m)\{0\} = -\pi p m$

(9) $V_C(\text{Not Evade}) = m\{[-f\pi + (1-\pi)(-f)] + (1-m)(-f) = -f$

By setting V(Evade) = V(Not Evade) we obtain $\pi = f/(p*m)$.

Equilibrium b_e, in turn, is found by setting $V_F(\text{Detect}) = V_F(\text{Not Detect})$ and solving for b. Since the firm is informed about its own type, the calculation of the equilibrium value for 'b' is identical to the case of perfect information.

(10) $V_F(\text{Detect}) = b(p-IC_H) + (1-b)(f-IC_H) = bp - bIC_H + f - IC_H - bf + bIC_H$
$= bp - bf + f - IC_H$

(11) $V_F(\text{Not Detect}) = b\,0 + (1-b)\,f = f - bf$

By setting $bp - bf + f - IC_H = f - bf$ we find that $bp = IC_H$ and $b = IC_H/p$)

The equilibrium strategies, therefore, are as follows:

For the traveller : Evade with the probability $b_e = IC_H/p$ and Not Evade with the probability $(1-b_e) = 1 - (IC_H/p)$;

and for the firm: Detect with the probability $\pi_e = f/(p*m)$, and Not Detect with the probability $1 - \pi_e = 1 - (f/p*m)$.

Since $(\partial \pi_e / \partial m) = -(f/p*m^2) < 0$, the lower the subjective probability that the firm is of Type I, the higher will be the equilibrium π_e and, consequently, the higher the expenditures on detection. Thus, paradoxically the equilibrium probability of evasion has not changed, but the equilibrium probability of detection has increased. Even though the required enforcement effort on the part of the firm is now higher, it does not result in the lower rate of evasion. Such outcome is clearly socially inefficient. This is because the fine revenues, which increase as more evadors are caught, merely represent redistribution of income from customers to the firm. On the other hand, the expenditures on enforcement that are a function of the equilibrium probability of detection are socially wasteful. Thus, from the social point of view, it is important that the firm does not leave the impression that it might not be committed

to its strategy of conducting random checks.

Furthermore, it is possible to reduce the required enforcement effort by creating an impression that the firm's dominant strategy is Detect. Suppose now that the customer thinks that there is a possibility that the firm is of Type I with the probability 'm' and of Type II with the probability '1-m', where for Type II the dominant strategy is to Detect. This will be possible if the payoffs to the firm are such as those presented below.

	Type I (m) Firm		Type II (1-m) Firm	
	Detect (π)	Not Detect ($1-\pi$)	Detect 1	Not Detect 0
Evade (b)	$-p$; $p - IC_H$	0 ; 0	$-p$; $p - IC_H + G$	0 ; 0
Customer				
Not Evade ($1-b$)	$-f$; $f - IC_H$	$-f$; f	$-f$; $f - IC_H + G$	$-f$; f

(where $(f - IC_H + G) > f$).

To find mixed strategies equilibrium in this game we proceed in a manner identical to the previous game.

(12) $V_C(\text{Evade}) = m\,[-p\pi + (1-\pi)\,0\,] + (1-m)(-p) = -\pi p m - p + m^*p$

(13) $V_C(\text{Not Evade}) = m\,[-f\pi + (1-\pi)\,(-f)] + (1-m)\,(-f) = -f$

by setting V(Evade) = V(Not Evade) we obtain $\pi = [\,(f-p+mp)/(p^*m)]$

The equilibrium b_e, in turn, is found by setting $V_F(\text{Detect}) = V_F(\text{Not Detect})$ and solving for b. Since the firm is informed about its own type, the calculation and the value of equilibrium probability 'b' is identical to the case of perfect information and that of the previous game. Thus the equilibrium strategies are:

For the travellers, Evade with the probability $b_e = IC_H/p$ and Not Evade with the probability $(1-b_e) = 1-(IC_H/p)$;

and for the firm: Detect with the probability $\pi_e = [\,(f-p+mp)/(p^*m)]$, and Not Detect with the probability $1-\pi_e = 1-[\,(f-p+m^*p)/(p^*m)]$.

Given that $\partial\pi_e/\partial m = [-f/(p^*m^2)] + 1/m^2 = [(1/m^2)][\,1-(f/p)] > 0$, the lower the subjective probability that the firm is of Type I (and consequently the higher the probability that the firm is of Type II - the one that always Detects), the lower will be the equilibrium probability of detection. From which it follows, that even though the equilibrium evasion rate has not changed, the equilibrium probability of detection and the required expenditures on inspectors can be lowered.

Should the firm be able to 'fool' the travellers into believing that it is more committed to detecting the evadors than it actually is, such deception may be socially beneficial!

4. Are There Incentives for the Firm to Reduce the Evasion Rate by Manipulating the Relevant Information ?

In Section 2, it was demonstrated that the firm has an incentive to increase the level of penalty to the maximum socially acceptable level, which strategy lowers the evasion rate and the expenditures on detection. The question remains, however, whether the firm has an incentive to influence consumer beliefs about its toughness in catching the evadors. We recall that the profit function is given by:

$$(14)\quad P = \alpha f + (n-\alpha)[\, b_e \pi_e (p - IC_H) + b_e (1-\pi_e) 0 + (1-b_e)(1-\pi_e) f + (1-b_e)\pi_e (f - IC_H) - F - c n =$$

$$\alpha f + (n-\alpha)[\, b_e \pi_e (p - IC_H) + (1-b_e)(1-\pi_e) f + (1-b_e)\pi_e (f - IC_H) - F - c n \;;$$

Differentiating (14) with respect to π_e we obtain:

$$(15)\quad \partial P/\partial \pi_e = (n-\alpha)[\, b_e (p - IC_H) - (1-b_e)\pi_e f + (1-b_e)(f - IC_H) =$$

$$= (n-\alpha)[\, b_e p - IC_H].$$

Since the equilibrium probability of evasion does not change and is equal to $b_e = IC_H/p$ in all three games, $\partial P/\partial \pi_e = (n-a)[\, [(IC_H/p)^* p] - IC_H] = 0$, and, consequently, changes in the equilibrium detection rate have no impact on the firm's profit. Increased evasion and the revenue loss in game #2, are compensated by firm's higher revenues from fines (penalties). Reduced evasion rate in game #3, leads to lower revenue loss due but is offset by lower revenues from fines.

The firm, therefore, has no incentive to properly inform the customers about the relevant parameters of the model. The firm also has no incentive to strategically manipulate information to reduce the evasion rate, even if such manipulation can be socially beneficial.

Consider now a more dynamic framework. Suppose that there has been a change in what is perceived a socially fair penalty for evasion and that the bus company has been allowed to increase its penalties. The consumers, however, are not informed about this change. Their evasion rate $b_e = IC_H/p_0$ is set on the basis that the penalties are at the original level p_0. Since the true level of penalty is p_1, the firm will apply the pure strategy Detect, which ensures that all the potential evadors are caught[4]. It is only when caught, that the evadors are informed about the new level of penalty.

Consequently, in the next period they adjust their strategy and the mixed strategy equilibrium of game #1 is reestablished. To see if the firm gains by not informing the customers, we calculate its profits in the period when consumers are not informed about the true level of penalties (P_{NI}), and compare it with the case when consumers are fully informed (P_I):

$$(15)\quad P_{NI} = \alpha f + (n-\alpha)\{ b_e (p_0 - IC_H) + (1-b_e)(f-IC_H) \} - F - c n =$$

$$\alpha f + (n-\alpha)\{ [(IC_H)/p_0)^* (p_1 - IC_H) + (1-(IC_H)/p_0))^*(f-IC_H) \} - F - c n =$$

$$\alpha f + (n-\alpha)\{ (IC_H)^*p_1/p_0) - IC^2_H/p_0 + f - IC_H + (IC_H)^*f/p_0) + IC^2_H/p_0 \}$$

$$- F - c n = \quad \alpha f + (n-\alpha)\{ (IC_H)^*p_1/p_0) + f - (IC_H)^*f/p_0) - IC_H \} - F - c n.$$

On the other hand, the profit function given by the solution to game of perfect information with the penalty equal to p_1, is given by:

$$(16)\quad P_I = \alpha f + (n-\alpha)\{ b_e \pi_e (p_1 - IC_H) + b_e (1-\pi_e) 0 + (1-b_e)(1-\pi_e)f +$$

$$+ (1-b_e) \pi_e (f-IC_H) \} - F - c n = \alpha f + (n-\alpha)\{ f - f(IC_H/p_1) \} - F - c n$$

(see Appendix).

By subtracting (16) from (15) we obtain:

$$(17)\quad P_{NI} - P_I = (n-\alpha)\{ (IC_H)^*p_1/p_0) - f(IC_H)/p_0 + f(IC_H/p_1 - IC_H \} =$$

$$(n-\alpha)\{ (IC_H) [(p_1/p_0) + (f/p_1) - (f/p_0) + 1] \}.$$

Since $p_1 > p_0$ and $[(f/p_1) - (f/p_0)] < 1$, $(P_{NI} - P_0) > 0$, or $P_{NI} > P_0$, which proves that the firm's profits are greater when the consumers underestime the true level of penalty.

It is possible, therefore, for the firm to gain by not informing the customers about the true penalty level and thus increasing the evasion rate!

The outcome is not socially efficient since extra revenues collected from penalties represent merely income redistribution from consumers to the firm. In addition, in the period when the consumers are not informed about the true level of penalties, the firm increases its expenditures on detection, which is a social waste.

Conclusion

The first conclusion of the paper is that the strategic variables at the disposal of the firm that is contemplating introducing the honour system are the levels of penalty and fare, but not the level of inspection expenditures. The level of inspection is endogenours and is determined by the ratio of fares to penalties. In setting the level of penalties for cheating, the firm should set them at the maximum feasible level. To the degree that high penalties reduce the evasion rate and the required enforcement level they are also socially desirable.

In a practical evaluation of the viability of the honour systems, the usual difficulty is to identify the proportion of individuals that are intrinsically honest, and those who are potential evadors. (At any given time, the population that does not cheat includes the honest travellers plus some of the potential cheaters who are following their randomized strategy, thus the number of honest passengers is not directly observable). The analysis based on the proposed model, however, does not require the knowledge of the exact proportion of honest passengers.

To decide whether the honour system is viable requires a bus company to conduct an experiment. The penalty should be set at its maximum socially acceptable level, p_{max}, and the level of enforcement should be set to $AIC_H = (f/p_{max})*IC_H$. Since it takes time for the equilibrium to be established, the authorities should wait until the proportion of evadors that are being apprehended stabilizes. Once the percentage of passengers caught cheating stabilizes, it will indicate that the equilibrium probability of evasion has been achieved. The company should then compare the observed profitability of the honour system in equilibrium(P_H) with the profitability of the full audit system (P_A). If $P_A > P_H$, the firm should discontinue the experiment and return to the full audit system.

If information is not complete, the analysis is more complicated. A firm that fails to properly inform the public will end up incurring higher inspection costs without the benefit of the lower evasion rate, which is socially inefficient. However, a firm that creates the impression of toughness may reduce its enforcement costs without increasing the evasion rate. The problem is that the firm has no incentive to increase the consumer awareness about its audits and the relevant parameters (such as levels of the penalty) in order to reduce the evasion rate. Furthermore, under some conditions, the firm may even gain when both the evasion rate and the expenditures on inspection increase, which leads to social inefficiency. Regulation which requires full disclosure (through advertising, for example) about the level of penalties might, therefore, be socially desirable.

The model presented in this paper makes a number of simplifying assumptions concerning demand and costs, information and the players' characteristics. As such it should be treated not as a final word, but rather as an introduction to analyzing the fare evasion problem using the tools of noncooperative game theory.

Endnotes

1. The equilibrium concept that is standardly employed in noncooperative game theory is Nash equilibrium. It is defined as follows: *The strategy combination is a Nash equilibrium if no player has an incentive to deviate from his strategy given that others do not deviate* (Rasmusen,1989).

2. If costs of collecting fines is high, however, the firm may decide to adopt the policy of the lower fines than the maximum socially acceptable. For example, this maximum may be the typical amount of cash that the individuals carry with them. The penalties can thus be collected on the spot.

3. In this model, we shall not consider the case where consumers update their subjective probabilities, which requires a more dynamic framework.

4. The mixed strategy equilibrium in a full information game with the penalty level p_1 is given by the following strategies:

For the traveller : Evade with the probability $b_e = IC_H/p_1$ and Not Evade with the probability $(1-b_e) = 1-(IC_H/p_1)$;

and for the firm: Detect with the probability $\pi_e = f/p_1$, and Not Detect with the probability $1-\pi_e = 1-(f/p_1)$.

Since the travellers are not informed about the change in the probability of evasion, their probability of evasion $b_0 = IC_H/p_0$ is above the new full information equilibrium level, and consequently the optimal strategy for the firm is to follow the pure strategy Detect (for a discussion on mixed strategy equilibria see Rasmusen(1989)).

Appendix

The profit function for the bus company in equilibrium is defined as follows :

$$(18)\ P = \alpha f + (n-\alpha)\{ b_e \pi_e (p - IC_H) + b_e (1-\pi_e) 0 + (1-b_e)(1-\pi_e)f +$$
$$+ (1-b_e)\pi_e(f-IC_H\} - F - c n =$$
$$\alpha f + (n-\alpha)\{ (IC_H/p)(f/p)(p - IC_H) + [1-(IC_H/p)][1-(f/p)] f +$$
$$+ [1-(IC_H/p)](f/p)(f-IC_H)\} - F - c n =$$
$$\alpha f + (n-\alpha)\{ [(IC_H f/p) - (IC_H f/p^2)] + [f - (f^2/p) - (IC_H f/p) + (IC_H f^2/p^2)]$$
$$+ [(f^2/p) - (fIC_H/p) - (IC_H f^2/p^2) + (IC_H{}^2 f/p^2)]\} - F - n c =$$
$$\alpha f + (n-\alpha)\{ f - f(IC_H/p)\} - F - c n = \alpha f + n f - \alpha f - n f(IC_H/p) + \alpha f(IC_H/p)$$
$$- F - c n =$$
$$n f + \alpha f(IC_H/p) - n f(IC_H/p) - F - c n =$$
$$n f - (n-\alpha)[f(IC_H/p)] - F - c n$$

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PAY THE PRODUCER — A CHANGE IN THE METHOD OF PAYMENT

by

J.M. Bowland and F.E. Collins
Peat Marwick Stevenson & Kellogg

INTRODUCTION

Is it the *right time* for a change in the method of paying the *Crow Benefit*? The current method of paying the *Crow Benefit* — established in 1984 by the Western Grain Transportation Act to replace the Crow Rates in effect since 1897 — has been reviewed and discussed by several parties over the last five years. The annual government commitment, currently about $720 million, is comprised of the $658.6 million *Crow Benefit* plus the cumulative government share of inflation.

Because the *Crow Benefit* is only paid on export grains, the price of local grains is artificially distorted by amounts which could equal the government's share of the of the export grain transportation costs. All of the western provinces have now introduced support payments to compensate for some of this price differential.

This paper touches upon several issues related to changing the method of payment including:

- The advantages and disadvantages of paying the producer from the perspective of several parties;
- The effects on grain handling and transportation efficiency;
- The option of one or more province(s) implementing a *Pay the Producer* scheme versus a federal government initiative;
- The impact of *Pay the Producer* on Canada's position with the Canada-United States Trade Agreement.

The analysis is based on previous work done by the authors, a review of the Alberta Government's recent initiatives, an update of other current happenings on the issue and the authors' evaluation of the subject.

BACKGROUND

The total WGTA grain related rail costs are currently about $1 billion per year. The existing rate setting formula requires grain shippers to pay about 30 percent ($300 million) of the cost of moving grain. The balance is paid by the federal government directly to the railways ($720 million).

Payment of the *Crow Benefit* to the producers raises several very interesting and complex issues, most of which have been reviewed over time with no unanimous agreement within the industry. Some relevant questions are:

- What should the method of payment be? — a range of alternatives have been suggested including pay the railways, pay the producer, and some hybrid proposals.
- If the *Crow Benefit* was paid to the producers, what should be the basis for division? — e.g., cultivated acreage, tonnes exported, average yield, permit book sales.
- Which producers or movements are eligible to receive *Crow Benefit* payments? — i.e., which commodities, exported grain, domestic grain, transferability of eligibility.
- Should producers be compensated for dilution[1] and if so, do the governments have sufficient funds to cover dilution?
- Which avenue should be used to *Pay the Producer*? — e.g., annuity payments over a specified time period, bonds, annual cash payments.

In 1982, Gilson recommended a hybrid proposal which provided for a phasing in of the *Pay the Producer* alternative. According to this proposal, after eight years (1989/90) the railways would receive some 20 percent of the payment and the producers 80 percent.

In 1985, the Hall Commission recommended that the *Crow Benefit* be paid annually to producers based on their net sales of grain. The Grain Transportation Agency recommended in 1986 that the *Crow Benefit* be paid out to current beneficiaries.

A change in the method of payment could be implemented on a province by province basis or at a federal level. In the report *Growing Together*,[2] the Federal Government recommended that a review of the WGTA be conducted to evaluate whether the program contributes to the long term strength of the Canadian agri-food industry.

In 1989, Manitoba Agriculture commissioned studies to analyze the impact of a change in the method of payment on the province of Manitoba. The conclusions on these studies were similar to those of the Alberta review which are discussed in more detail below. The Manitoba studies predicted only modest shifts in grain production as a result of a change in method of payment. Substantial increases in cattle and hog production, 25 percent and 28 percent respectively, were forecasted. As well, feeding cattle in Manitoba could double, followed by increased jobs in the processing industry. Manitoba concluded, however, that the province could not afford the additional payments — some $30 million annually — required to cover dilution.

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[1] The term "dilution" refers to the fact that a change in the method of payment would result in lower prices for grains sold or used locally, thus partially reducing producer incomes unless otherwise compensated.

[2] Agriculture Canada, *Growing Together — A Vision For Canada's Agri-Food Industry*, 1989.

Prior to the Federal initiative, the Alberta Government seriously considered *going it alone* as a test case for paying the producer. Studies done for the Alberta Government and the Alberta Wheat Pool show that there are significant economic advantages to proceeding with paying the producer. The Alberta Government is considering making a dilution payment so that both domestic and export grain sales would be given equal treatment. As discussed in the next section, changing the method of payment means revising the administration of the program, the eligibility of producers, the regulatory environment, and possibly the rail rate setting mechanism.

ALBERTA/BRITISH COLUMBIA — A TEST CASE

As noted above, the western provinces have been concerned about the apparent negative effects of paying the *Crow Benefit* to the railways, and all four provinces have introduced producer payment programs which seek to offset price distortion in the local feed grain markets. However, these concerns are so important to the provincial economies that the provinces of Alberta and British Columbia, together with the Alberta Wheat Pool, decided to establish a task force to investigate the *Pay the Producer* option.

The Alberta/British Columbia Task Force conducted its investigation of *Pay the Producer* through an extensive research program. The authors of this paper served as members of the Final Assessment Committee[3] which reviewed the research results and developed an assessment of the overall impact of changing the method of payment. The Alberta/British Columbia investigation was based upon a carefully structured "Pay the Producer Proposal" which was fashioned around the following six prespecified guiding principles:

1. The Alberta and British Columbia shares of the *Crow Benefit* will be, to the greatest extent practicable, the same as if the current method of payment were retained.

2. Rail capacity and efficiency will be improved so that producers experience a net revenue gain over the long-term.

3. Grain producers collectively in each region of the Province will not experience a loss in net revenue (i.e., no average dilution).

4. Impediments to livestock production and secondary processing in Alberta and British Columbia, to the extent that they result from the current method of payment, will be minimized (i.e., minimized distortion).

5. Consistent with international obligations, it will provide for the unrestricted purchase and sale (i.e., arbitrage) of grain, oilseeds and livestock across provincial and national borders to take advantage of market opportunities that develop.

6. The administration of the *Pay the Producer* alternative will be feasible and cost effective.

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[3] The members of the Alberta/BC Final Assessment Committee were Mrs. Janice Bowland, Mr. Frank Collins, Mrs. Maureen Farrow, Dr. Hartley Furtan, and Dr. John Heads.

Alberta/British Columbia Proposal

The essence of the proposal was that the *Crow Benefit* would be paid directly to the producer, who in turn would pay the full rate for grain transportation. The anticipated immediate effects of this change are:

- the local price of grains would drop;
- grain producers would become more interested in, and responsive to grain transportation costs, and intermodal competition would emerge.

It is important to understand that the proposal envisages Alberta and British Columbia changing to a *Pay the Producer* régime, while Saskatchewan and Manitoba would continue with the existing *Pay the Railway* system. This poses a number of problems involving the design and administration of the program which are dealt with in the Proposal.

The detailed arrangements for *Pay the Producer* are described in the Proposal document.[4] A brief outline of the program is provided below.

Program Scope

The following criteria define eligibility for participation in the program:

- The provinces of Alberta and British Columbia would constitute the program area.
- Grains eligible for *Crow Benefit* payments under the WGTA would constitute eligible products, specifically grades of grain and screenings of products, as well as alfalfa dehy and sugar beet pulp. Processed or semi-processed products would not be eligible.
- Eligible participants would include all grain producers within the program area; all dealers and merchants in the program area, including most of those who sell for export; and, all grain users in Alberta and British Columbia, including processors.

Benefit Payments

Payment would be made on the basis of eligible net sales of grain, and grain fed on-farm. Net sales are the quantity of product sold by a producer net of dockage, less the quantity of grains or grain screenings purchased.

The amount of the benefit per tonne would be based upon the Federal Government share of the statutory freight rate (i.e., WGTA rate) to Vancouver/Prince Rupert. This rate would be based upon the delivery point closest to each farmer's home quarter section.

[4] Alberta/British Columbia Pay-the-Producer Proposal (November 10, 1989).

Rail Rate Setting

The Proposal envisages use of the WGTA mechanism to establish rail rates, while recognizing that this would limit the amount of change possible in the transportation and handling system. In fact, the Proposal contains no recommendations on how any issues relating to improved grain handling and transportation efficiency should be addressed.

Administration and Funding

An agency would be formed to administer the *Pay the Producer* program. Administrative procedures and mechanisms would be similar to those used under the Alberta *Crow Benefit* Offset Program.

The majority of the benefit payment to the producers would derive from the Federal Government's *Crow Benefit* commitment for the movement of Western Canadian export grain. This would be determined on the basis of the Alberta/British Columbia historical share of waybills paid on export grains, and would amount to approximately $220 million per year.

The governments of Alberta and British Columbia would add funding so that all qualifying grains would be paid the same per tonne subsidy as paid for export grains, thus avoiding dilution. The provincial payments would total approximately $105 million per year.

It is important to note that the dilution payments would not incorporate or sustain increased shipper costs which are due to the normal working of the WGTA. The *Crow Benefit* payments are tied to the Federal Government share of the grain freight rate, and the per tonne costs are expected to decrease with increasing volume and cost inflation.

Implementation and Review

The program would be fully implemented at the commencement of its first year of operation. A comprehensive review would be undertaken after five years of operation.

Pay the Producer Effects

The research program endeavoured to measure the impact on segments of the provincial economy affected by the change in the method of payment envisaged in the Alberta/British Columbia Proposal. The research was conducted for Alberta only, as appropriate data for British Columbia were not available.

Overview of Economic Influences

Grain prices in Alberta (and Canada) are largely established in the international arena. The local price of grains is therefore largely determined[5] by two factors — the export price and the cost to the producer of transporting grain to export position. Under the WGTA producers pay a portion of the transportation cost, at present approximately 30% of the rail rate. The local grain price therefore reflects both the export price and the producer share of the rail rate.

Under *Pay the Producer* the farmer will be paid the full per tonne *Crow Benefit* subsidy on his grain, but will also pay the full rail rate. As a result, the local price of grain will drop because the farmer will pay the full cost of transporting his grain to export position. Thus, the farmer's total revenue per tonne of grain produced will be unchanged, but the local price of grain will be reduced.

This lower price of grain will benefit the local production of livestock which will take advantage of lower feed grain (particularly barley) prices. Livestock production is therefore expected to increase, as will activity in a number of agricultural products processing industries.

Turning to the grain handling and transportation system, producers will be more sensitive to the cost of transportation under *Pay the Producer*, as they will be paying the full rail rate. It is reasonable to expect, therefore, that producers will support and pursue changes which reduce the cost of transportation, providing that such cost reductions flow through to them in reduced rates and charges.

In sum, market prices are expected to encourage farmers to grow crops which achieve the highest net revenues, and to pursue efficiencies in grain handling and transportation.

Agricultural and Processing Industries

For agriculture the general effect of the economic influences previously outlined is to shift the use of land and other resources from their present applications to more profitable uses, wherever practical. In particular, high value crops (e.g., canola) become relatively more profitable as does livestock production due to the reduced cost of feed grains. Specific agricultural and processing impacts are outlined below.

Grain Producers

Wheat

Production declines by 331,000 tonnes ($46 million gross revenue decline) with negative impact on employment, income, output and a reduction of exports.

[5] Other factors may influence prices to some extent in particular locations such as local supply-demand conditions for grains.

Barley

Production increases by 84,000 tonnes ($8 million gross revenue increase) with positive impacts on income and output. This production increase is driven by an increase in local demand for feed grains to serve an expanding livestock sector. Barley exports decrease.

Canola

Production increases by 232,000 tonnes ($63 million gross revenue increase) with the largest attendant gains in output, employment, income and exports. This high valued crop will be particularly remunerative under *Pay the Producer.*

Oats

Production increases by 16,000 tonnes ($1 million gross revenue increase) with modest positive impacts on income and output.

Grain Processing

Cereal and Flour Processors

This sector can expect to gain economic benefit as a result of the change in method of payment, despite reduced production of some grain crops. Less grain will be shipped out of province and local prices are expected to decline. Therefore the industry will enjoy better access to raw material and lower input costs.

Feed Industries

This industry can expect to gain some economic benefit from the change in method of payment. *Pay the Producer* results in an increase in barley production which is the main feedgrain. Barley prices will decline, and as less barley will be shipped out of the province the industry will enjoy better access to raw material.

Oilseed Processors

Oilseed processors will likely experience a positive impact, particularly over the longer term, with the increase in oil seed (canola) production. Exports will increase.

Livestock Producers

Cow/Calf Operators

Cow/calf operators will benefit significantly, as lower feed grain prices will encourage feedlot operators to bid up calf prices. This will improve profitability and result in herd expansion in the province. Output will increase by approximately 265,000

head ($155 million gross revenue increase). Growth in this sector is a key step in the initial adjustment to build a value added meat processing industry.

Feedlot Operators

Volumes are expected to increase by 315,000 head ($364 million gross revenue increase — from which the cost of additional feeder cattle must be subtracted). In the first round of adjustment the feedlot operator will not increase his margins, as whatever gains are made on feed prices will probably be offset by higher calf prices. The initial increase in feeder cattle will likely be from imports, until the local industry increases its herds. The longer term outlook for feedlot operators is more positive, as calf prices will stabilize and possibly soften in the light of increased supply.

Slaughter and Meat Processing

There is much to be gained in terms of economic benefits to the province from enhanced meat processing operations. The cost of feed grain is the major portion of hog (75%) and cattle (55%) production costs, which in turn can account for up to 80% of the cost of sales for a meat processor. Therefore any cost advantage which is passed through to the processor will improve the competitiveness of this industry sector in the domestic and international markets.

Increased agricultural activity gives rise to significant increases in GDP, employment and labour income. The total increase in Alberta's economic activity as a result of changes in the agricultural sector is estimated to be approximately $360 million.

Grain Handling and Transportation

As previously explained, the Alberta/British Columbia Proposal assumed no change to the existing WGTA rail rate system. The effects of a change in the method of payment were therefore assessed on the basis of this somewhat limiting assumption.

The Alberta studies concluded that a change in the method of payment alone is a necessary, but not significant condition to achieve major improvements in grain handling and transportation efficiency. The present grain handling and transportation costs for Alberta grain amount to approximately $554 million, with rail transport accounting for some four-fifths of this total. A change in method of payment alone will reduce grain handling and transportation costs by an estimated $20 million or 4 percent. Distribution of this savings will be as follows:

Effects of *Pay the Producer* on Grain Handling and Transportation Costs — Alberta ($ million)

	Pay the Railways	*Pay the Producer*	*Cost Changes*
Farm to country elevator	31.5	31.0	– 0.5
Elevator handling	62.1	56.3	– 5.8
Rail transport	447.8	422.8	– 25.0
Motor carrier transport	12.2	23.6	+ 11.4
Total:	553.6	533.7	– 19.9

The study concluded that the more significant savings in the grain handling and transportation system will require changes to the the rail rate structure, institutional rigidities, regulations and legislative restrictions. The study did not calculate the total amount of such further savings.

Trade Implications

Research on the Alberta initiative included a brief review of the Canada-U.S. Trade Agreement (CUSTA) and multilateral trade (GATT). The determination of trade effects of a change in the method of payment is difficult for a number of reasons, particularly because Canadian and worldwide trade arrangements are currently in a state of significant change.

The examination of trade implications revealed that, in some ways, *Pay the Producer* should theoretically be less problematic than pay the railway. In practice, however, some aspects of the Alberta/British Columbia proposal lead to trade problems. *Pay the Producer* may, in fact, engender countervail action in the U.S., and may also cause difficulties in multinational trade negotiations. The probable impact of such actions are, as of yet, difficult to estimate. It should be noted however, that the WGTA itself appears destined for countervail action as a domestic subsidy on grain. The Alberta Crow Benefit Offset Program has already been countervailed as a domestic subsidy on pork.

Overall Assessment of Alberta/British Columbia Proposal

The extensive research carried out by the Province of Alberta and the Alberta Wheat Pool revealed that, in the main, *Pay the Producer* would be beneficial to the provincial economies. Provincial agricultural industries would be diversified and strengthened, including improvement to value-added processing industries. Some improvements in grain handling and transportation efficiency would arise from a change in the method of payment, which might act as a catalyst for further changes. The expected overall economic gains would be significant, and would exceed the program cost (i.e., approximately $105 million for provincial dilution payments).

GRAIN HANDLING AND TRANSPORTATION EFFICIENCY

The real cost of grain transportation will be increasingly borne by producers no matter which method of payment is applied. Research indicates that the combined effect of inflation and higher grain volumes will increase the producers' share of the WGTA rates to over $29.00 per tonne up from the existing average of some $9.00 per tonne by the year 2000. This represents a 320 percent increase in the existing rate. The *Pay the Producer* approach provides significant incentive to improve grain handling and transportation efficiency, therefore possibly retarding some of the cost increases.

As discussed below, grain handling and transportation savings will result from the following changes:

- Rationalization of branch lines and intermodal competition;
- Further consolidation of elevators due to branch line rationalization;
- More efficient train operations and better utilization of railway assets.

Rationalization of Branch Lines and Intermodal Competition

A Senior Grain Transportation Committee study[6] found that no other measure has as much potential for reducing grain transportation costs as does the elimination of high cost branch lines. Grain dependent branch lines now total some 6650 miles. The line related costs for these branch lines amounted to $103 million in 1984. Line related and volume related costs savings would be possible if the high cost branch lines were eliminated.

In CP Rail's ranking of its branch lines,[7] the average 1984 costs ranged from a high of 103 cents per tonne mile to a low of 4 cents per tonne mile. As one would expect, the high cost per tonne branch lines were lines which originated minimal traffic. These high cost lines are distributed across all of the Prairie provinces.

Because the WGTA rates are distance-related, rather than cost related, the WGTA rate structure is not fully compatible with a *Pay the Producer* approach. Under the WGTA rates, producers on main lines pay rates substantially higher than the railway's costs, and on branch lines, producers pay rates lower than the railway's costs. Trucks could compete for traffic loaded at main line points because of this rate structure. Under the WGTA the railways could not adjust its rate. Discrepancies such as this would cause producers, railways and others to press for changes from a WGTA rate structure to a commercial rate system. Under a commercial rate structure, the freight rates on the branch lines would only increase to the level at which commercial trucking would become a viable alternative.

If rail freight rates increased to reflect real operating costs, producers located on many branch lines would find trucking to be a more viable alternative. Trucks

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[6] Senior Grain Transportation Committee, *High Cost Branch Line Study — Final Report*, September 26, 1985.

[7] D. Craig, CP Rail, *Recent and Potential Efficiency Gains in Grain Related Rail Operations: Focus on Branch Lines*, The University of Manitoba Transport Institute, November 1986.

could haul the grain to main line points. Long haul intermodal competition between rail and truck would arise most extensively in Manitoba on shipments to Thunder Bay. The lack of back haul and topography limit the competitiveness of trucking on shipments to the west coast.

Under a commercial rate structure, producers would find a number of branch lines and related elevator points to be unattractive and would shift to lower cost points. Elevator consolidation in conjunction with branch line rationalization would enhance rail transportation and grain handling efficiency but would result in greater average trucking distance and associated additional road maintenance costs. The trucking distance and road maintenance costs have been considered in other studies but is not specifically addressed here.

Elevator Consolidation

Elevator consolidation in the Prairies has increased considerably over the last twenty years because of changes in government policies, branch line rationalization, and the operating economies of larger units.[8] Turn rates (the number of times the elevator "turns over" its capacity) have increased as a result of increased grain movements and a reduction in total country elevator capacity. Several large, high throughput elevators have been built in the Prairies. Elevator consolidation should increase in the future. The studies in Alberta concluded that less grain would move through primary elevators due to reduced grain exports. This event would stimulate further elevator consolidation.

Railway Operations and Assets

Branch line rationalization and elevator consolidation would lead to more efficient train operations through consolidation of loading points. These savings, referred to as volume related saving in the WGTA, are possible through at least the following measures:

- Longer average trains through the ability to collect more cars on any given train movement,
- More unit trains because of the consolidation of rail car loading points,
- Less train and yard switching as a result of elevator and branch line rationalization and more efficient blocking of cars.

As well, transportation savings would result from better utilization of railway assets including railway cars, locomotives and track. Consolidation of rail car loading points would allow faster turnaround times on rail cars, thus reducing the size of the hopper fleet required to handle grain. Rail cars days per mile are generally higher on branch lines than they are on main lines due to the less efficient train operations on the branch lines. For the same reason, locomotive utilization would improve with the consolidation of loading points. Savings in track investment would occur with reductions in branch line miles.

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[8] Weik,,Saskatchewan Wheat Pool *Recent and Potential Efficiency Gains in the Grain Handling System*, The University of Manitoba Transport Institute, November 1986.

CONCLUSIONS

Clearly there are both substantial benefits as well as significant difficulties associated with a change in the method of payment. However, if Canada is to achieve major improvements in its grain handling and transportation system, a change in the method of payment seems necessary.

A change to *Pay the Producer* would create a new type of incentive system. Producers would be paying the full cost of transportation and will therefore be more likely to apply their management skills to reduce handling and transportation costs and maximize their profits. A change to *Pay the Producer* would create pressure for many further changes in the regulatory and institutional structures which determine the tariffs and charges for grain handling and transportation. Once commenced, the process of change would be extensive. Planning is necessary to coordinate the process and to minimize the negative economic impacts during the transition period.

The Application of Public Choice Theory to Rail Line Abandonment

A.G. Wilson and D.M. Ostrowski*

Under the Western Grain Transportation Act, the Federal Government undertook to make a Crow Benefit payment of $658.2 million on movements of up to 31.5 million tonnes of prairie "grain" to "export" position annually and to assume responsibility for increases in railway costs in excess of 3 per cent initially (now 6 per cent) on an annual basis. At the same time, shippers were further protected by provision of a "safety net" whereby the weighted average freight rate paid by the shipper would not be allowed to rise above a certain maximum share of the weighted average price received for the six major grains, this share now being fixed at 10 per cent. The government contribution now amounts to approximately $720 million annually and is paid directly to the railways with the rate assessed the shipper being determined after the government contribution is deducted from the "cost" of movement by rail, this rate being related to distance rather than to the cost of movement over a particular segment of line.

Since the rate paid by the shipper is an "average" rate based on the distance of rail travel there is no incentive for those shippers located on high cost branch lines to seek out the least cost means of moving their "grain" to export position. Furthermore, these high cost branch lines are included amongst those "guaranteed" to the year 2000 A.D. While shipment from high volume points on the main lines is being encouraged by incentive rates, this attracts some grain from the branch lines making the unit costs of rail movement over these lines even higher.

Abandonment of these high cost branch lines would result in the costs of rail movement of grain being significantly lower thereby accomplishing a reduction in the average rate charged the shipper. While shippers would collectively gain from such abandonment, there would also be losers. The losers would be primarily the producers required to haul their grain further to elevators located on a remaining line with provincial governments, towns and

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municipalities also being considered affected. Not all the savings in cost arise from a reduction in rail costs. A previous study revealed that elevator consolidation arising from rail line abandonment in west central Manitoba since 1975 resulted in an average saving of $6.43 per tonne in elevator handling costs, these being offset by an average increase of $2.59 per tonne in the trucking costs of those producers adversely affected.[1] This study lent further credence to the 1985 report released by the Senior Grain Transportation Committee which stated that "the retention of a high cost branch line results in farmers in general and the federal government incurring costs in the millions to save local farmers and municipalities on the line costs in the hundreds of thousands."[2] An attempt has been made to reduce the cost of movement over a few of these lines by closing some of them and subsidizing the trucking cost of movement from the remaining "off-track" elevators to elevators on other lines on a temporary basis. Conversion of a branch line to a "short line" has also been used in an attempt to reduce the cost of the line. Both of these attempts must be considered stop-gap measures as compared to action ensuring all producers experience a net benefit from closure of these high cost branch lines. It is believed that if those currently delivering grain to elevators on these lines receive sufficient compensation, they will be led to agree to have these lines abandoned. Such would be an application of public choice theory.

Public Choice Theory

One of the fundamental tenets of public choice theory is that people in society respond to their own self-interest. This helps explain the degrees of success governments experience when attempting to effect a particular policy. Individuals will oppose those policies not in their own economic interest and support those which are. Policy which is of benefit to the many in a democracy may be bitterly opposed by the few who see their own interest in anyway curtailed or threatened. The interest of the many is likely to be of lesser intensity than that of the few who see their position being impaired.

A more apt application of public choice theory than to branch line abandonment cannot be imagined. It has been widely demonstrated that the economic interests of grain producers collectively would be furthered by abandonment of the high cost lines. Not only would total rail transportation costs for "grain" be reduced but also the cost of operation of the elevator system. On the other hand, the additional cost of trucking grain to elevators on the remaining lines would impact unfavourably on those producers whose lines are abandoned. The latter group can be expected to oppose abandonment. Consequently, when hearings are held on branch line abandonment, opposition tends to be intense even in the presence of strong economic arguments for abandonment.

Public choice theory suggests that the affected parties be compensated for their perceived costs from the savings to be achieved so that they also may see themselves as beneficiaries. There is believed to be a particular level of guaranteed compensation which will bring about agreement for a reorganization, e.g., the abandonment of a high cost line, which will be beneficial both in perception and practice. While an extensive list of those adversely affected by abandonment can be suggested, producers who experience greater lengths of haul are the prime candidates for compensation. Since their direct costs are increased they have been most vocal in their opposition to abandonment. Public choice theory indicates they should be compensated for their increased costs as a minimum in order to obtain their support for change. While local and provincial governments also have a concern, this can be expressed most effectively in the incidence of the taxes assessed to offset any increase in road costs; these taxes being largely imposed on users. Therefore, compensation should be concentrated on the group whose costs are directly increased by abandonment; those producers required to haul additional distances to elevators on the remaining lines and who may be called upon to pay increased taxes to support local roads. Provision of compensation may be expected to reduce the opposition of producers to the removal of their branch lines. These producers would no doubt consider such compensation to be their just desserts for accommodation to change. Compensation would be seen by the public as provision of fair treatment to the parties affected by a change beneficial to the larger community. In view of this and the vested interest of the federal government in reducing costs the compensation could most appropriately come from that body in the short run.

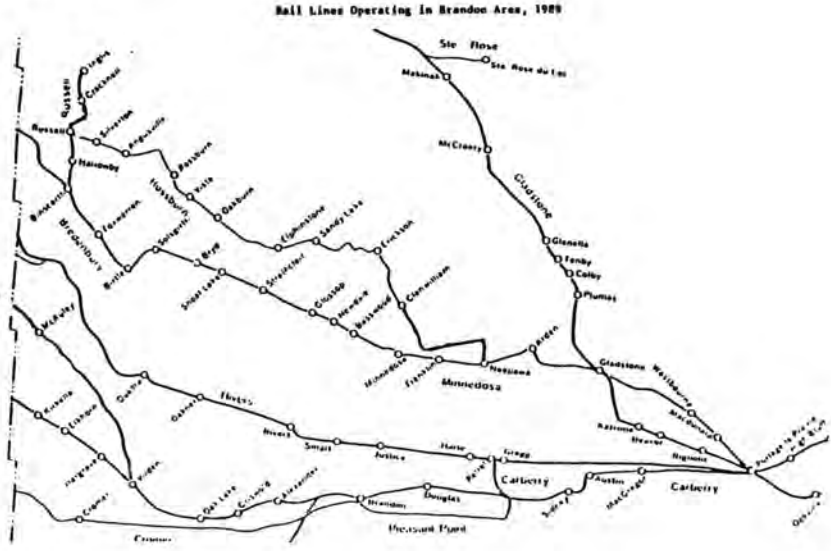
Prior researchers of the compensation issue have largely made subjective judgements on producer attitudes. The current study was therefore directed towards ascertaining those attitudes and relating these to the level of compensation required to obtain producer approval for the abandonment of a high cost branch line. The general applicability of the results of such research depends upon determining the attitudes of a representative group of producers and the amount of compensation required in order to obtain their approval for the abandonment of their rail line.

Study Area

The area selected for study was that extending westward from Portage la Prairie to the Saskatchewan border and lying between the CP Rail main line and/or the Assiniboine River and Riding Mountain National Park, this being termed the Brandon area. This area was selected for several reasons. It contains producers currently and historically serviced by elevators on a main line or a secondary main line, producers whose rail lines have been abandoned since 1975 and who now deliver to elevators on the remaining lines and

producers who deliver to elevators on high cost branch lines which were frozen to the year 2000 A.D., Figure 1. This area has been intensively studied in the past and information from the published studies would be invaluable during further research. In addition, the area was convenient for researchers collecting data and yet could be considered representative of many other areas on the prairies. Farms in the area varied from less than 320 acres to more than 2560 acres, the average size in 1986 being 763 acres. There were 2.2 trucks on average per farm that year. There are two cities in the area which is also endowed with a number of growing service centres with other centres tending to decline. Twelve major trunk highways cross the area which is also served by 45 provincial roads and a large number of municipal roads, the latter largely gravel surfaced. Since 1975, several branch lines were abandoned leaving two main lines, a secondary main line and two branch lines in the area, the latter being high in cost in relation to traffic volume. There were 59 grain delivery points in the area in 1987/88 having a total capacity of 280,750 thousand tonnes. Abandonments gave rise to a loss of capacity of 64100 tonnes, this being accompanied by rationalization of elevators along the remaining lines resulting in a further loss of capacity of 39,970 tonnes. This was offset by construction of 43,750 tonnes of capacity on the main lines. In 1987/88 grain receipts totalled 1,420,400 tonnes, the handling to capacity ratio being 5.06.

Figure 1



Program of Research

In order to have unbiased results, a random sample of producers was drawn from within the area with the assistance of the rural telephone directory. While a significant number of those drawn were found to be rural dwellers rather than producers, the sampling procedure adopted enabled randomness to be maintained in selection of actual producers, there being 134 producers in the final sample. A mail questionnaire was designed, pre-tested and such modifications made as considered necessary. Non-respondents by mail were followed up and other producers drawn from the same area when the individuals selected initially could not be located. The characteristics of the sample were found to be consistent with those of the area as recorded in the 1986 Census.

Producers in the area delivered varying proportions of grain to the elevator system, such being related to the type of farming conducted, Table 1. As could be expected, the distance to the closest delivery point varied, Table 2. Many of the producers had experienced abandonment with the remaining 92 producers continuing to deliver to branch lines or the main lines, Table 3. From the questionnaires, it was possible to categorize respondents by size of farm, proportion of the farm rented/leased, class of rail service, type of operation, area of land in grain and change in distance to the nearest elevator. The latter was found to be caused by abandonment and also by elevator rationalization, Table 4. Abandonment resulted in an average distance increase of 5.8 miles while elevator rationalization on the branch lines increased the length of haul an average of 5.0 miles and that on main lines by 4.0 miles. This resulted in an overall average increase in length of haul of 5.0 miles giving rise to an average total length of haul of 10.1 miles. This situation should be kept in view when producer attitudes are discussed.

TABLE 1: Distribution of Farms by Proportion of Grain Delivered to Elevator System, Brandon Area Study, 1989

Proportion Delivered	Number of Farms	Proportion of All Farms
per centper cent		
0	7	5.2
1 - 25	7	5.2
26 - 50	12	9.2
51 - 75	32	23.9
76 and over	76	56.7
ALL FARMS	134	100.0

TABLE 2: Distribution of Farms by Distance to Closest Delivery Point Brandon Area Study, 1989

Distance from Closest Delivery Point	Number of Farms	Proportion of All Farms
miles per cent		
0 - 3	33	24.6
3.1 - 6	35	26.1
6.1 - 9	22	16.4
9.1 - 12	26	19.4
12.1 - 15	12	9.0
15.1 - 18	5	3.7
18.1 and over	1	0.8
ALL FARMS	134	100.0

TABLE 3: Distribution of Farms by Nearest Rail Service, Brandon Area Study, 1989

Rail Service	Number of Farms	Proportion of All Farms
		per cent
Abandoned Line	42	31.3
Branch Line	31	23.1
Main Line	61	45.6
ALL FARMS	134	100.0

TABLE 4: Average Change in Length of Haul to Nearest Elevator[1] Arising from Rail Line Abandonment and Elevator Rationalization According to Class of Rail Service, Brandon Area Study, 1989

Class of Service	Original Distance	Distance Increase	Current Distance
		miles	
Abandoned Line	5.8	10.7	
Branch Line	4.6	5.0	9.6
Main Line	5.5	4.0	9.5
ALL CLASSES	5.1	5.0	10.1

[1] Two producers serviced by main lines, 1 serviced by a branch line and two previously serviced by an abandoned line experienced a lower length of haul.

Producer Attitudes

An attempt was made when designing the questionnaire to encourage the respondents to state their views concerning rail line abandonment and elevator

rationalization and to elicit from them the amount of compensation required to obtain their approval for the abandonment of a branch line. Views obtained from producers on such an individual basis are deemed more representative than those expressed collectively at farm meetings, the latter being subject to peer pressure.

Producers do not necessarily deliver to their closest elevator, Table 5. Those who do not so deliver have a number of reasons such as lack of competition at that delivery point, a superior elevator manager at another point, the company preferred is not locally represented or physical difficulties related to delivery. It was apparent that the respondents attempt to maximize their net returns from sale even though being influenced to a degree by the philosophies of the companies represented. Some producers patronized as many as four elevator companies, the average length of haul to subsequent elevators increasing significantly. If the two remaining branch lines in the area were to be abandoned, 40 producers would have to haul their grain significantly further, with 6 of these having to haul in excess of 24 miles to the closest delivery point, Table 6.

TABLE 5: Length of Haul and Proportion of Grain Delivered by 51 Producers Delivering to More Than One Elevator, Brandon Area Study, 1989

	Average Length of Haul	Producer Patronizing	Average Proportion Delivered
	miles	number	per cent
Elevator 1	7.5	51	63.4
Elevator 2	12.8	51	32.6
Elevator 3	16.8	12	3.4
Elevator 4	32.8	2	0.6
AVERAGE TO ALL ELEVATORS	10.8		100.0

(The 51 producers collectively patronized 116 elevators, 17 had previously been served by lines now abandoned, 14 were served by branch lines and 20 by main lines)

TABLE 6: Length of Haul to Nearest Elevator in Event of Branch Line Abandonment[1], Brandon Area Study, 1989

Distance to Nearest Elevator	Respondents	
miles	number	percent of total[2]
0.0 - 3.0	0	0.0
3.1 - 6.0	2	5.0
6.1 - 9.0	2	5.0
9.1 - 12.0	8	20.0
12.1 - 15.0	6	15.0
15.1 - 18.0	7	17.5
18.1 - 21.0	9	22.5
21.1 - 24.0	0	0.0
>24.0	6	15.0
ALL DISTANCES	40	100.0

[1] Forty of the 134 respondents in the sample are presently serviced by the two branch lines remaining in the area. Ninety four are serviced by the main lines.

Attitudes of some producers in the area were influenced by the fact that prior to the abandonment which had occurred, they were led to believe that compensation would be forthcoming and were disappointed. About 75 per cent of the respondents desired that compensation be paid in the event the remaining branch lines were abandoned, Table 7. Many of those whose branch line was abandoned previously considered that compensation should not be provided this being consistent with their own experience while also revealing a degree of prejudice. Others of these viewed the alternative facilities available on the remaining lines more satisfactory. Nonetheless, there was general support for compensation regardless into which category the farm operation fell.

TABLE 7: Attitudes Toward Compensation for Branch Line Abandonment, Brandon Area Study, 1989

Attitude	Respondents	
	number	per cent of total
Compensation Desired	100	74.6
Compensation Opposed[1]	34	25.4
ALL ATTITUDES	134	100.0

[1] This category includes 4 respondents who did not express an opinion and therefore were assumed to be unsupportive of compensation.

Respondents were particularly interested in being compensated for their additional trucking costs. In general, they supported being paid according to the additional tonne miles of hauling effort experienced, Table 8. While only a limited number provided estimates of their current handling costs, the average figure provided was about 37 cents per tonne mile. This average figure reflected both the fixed and variable costs associated with hauling by truck whereas the additional tonne mile costs would be restricted to those arising from variable costs. The average cost figure of 37 cents per tonne mile compares with the 35 cent per tonne mile custom hauling charge prevalent in the area and the additional tonne mile cost calculated by Meyer and Sparks using two axle trucks of 33 cents per tonne mile, their figure for 1987 being updated to 1989.[3] Such costs are relatively favourable compared to the train run costs of 42 cents per tonne mile experienced on the Rossburn Subdivision between Rossburn and Russell in 1984 (SGTA). Indeed it was estimated that in 1986 the on line costs on the Rossburn Subdivision were $1.7 million while the additional trucking costs associated with the abandonment of this line would have been $0.5 million (Wilson).

TABLE 8: Desired Basis for Compensation for Additional Trucking Costs, Brandon Area Study, 1989

Desired Basis of Compensation	Respondents	
	number	per cent of total
Dollars Per Tonne	12	9.0
Cost per Tonne-Mile	72	53.7
Other	9	6.7
No Response	41	30.6
ALL BASES	134	100.0

The respondents, in general, reacted positively to provision of compensation for the additional trucking effort arising from abandonment. While the views of a significant number would not be affected by provision of compensation, these including those opposed to any compensation, the majority of those responding indicated that their views would be modified. In other words, they would be influenced by compensation. On the other hand, obtaining producer approval for abandonment will require more than compensation for their additional trucking costs. Some will have to be convinced that abandonment will work to their personal advantage. Some believe other costs are associated with abandonment. It is of interest that the majority of the respondents opposed any ceiling being imposed on the compensation paid to any individual producer. Producer concerns other than the additional trucking costs arising from abandonment included community impacts, the level of taxes imposed for roads, the time involved in delivery and the increasingly impersonal aspects of delivery, Table 9. While a large proportion of the respondents were concerned over the effects on the community associated with abandonment this gave rise to few requests for compensation. Likewise, the additional time required for delivery and any impact on the personal aspects of delivery received little support as objects of compensation. No doubt, these attitudes were influenced by those initially opposed to the abandonment which they experienced and who now had their

delivery time reduced by the alternative facilities available. A large proportion of the respondents nonetheless desired compensation for any additional taxes which might be imposed to maintain roads even though data suggest that the premise that taxes increased as a result of abandonment cannot be supported. Since perception must be overcome some limited degree of compensation appears justified, this having a significant impact on producer attitudes.

TABLE 9: Producer Concerns Other Than Trucking Costs Arising from Rail Line Abandonment, Brandon Area Study, 1989

Producer Concern	Respondents	
	number	per cent of all
Community Impact	94	70.1
Taxes for Roads	103	76.9
Elevator Line-Ups	78	58.2
Impersonal Delivery	41	30.6
Other	17	12.7
ALL RESPONDENTS	134	100.0

The majority of the respondents did not consider there to be any difference between elevator consolidation and rail line abandonment with respect to the need for compensation. However, compensation for the effects of such consolidation was not of high priority, this no doubt reflecting that most of the elevators were owned by producer organizations.

Any compensation scheme to be successful must be based on a producer clientele well aware of handling and transportation costs. Unfortunately, the necessary degree of knowledge apparently does not exist. Over 66 per cent of the respondents were unaware of the handling costs imposed at their local elevator even though the tariffs are prominently displayed in the elevator, Table 10. Furthermore, an even lower proportion were aware of the W.G.T.A. rate

paid on shipments from their elevator, Table 11. While a somewhat higher proportion were able to identify the proportion of the total rate paid even this is disconcerting, Table 12. The general lack of awareness by the respondents of factors such as freight rates and elevator tariffs is of great concern to anyone applying public choice theory to the branch line question. The issues involved are complex and the responses to the questionnaire provide little grounds for optimism that the issues will be easily addressed. A major education program may be necessary so that those who would be affected by rail abandonment are in a position to make an objective judgement on the merit of any compensation package that may be offered.

TABLE 10: Producer Awareness of Elevator Handling Tariff, Brandon Area Study, 1989

Awareness	Respondents	
	number	percent of total[1]
Correct Information	28	20.9
Incorrect Information	17	12.7
Not Aware	89	66.4
TOTAL	134	100.0

[1] Numbers do not add because of rounding.

TABLE 11: Producer Awareness of W.G.T.A. Rate at Elevator, Brandon Area Study, 1989

Awareness	Respondents	
	number	percent of total[1]
Correct Information	33	24.6
Incorrect Information	8	6.0
Not Aware	93	69.4
TOTAL	134	100.0

TABLE 12: Producer Awareness of Share of Total Freight Rate at Elevator Paid, Brandon Area Study, 1989

Awareness	Respondents	
	number	percent of total
Correct Information	43	32.1
Incorrect Information	42	31.3
Not Aware	49	36.6
ALL DEGREES	134	100.0

Most of the respondents were unwilling to pay higher freight rates in order to retain their line. The majority are either resigned to believe that abandonment will occur regardless of any action they may take or hold the view that branch line service is a continuing right. None of those willing to pay a higher rate were willing to contribute more than $5.00 per tonne, the contribution suggested by the majority being in the $1.00 to $2.00 per tonne range. Obviously rail lines are considered valuable so long as retention does

not necessitate a significant additional commitment from the user of the service. Even a commitment of $5.00 per tonne pales in relation to the train run costs incurred in the Rossburn-Russell section of the Rossburn Subdivision which exceed by $10.00 those incurred over the same distance on the main lines. The current shielding of the producer from the actual cost may also be a contributing factor to the size of the commitment of the respondents. Nonetheless, there appears to be a significant difference between the value placed on a particular line by respondents and the amount of compensation desired should abandonment occur. This situation is highly relevant to the development of a compensation package which will be sufficiently attractive to assure general approval for the abandonment of a line without being prodigal in the use of public funds. However, in many cases the savings accruing to the entire system from abandonment of a particular line will far exceed any additional costs incurred by those adversely affected.

Perception and Reality

Most of the respondents who had not experienced abandonment held perceptions of its impact which were at variance with those which would ensue after the event. Those respondents who had experienced abandonment tended to be less concerned than those who had not, being generally satisfied with the event but unhappy with the process. Creating the correct perception must therefore precede provision of compensation for abandonment. Most respondents could not even provide an estimate of their hauling costs. Few knew the handling tariff of the elevator to which they delivered. The same was true for the freight rate deducted at the time of settlement. Unfortunately, the costs of operating an individual branch line are not made apparent to those patronizing the line through the rate charged since, rail costs are averaged over the system on a distance basis under the Western Grain Transportation Act. Elevator tariffs because of their uniformity draw forth minimal comment from producers. It is nonetheless apparent that some means must be found to alert producers to the cost of operating the system.

The Level of Compensation Required

While the respondents were unwilling to pay the full costs of operating a branch line in order to obtain their agreement to abandon the line, the compensation provided would have to offset both their real and perceived additional costs. In so far as their additional trucking costs are concerned, a rate of 35 cents per additional tonne mile is considered to meet with producer approval. This rate is equal to the custom rate of 35 cents per tonne mile which is an average rather than a marginal rate on short distances of haul. Such a rate of compensation is therefore generous.

Producers as represented by the respondents hold the view that taxes will increase to offset the additional maintenance perceived to be required on roads as a result of abandonment. Abandonment may cause a change in the direction of haul while giving rise to limited increases in the distance of haul for many of those affected. Nevertheless, to overcome the perception of abandonment giving rise to higher taxes, under public choice theory compensation should be provided. For those in the Brandon area, payment of compensation to overcome this perception at the rate of 3 cents per additional tonne mile is believed liberal. An aggregate compensation package of 38 cents per additional tonne mile of hauling effort is believed to be fair and to meet with the approval of the majority of those producers now delivering to the remaining branch lines.

As applied to those producers now delivering to elevators on the Rossburn Subdivision, the total amount of compensation would be substantially less than the cost of maintaining this line and associated elevators. The additional hauling effort which would have been experience by abandonment of this Subdivision was estimated to be 1712 thousand tonne miles in 1986. If compensation were to be provided at the rate of 38 cents per tonne mile the total amount would be about $651 thousand. The estimated on-line costs experienced in this Subdivision were $1.7 million. Therefore, if compensation for abandonment were made, there would be a net saving of over $1 million in railway costs alone. To this sum should be added the saving attached to rationalization of the elevator system arising from closure of the elevators along the Subdivision. The proposed liberal rate of compensation to obtain producer approval is therefore well justified by the potential savings attainable.

Payment of Compensation

A large number of alternative means for paying out the compensation funds may be devised. Many would involve significant administrative costs relative to the funds being dispersed. Determination of the increased hauling effort for an individual producer affected by abandonment would be relatively simple. The annual amount of compensation on the basis of the increase in cost could be readily calculated. In order to retain simplicity in the provision of compensation while at the same time eliminating further administrative costs, a one time payment, the interest on which would represent the compensation due annually is proposed. For example, if a producer delivered 750 tonnes of grain annually and as a result of abandonment the hauling distance increased by 10 miles, the increase in hauling effort would be 7500 tonne miles. The proposed level of compensation of 38 cents per tonne mile would result in an annual entitlement of 7500 x .38 = $2850. Given an interest rate on Canada Savings Bonds of 10.5 per cent, this represents the return on $27,143 invested

in these bonds. This producer's lump sum compensation payment would therefore be $27,143.

Use of a lump sum payment for compensation has several advantages. The payment procedure is simple and easily understood. A substantial sum is made available immediately which can be used to offset the costs experienced in adjusting to the new environment, such as the purchase of a new truck. In addition, the impact of the compensation from the standpoint of public choice would be maximized and any doubts as to the future security of compensation eliminated. On the basis of the views of the majority of the respondents such a compensation package while fair would also be seen to be fair, perception as well as reality being of the essence.

Concluding Comment

Public choice theory has a direct application to the branch line abandonment issue. Responses from producers indicate that they will agree to abandonment if their additional costs are offset. The rate of compensation desired appears relatively modest compared to the savings which would accrue from the abandonment of particular branch lines. The objective should be to abandon the high cost branch lines to the extent to which the savings arising exceed the compensation required. Such a course will ensure no producer is worse off while all producers are collectively better off following such abandonments.

Endnotes

1. A.G. Wilson, After Rail Line Abandonment: The Brandon Area Revisited. University of Manitoba Transport Institute, 1989.

2. Senior Grain Transportation Committee, Report of the Administrative Constraints to Efficiency Sub-Committee. Winnipeg, 1985, p.i.

3. N. Meyer and G. Sparks, "The Economic Cost of Transporting Grain from Farm to Market," Proceedings. Canadian Transportation Research Forum, June 1987.

IMPACT OF THE ECONOMIC AND POLITICAL EVENTS IN EUROPE AND THE SOVIET UNION ON FUTURE GRAIN EXPORTS THROUGH THE GREAT LAKES - ST. LAWRENCE SEAWAY SYSTEM

By

Hazem Ghonima[1]

INTRODUCTION

Political and economic events in Western Europe, Eastern Europe and the Soviet Union should prompt a noticeable change in future world trade pattern. Among the factors which should contribute to this situation are: the removal after 1992 of the remaining trade barrier among the 12 members of the European Community; the restructuring of the Soviet economy "Perestroika" ; the attempt by the U.S.S.R. for an economic rapprochement with the West and particularly with Western Europe; and the rapid political and socio-economic changes in Eastern Europe. Since those regions are the most important markets for the North American grain (Canadian & U.S.) exported through the Great Lakes - St. Lawrence Seaway, these new historical events will have an important impact which could alter current pessimistic perception on future trade of this commodity through the waterway .

This paper assesses the impact of economic and political events in Europe and the Soviet Union on future grain traffic through the Great Lakes - St. Lawrence Seaway Transportation System. A scenario of world grain trade, reflecting an optimistic situation relative to Great Lakes was developed. Finally, the potential grain export which could use the Great Lakes - St. Lawrence Seaway, under this scenario, was estimated.

GRAIN EXPORTS & THE GREAT LAKES - ST.LAWRENCE SEAWAY

This chapter will examine the characteristic of grain exported through the Great Lakes - Seaway system and will be followed by a chapter on the influence of the European and the Soviet markets on the behaviour of grain trade through the waterway.

Grain traffic through the Great Lakes - St. Lawrence Seaway is composed mainly of Canadian and U.S. export movements that originate at the Great Lakes terminals and are destined to markets in Western Europe, Eastern Europe, the Soviet Union, North Africa & Middle East, and Latin America. The greater part of this traffic is carried by Canadian lakers to lower St. Lawrence ports, such as, Quebec City, Baie Comeau, Port Cartier for transshipment to ocean vessels. A smaller portion, consisting mainly of feed grain, is dropped off

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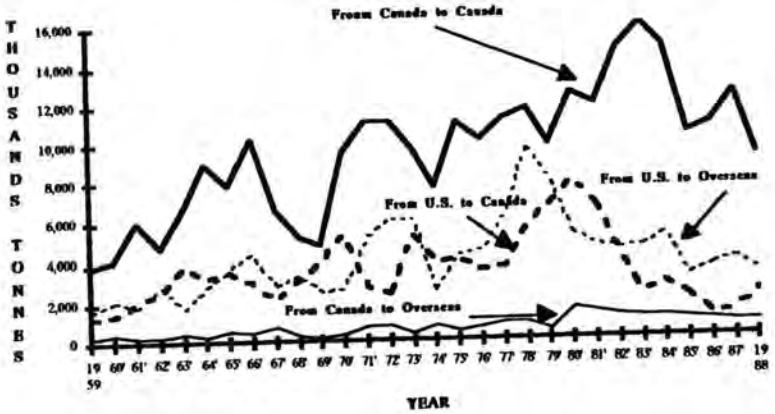
[1] President , TAF Consultants

for domestic use, at Hamilton, Prescott, Toronto, Montreal and other river ports. An important portion of the grain traffic, mainly U.S. grain, is exported directly overseas in foreign flag vessels.

In 1978, grain traffic through the St. Lawrence Seaway reached the record level of 28.2 Mt, representing about 43% of the total cargo traffic on the Welland Canal section.. However, in the following years, the softening of the world grain trade market, and in particular, the decline of grain imports in Europe - the Seaway 's most important grain market - brought about a significant reduction in grain movements through the waterway. In 1989, this traffic has dropped to 12.1 Mt. The following chart shows major grain flows through the Welland Canal.

GRAIN FLOWS THROUGH THE WELLAND CANAL

1959 -1988

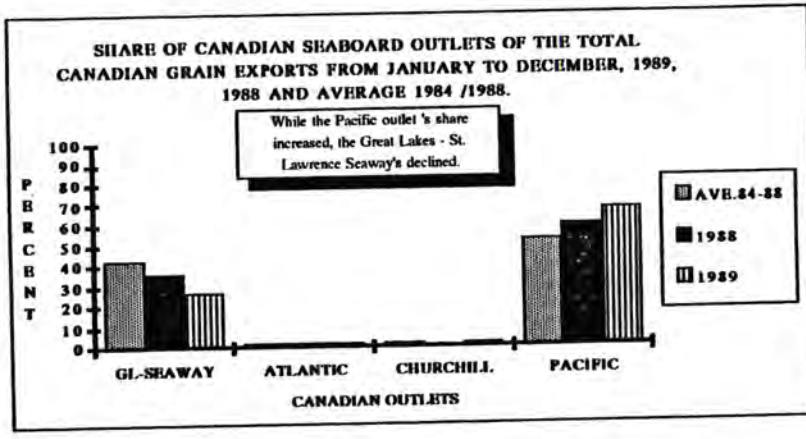


CANADIAN GRAIN MARKET

The Canadian component of grain traffic increased steadily from about 4 Mt in 1959 to the record 17 Mt in 1983, representing 35% of total Seaway traffic on the Welland Canal. However, from 1984 to 1988 this traffic declined gradually from 16 Mt to 10 Mt and in 1989 it sharply dropped to 6.1 Mt .

Canadian grain is transported to markets through four Canadian alternative routes; the Great Lakes - St. Lawrence Seaway system including transshipment in the lower St. Lawrence and direct overseas exports from Thunder Bay, rail to Canada's Pacific ports, direct rail to the Atlantic including lower St. Lawrence ports, and to Churchill. While all grain shipped to the Pacific is for export, grain moving eastward by water is for export and domestic use, both of which contribute to the Seaway traffic. The following chart shows the shares of Canadian seaboard outlets of total Canadian grain exports .

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Canadian grain shipped through the Seaway depends on world grain demand and to a larger degree, on grain demand from traditional markets in Europe, the Soviet Union and North Africa - Middle East as well as on the available capacity of the Canadian Pacific outlet. Traditionally grain exports through this outlet has reflected fluctuations in Canadian grain exports more sharply than Canada's Pacific outlet. When Canadian exports strengthened, the Seaway grain traffic increased somewhat more than its Pacific alternative and vice-versa. The sharp drop in the 1985 traffic was expected to be corrected once Canadian grain exports rebound. This did not materialize. On the contrary, despite a noticeable rise in total Canadian grain exports in the following year, the Seaway share continued to drop while the Pacific share increased. For the first time in more than a decade, the waterway's share of total Canadian grain exports dropped below that of the Pacific outlet. This situation coincided with the implementation of the Western Grain Transportation Act (WGTA). The latter has added a new factor in the shaping of the Canadian grain distribution pattern in recent years.

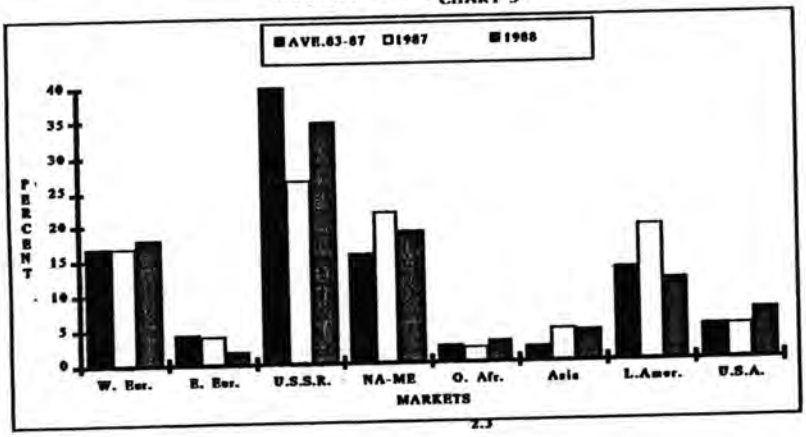
During the 1983/87 period, on the average, 36% of the total Canadian grain exports went to Asia, 23% to the Soviet Union, 14% to North Africa-Middle East, 9% to each Western European and Latin American markets, 4% to each Eastern European and U.S. markets and 1.5% to Other Africa. During the same period, the U.S.S.R market accounted for 40% of Canadian grain exported through the Great Lakes - St. Lawrence Seaway, followed by Western Europe (17%), North Africa-Middle East (16%), Latin America (13%), U.S.A. (5%), Eastern Europe (4%) and Other Africa and Asia with each 2%.

In contrast, market for Canadian grain exported through Canada's Pacific seaboard outlet is concentrated in Asia, which during the average five year period 1983-87 represented 69% of total grain exported from this outlet. The U.S.S.R. and North Africa - Middle East each accounted for about 9% of total Canadian grain exported via the Pacific, followed by Latin America (5%),

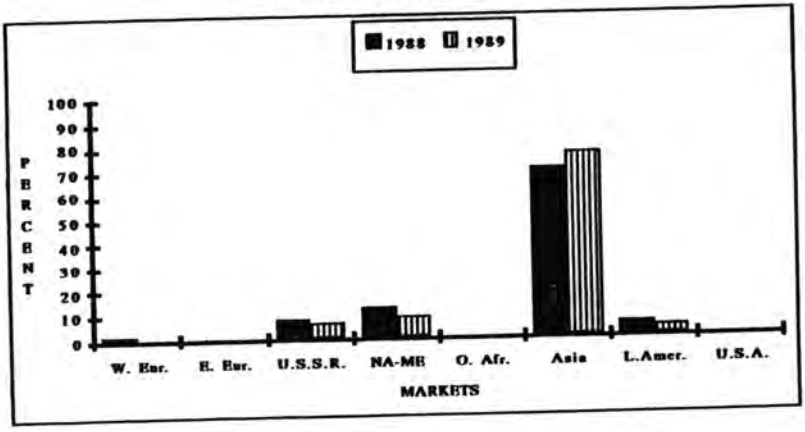
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Eastern Europe (1.6%) and Other Africa (0.8%). From the above we can deduce that the market for Canadian grain exported through the Great Lakes - Seaway is somewhat more diversified, compared to the market for Canadian grain exported through Canada's Pacific outlet. The following charts show the Canadian grain exports through the Great Lakes - St. Lawrence Seaway and the Pacific outlet by market share in 1988, 1987 & average 1983/1987.

CANADIAN GRAIN EXPORTS THROUGH THE SEAWAY BY MARKET SHARE



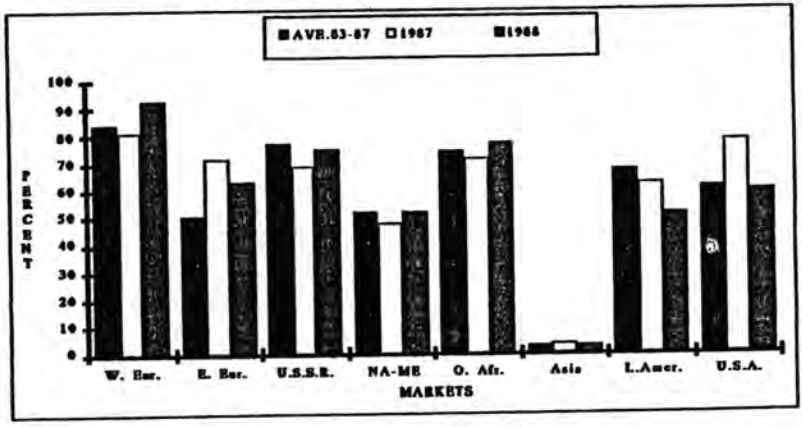
CANADIAN GRAIN EXPORTS THROUGH THE PACIFIC BY MARKET SHARE



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In 1988, the shares of Western Europe and the Soviet Union (both are important traditional markets for Canadian grain exports through the Great Lakes/Seaway) of the total Canadian grain exports diminished to 7% and 17% respectively. In contrast the Asian market increased its share to a dominant 48% of the total Canadian grain exports. Therefore, with increasing demand from Asia relative to the demand from Western Europe and the Soviet Union, the Seaway share of total Canadian grain exports, which averaged 47% during the 1983-87 period, declined to 36% in 1988.

SHARE OF THE SEAWAY OF TOTAL CANADIAN GRAIN EXPORTS BY MARKET, 1988, 1987 & AVERAGE 1983/1987



In 1989, the major Canadian seaboard outlets experienced a decrease in the amount of Canadian grain exported through their facilities. This was mainly due to substantial decrease in Canada's grain production that was caused by drought conditions. Canadian grain exports through the Great Lakes - St. Lawrence Seaway were the hardest hit. They declined by 47% from their 1988 level. Moreover, the share of this outlet, of total Canadian grain exports, dropped to 27% from 36% in 1988. Comparable figures for Canada's Pacific outlet show that despite the decline in the quantity of grain exported through this outlet during 1989, its share of the Canadian grain exports climbed to 68% from 60% a year earlier.

Finally, the Great Lakes - St. Lawrence Seaway saw its traditional dominance in seven out of eight export markets for Canadian grain reduced to only four in 1989. Meanwhile, the Pacific outlet that had a majority share in only one market a year earlier increased its dominance in four markets in 1989. Similarly, but on a much smaller scale, the share of Canadian grain exports through Churchill increased from 0.2% to 1.6%. In contrast, the share of Canada's Atlantic outlet declined from 2.2 % to 1.7%.

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U.S. GRAIN MARKET

U.S. grain exports move to overseas destinations from four major U.S. coastal areas: the Great Lakes - St. Lawrence Seaway, the U.S. Atlantic, the Gulf and the U.S. Pacific. These seaboard outlets are linked to U.S. grain-producing areas by four major transportation arteries composed of various modes and routes. Exports through the Seaway system originate at the U.S. Great Lakes terminals and are destined for Europe, North Africa & the Middle East, Latin America and the Soviet Union.

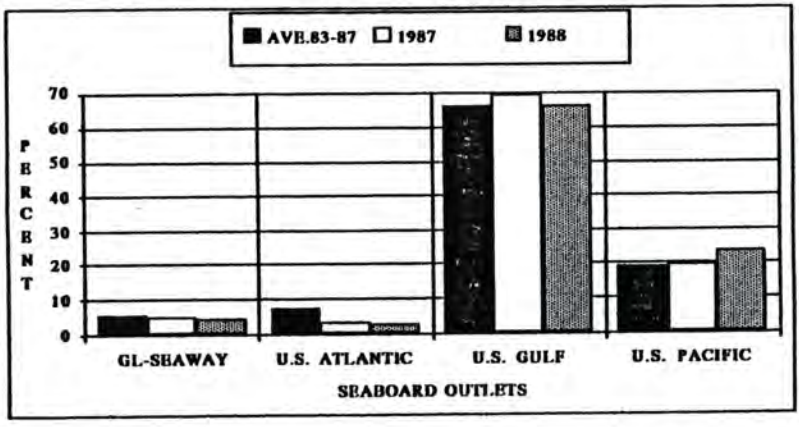
In 1959, U.S. component of grain traffic on the Welland canal amounted to 3.1 Mt. This movement reached the record level of 14.5 Mt in 1978. During this period, two major cycles occurred in which the traffic fluctuated sharply. A third major cycle appears to have started after 1979 and seems to have reached a bottom line in 1986 when U.S. grain traffic through the Welland canal dropped to 4.8 Mt. A slight upward trend that started in 1987, brought this traffic to 6.0 Mt in 1989.

U.S. grain traffic through the Seaway depends mainly on the level of U.S. grain exports and on the demand for U.S. grain from traditional Seaway grain markets in Western Europe and, to a lesser degree, in North Africa and the Middle East. The decline in demand from the European market in the last few years has had a drastic impact on the amount of U.S. grain exported via the Seaway. Moreover, the capacity of the U.S. grain transportation system has an important impact on the level of U.S. grain exported through the Seaway.

For example, in years when world grain demand was high and the U.S. economic situation was robust, the flow of various commodities through the U.S. transportation system flourished and the U.S. transportation system tended to experience capacity limitations. Therefore, the Great Lakes - Seaway system, which acted as a safety valve by handling the grain overflow, experienced a sharp increase in its U.S. grain traffic. But with depressed economic situation in the U.S., commodity movements through the overall U.S. transportation system declined. Therefore, the available capacity of this system artificially increased, transportation rates (particularly the Mississippi barge rates) somewhat fell and consequently U.S. grain via the Seaway declined.

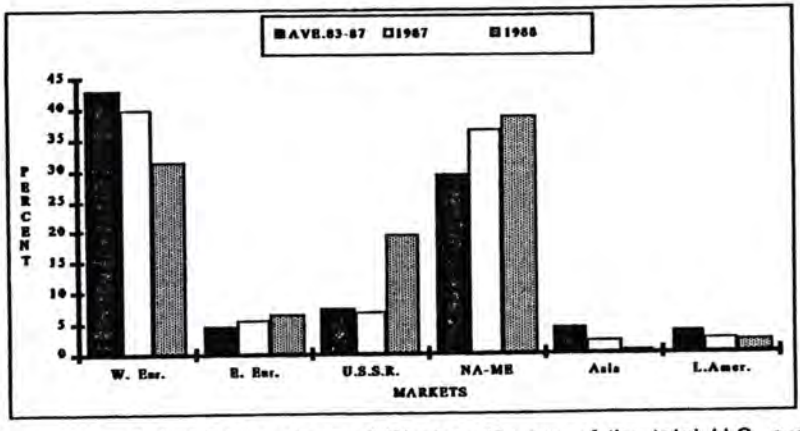
During the 1983-87 period, Western Europe was the biggest market for U.S. grain exported via the Seaway, representing an average of 43% of total U.S. grain exports through this outlet. North Africa-Middle East was second in importance accounting for 29%, followed by the Soviet Union (7%), Eastern Europe (4.4%), and Latin America and Asia with each (4%). The following chart shows U.S. seaboard outlets' share of total U.S. grain exports in 1988, 1987 & average 1983/87.

U.S. GRAIN EXPORTS BY SEABOARD OUTLET



The two charts that follow show the share by market for U.S. grain exported through Great Lakes - St. Lawrence Seaway and the share of this outlet of U. S. grain by market in 1988, 1987 & average 1983/87.

U.S. GRAIN EXPORTS THROUGH THE SEAWAY BY MARKET SHARE

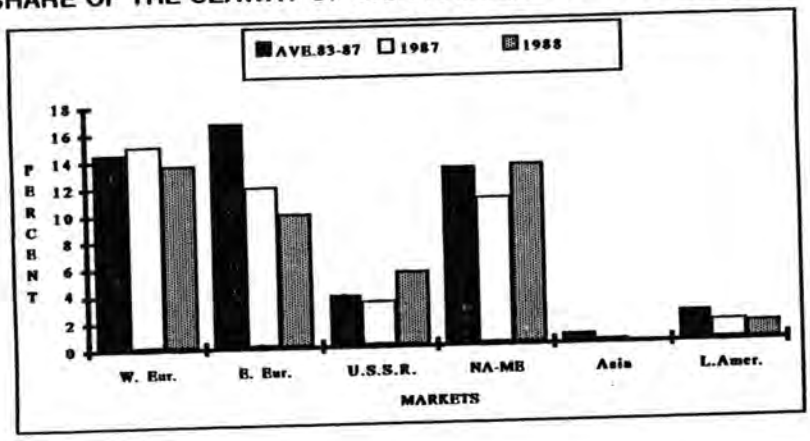


As a result of diminishing share of Western Europe of the total U.S. grain exports in recent years, the Great Lakes - St. Lawrence Seaway's share for moving U.S. grain gradually declined to 4.5 percent in 1988. Meanwhile, the U.S. Gulf and the U.S. Pacific outlets both increased their share to 66 % and 24% respectively as their traditional markets, particularly in Asia, gained in importance. By 1988, market for U.S. grain exported via the Great Lakes - St.

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Lawrence Seaway had changed. North Africa-Middle East became first in importance with a market share of almost 39% of total U.S. grain exports via the Seaway. Western Europe, traditionally the most important market for U.S. grain using the Seaway, drastically diminished its share to only 31%. Meanwhile, the Soviet Union market, which tends to fluctuate sharply from year to year, accounted for 19% of the total U. S. grain exported through the waterway.

SHARE OF THE SEAWAY OF U.S.GRAIN EXPORTS BY MARKET



IMPACT OF THE ECONOMIC AND POLITICAL EVENTS IN EUROPE AND THE SOVIET UNION

The economic problem the Seaway is presently facing stems from the dynamic nature of the North American transportation network. The alternative routes and modes forming this network, including the Great Lakes - Seaway system, compete for various cargos flowing between different North American and overseas supply and demand centres. The amount and direction of grain flowing through this transportation network is influenced by a multitude of economic, political and institutional factors on domestic and global levels. Therefore, in order to estimate adequately future grain exports through the Great Lakes - St. Lawrence Seaway, the system should be examined within the context of the global perspectives.

Among global factors which influence the behaviour of grain flows using the waterway is the changing shape of world trade pattern. During the next two decades globalization will be a must for business to respond to a world market already made smaller by telecommunications and larger by a more balanced share of wealth between the U.S., Western Europe and East Asia. As a result more trans-border joint ventures and mergers will evolve as corporations seek global linkages. As business consolidates on a global level, countries are regrouping into trade blocs. Canada and the U.S. signed a Free Trade Agreement (FTA) that came into force in January, 1989. This agreement

provides for comprehensive liberalization of Canadian-U.S. trade by eliminating all tariffs, most non tariff barriers and easing restrictions on investment. After 1992, the remaining trade barriers among the 12 members of the European Community will be removed allowing the free movement of goods, people, capital and services within this wide market. Other trade blocs are also emerging in East Asia and in the South Pacific.

Meanwhile, the restructuring of the Soviet economy "Perestroika" and the attempt by the Soviet Union to develop an economic rapprochement with the West, particularly with Western Europe, is in line with this phenomena of trade globalization. Furthermore, the rapid political and socio-economic changes evolving in Eastern Europe will most probably make the economy of Eastern Europe less dependent on the previously isolated Soviet economy and more open to global trade. These developments should significantly change the world trade patterns, including the grain trade, but could also bring much tougher competition among trading nations. Since those world regions are the most important markets for the North American grain (Canadian & U.S.) exported through the Great Lakes - St. Lawrence Seaway, these new historical events will have an importance that could alter current pessimistic perception on future trade of this commodity through the waterway

POTENTIAL GRAIN EXPORTS THROUGH THE GREAT LAKES

This Chapter will describe a hypothetical optimistic scenario, relative to the Great Lakes - St. Lawrence Seaway, for world grain trade from which future potential grain traffic through the waterway can be derived.

World trade liberalization and business internationalization are expected to substantially increase world trade. Robust world trade will also reflect the growth in world population and should strengthen the global economy. The latter will prompt an increase in energy consumption and higher oil prices. Increasing oil costs should prompt Western Europe to soften its position on farm subsidies. Subsequently, a solution should be found to end the agriculture trade war with the U.S.

Realizing that they can never compete with the U.S. and Japan as long as their market remains fragmented, the twelve countries forming the European Economic Community (E.E.C.) will remove in 1992, all remaining non-tariff barriers which restrain trade between them. This single bloc of 320 million people and $4 trillion market should gradually evolve during the first decade of the 21th century to a near economic and political unity which, in addition of guarantying political stability in in Europe with a unified stronger Germany, is expected to adhere to free trade and less subsidies.

Removal of internal barriers in the E.E.C. should be in the interest of North American business (Canadian and U.S.), as long as the process adhere to free trade and less subsidies. North American interests will find Europe a more attractive export market - since they can sell one product rather than having to modify the same product for 12 smaller markets. As a result sea-borne trade between the two Western markets through the Atlantic ocean will grow

substantially. Consequently, ocean rates should rise and its proportion of the total transportation cost for exporting canadian grain increase.

The steady increase in oil prices, particularly in the beginning of the 21th century, should allow the North African - Middle Eastern and some Latin American countries to reduce their financial dept and increase their cash trade with Western Europe and North America. Thus, North American grain exports to these markets should significantly grow during the next two decades.

Under this scenario, we assume that "Perestroika", or the restructuring of the Soviet economy, achieves some success. As a consequence, the Soviet Union's rapprochement with the Western World should materialize and with it, the cold war practically come to an end. This should lead to a substantial increase in trade between the Soviet Union and Western Europe on the one hand and between the Soviet Union and North America (including Canada and the U.S.)on the other.

The rapid political and socio-economic changes in Eastern Europe will most probably make the economy of Eastern Europe less dependent on the Soviet economy and therefore, its trade relationship with Western Europe and North America increase substantially.

Eager to satisfy their populations in the wake of the new political situation, the Soviet Union and Eastern European countries will remain major grain importers particularly since they will be allowed to reasonably balance their trade deficit with North America through the exports of its non-agriculture products. The need to be self- sufficient in grain should gradually decrease in priority since this policy could prove to be costly in an era of global market economy. Furthermore, the end of the cold war between the two super powers should remove a major factor justifying this policy.

The negative impact of the WGTA on the Great Lakes - St. Lawrence grain traffic should be diluted as the result of stronger world grain markets, higher ocean rates and domestic efforts to lessen the distorting effects of this Act. As a result, the Seaway's share of total Canadian grain exports should range between 45% and 50%.

The moderate success of the U.S. B.I.C.E.P. in the 1990's and the cessation of the agriculture trade war will allow the U.S. to regain its market share in world grain trade. Therefore, U.S. grain exports will be substantially higher than in the 1980's and the Seaway's share of total U.S. grain exports should be between 6% and 8%.

Based on this scenario, potential grain exports through the Great Lakes - St. Lawrence Seway, during the first decade of the 21th century, should reach 30 Mt.

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CONCLUSION

During the next two decades globalization will be a must for business to respond to a world market already made smaller by telecommunications and larger by a more balanced share of wealth between the U.S., Western Europe and East Asia. As business consolidates on a global level, countries are regrouping into trade blocs. The political and economic events in Western Europe, Eastern Europe and the Soviet Union are partly the result of this global phenomena. The scenario described in this paper reflects an optimistic perception of the impact of these events on future grain exports through the Great Lakes - St. Lawrence Seaway. Accordingly, these developments are expected to alter current pessimistic perception on future trade of this commodity through the waterway, particularly since Europe and the Soviet Union are the most important markets for North American grain exported through the Great Lakes - St. Lawrence Seaway. Based on this scenario, potential grain exports through the Great Lakes - St. Lawrence Seaway, during the first decade of the 21th century, should reach 30 Mt.

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PRODUCTIVITY, REGULATORY PRICING AND THE WESTERN GRAIN TRANSPORTATION ACT

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1. Introduction

This paper examines the issue of productivity in the determination of freight rates for the movement of western Canadian grain by rail. Canadian National Railway (CN) and Canadian Pacific Ltd. (CP) are subject to economic regulation under the Western Grain Transportation Act (WGTA) which includes the annual determination of a distance-related freight rate scale, the payment by the Government of Canada of a significant portion of the freight rate, and the requirement for regulatory approval to lower the shipper's portion of the freight rate in any given crop year. The agricultural impacts of this subsidized freight rate, as well as the impacts on the grain handling and transportation system, have been the subject of a number of recent studies and a national agricultural policy review is currently underway which includes an examination of legislative alternatives to the existing scheme.

This paper will begin by focussing on the treatment of productivity savings implicit in the determination of the annual freight rate in the existing WGTA. Following a description of the treatment and its rationale in section 2, a chronology of related events since passage of the Act in November 1983 will be provided in section 3 including a discussion of two proposals which have been made to alleviate problems which have emerged. In section 4 the paper will explore the broader issue of productivity and pricing in other regulatory jurisdictions in the U.S. and the U.K. Finally, in section 5 a proposal is made for the treatment of railway productivity under a new annual freight rate setting formula.

2. Productivity and the WGTA Freight Rate

The WGTA requires the annual determination of a distance-related rate scale by the National Transportation Agency (NTA) based upon an estimate of the average combined railway costs for CN and CP of transporting western grain. The freight rate only applies to named commodities moving by rail to Thunder Bay or Vancouver, Prince Rupert and Churchill for export offshore.

Eligible railway costs are long-run variable costs and consist of volume-related variable costs for the movement of grain, line-related variable costs for the network of grain dependent prairie branch lines and a contribution for fixed costs which is prescribed at 20% of the volume-related variable costs. Table 1 summarizes the determination of the total freight rate for an average length of haul between 901 and 925 miles for crop years 1983/84-1989/90. Costs and tonnages are combined for CN and CP and differences between the average freight rate and the average estimated eligible costs are a result of technical adjustments related primarily to a payment made directly to CN by the Government of Canada for additional costs incurred in the movement of grain to Prince Rupert and Churchill. Note that the WGTA required a phase-in of the contribution to fixed costs over the first three crop years of 5%, 10% and 15% respectively while Table 1 has used 20% throughout for comparative purposes. On that basis total freight rates over the seven year period have increased at an average rate of 1.6% per year.

During the Gilson consultative process [1] and the subsequent Rates Task Force [2] which led up to the passage of the WGTA, the issue of productivity savings was discussed in the context of railway freight rates. The Gilson process identified productivity savings from two sources, branch line abandonment and the replacement of railway-owned boxcars by government-owned hopper cars, and recommended that these savings be shared on a 50:50 basis between the railways and the shippers. The Rates Task Force modified this recommendation and the WGTA requires that these savings be identified and used to reduce the total freight rate, thereby implying a sharing of the savings between the shippers and the Government of Canada but not the railways. The effect of this requirement has been identified in Table 1 where projected variable costs have been reduced by the estimated productivity savings from the two sources.

The annual projected variable costs are established from base year variable costs which are determined once every four years following a detailed costing review by the NTA. During intervening years, forecast price increases rather than forecast cost increases are used to establish projected variable costs, a procedure which permits productivity savings generated internally by the railway companies to be retained until the next costing review. While the WGTA does not explicitly mention productivity savings, it has therefore implicitly recognized three sources and specified the sharing arrangements: first and secondly, savings from branch line abandonment and the replacement of railway-owned equipment by government-owned equipment are used to reduce the total freight rate to the benefit of shippers and government; thirdly, savings from

TABLE 1: The determination of the total freight rate for an average length of haul between 901 - 925 miles for crop years 1983/84-1989/90

	83/84[1]	84/85	85/86	86/87	87/88	88/89	89/90
	$ millions						
Projected volume-related variable costs	655.3	671.4	732.4	670.1	751.0	759.9	788.0
less estimated savings resulting from the replacement of railway-owned boxcars by government-owned hopper cars	4.4	11.0	33.8	15.2	15.4	15.5	15.7
Estimated volume-related variable costs	650.9	660.4	698.6	654.9	735.6	740.4	772.3
Miles of grain dependent branch lines	6537.0	6998.1	6987.7	6852.4	6724.8	6630.9	6651.4
Projected line-related variable costs	110.2	101.5	105.2	106.5	103.7	101.6	93.0
less estimated savings resulting from branch line abandonment	1.2	4.4	4.7	2.1	3.9	5.2	4.5
Estimated line-related variable costs	109.0	97.1	100.5	104.4	99.8	96.4	88.5
Contribution to fixed costs at 20% of estimated volume-related variable costs[2]	130.2	132.1	139.7	131.0	147.1	148.1	154.5
Total estimated eligible costs	890.1	889.6	938.8	890.3	982.5	984.9	1015.3
Forecast volume of grain in million tonnes	31.7	31.8	31.8	28.4	31.6	31.7	32.6
Average estimated eligible cost per tonne	28.08	27.97	29.52	31.35	31.09	31.07	31.14
Freight rate per tonne for an average haul between 901-925 miles	27.63	27.40	29.14	30.94	30.46	30.26	30.31
Annual percent increase in freight rate		-0.8%	6.4%	6.2%	-1.6%	-0.7%	0.2%

[1]The WGTA came into effect January 1, 1984.

[2]Note that the contribution to fixed costs for crop years 1983/84 - 1985/86 has been set at 20% of volume-related variable costs for comparative purposes only. The WGTA actually required a phase-in of the contribution for those three years of 5%, 10% and 15% respectively.

efficiencies introduced by the railway companies are not used to reduce the total freight rate and therefore benefit the railways between costing reviews.

The rationale for these arrangements, while never made explicit, appears to reflect the principle that when the expenditure of investment funds by shippers, government or the railways creates productivity savings, then the party bearing the costs of the investment should be the beneficiary. More particularly, if investments by shippers permit productivity savings in railway costs then the provisions of the WGTA to allow lower or incentive shipper freight rates may be used to negotiate a sharing of these savings.

3. Related Events Since Enactment of the WGTA

The railway costing information upon which the early WGTA freight rates were based was prepared for Transport Canada by Snavely, King and Associates in respect of 1980. However, selected methodological changes were made to these railway costs, related primarily to capital cost determinations, prior to passage of the Act. The first costing review under the WGTA was conducted in respect of 1984 by the Canadian Transport Commission (CTC) the predecessor to the NTA.

3.1 The 1984 Costing Review

The summary report [3] issued in March 1986 contained a detailed analysis of the changes between 1980 and 1984 including price changes, changes in grain tonnage and traffic characteristics, changes in costing methodologies and an estimate of the net productivity savings generated by the railways. The net productivity gain for CN over the four year period 1980-84 was estimated at $13.6 million which represented a cost reduction of 3.1% or 0.8% per annum: for CP the net productivity gain was estimated at $14.8 million which represented a cost reduction of 4.1% or 1.0% per annum. A direct comparison of these figures with those contained in Table 1 is inappropriate: base year costs are actual costs determined on a calendar year basis while the figures in Table 1 are estimated costs on a crop year basis.

The figures in Table 1 for crop years 1983/84-1985/86 were based on operational characteristics in 1980 and the estimated savings resulting from the substitution of railway-owned equipment by government-owned equipment increased over that period. However, crop years 1986/87-1989/90 were based on railway costs in 1984 and estimated savings were reduced to reflect the operational characteristics of 1984. Since no additional government-owned equipment has been introduced since 1986 the estimated savings have remained essentially constant throughout the remaining period. The estimated savings resulting from branch line abandonment in the first three crop years are distorted by the regulatory treatment of branch lines omitted in the determination of railway costs for 1980 and a proper comparison is only possible in the remaining period where a gradual reduction in the number of miles of grain dependent branch lines has resulted in gradually increased savings.

The above discussion is only a partial explanation of the figures in Table 1 and highlights the complexities involved in the regulated rate-

setting formula contained in the WGTA. The casual reader can be forgiven for finding the results somewhat confusing. One important point to note for later reference is that the results of any costing review are not available until some 15 months after the end of the calendar year in question. Therefore the 1984 railway costs were used as a basis for determining freight rates up to crop year 1989/90 a total period spanning five years and seven months.

3.2 The 1986 Review of the WGTA

There was a statutory requirement for a comprehensive review of the WGTA and this was completed in April 1986 by the Grain Transportation Agency (GTA). The summary report [4] addressed the issue of productivity savings in the context of incentive rates. It was identified that incentive rates at specific origins represent a sharing of productivity savings in railway costs between the railway and the shipper involved and that, following a costing review, the savings were used to reduce the total freight rate at all origins. This feature acts as a disincentive to long-term investment by shippers and railways to create grain transportation efficiencies.

The report outlined a proposal to alleviate this problem involving Productivity Sharing Agreements between railways and shippers. It was suggested that, in lieu of incentive rates, such agreements would call for a railway to rebate to a shipper a portion of the railway cost savings resulting from identified grain transportation efficiencies and that such rebates be included as eligible railway costs in the next costing review.

The drawback to the proposal is that it would introduce one more level of complexity into rate-making under the WGTA and would presumably require the separation of cost savings induced by efficiencies in transporting grain traffic moving under incentive rates from cost savings induced by efficiencies in the overall transportation system. Otherwise the proposal might deny grain traffic not moving under incentive rates some of the benefits of overall transportation efficiencies following a costing review.

3.3 The 1988 Costing Review

During the conduct of the 1988 costing review by the NTA the issue was raised of railway productivity savings resulting from labour downsizing, the opening of the new CP Rogers Pass Tunnel in the Canadian

Rocky Mountains, and the operation of cabooseless trains. The timing of these events is critical to an understanding of the effect of the controversial decision issued by the NTA in November 1989 regarding this matter.

Evidence is provided in the decision [5] to indicate impressive railway productivity savings from labour downsizing on the basis of an increase in ton-miles per person-hour worked between 1985 and 1988. Note first that ton-miles per person-hour worked is a partial productivity measure and does not take into account the relative substitution of other factor inputs such as capital and material. This does not therefore represent a complete assessment of railway productivity which is more properly assessed using a measure of total factor productivity as outlined in the technical Appendix. Secondly, the NTA decided that continuing labour downsizing beyond the end of 1988 until approximately the end of 1989 would result in known and measurable savings to the railways which should be used to reduce the base year railway costs in 1988 for the purpose of determining WGTA freight rates for crop years 1990/91-1993/94. This second point is a new interpretation of the policy implicit in the WGTA that productivity savings generated internally by the railways should be retained by the railways between costing reviews. In effect such savings are to be retained by the railways strictly for a four year period only and not for the five year and seven month period as previously.

CP's Rogers Pass Tunnel was constructed to minimize the grade of the track between Rogers Pass and Stony Creek thereby reducing railway operational costs and was opened in late 1988. While little if any savings were made in 1988, the NTA decided that the tunnel would result in known and measurable savings to CP in the future and therefore decided to reduce base year costs for CP in 1988, once again to reflect savings until approximately the end of 1989. On the issue of the operation of cabooseless trains, the NTA recognized that at the time of the decision neither CN nor CP had operated cabooseless trains in commercial service and therefore such savings were not known or measurable: the NTA therefore declined to make any adjustment for such operations. In a subsequent decision issued in January 1990, the NTA determined that an amount of $18.5 million should be deducted from base year costs in 1988 to reflect productivity savings to the railways during 1989 resulting from labour downsizing and the CP tunnel.

The NTA decision to make these productivity adjustments has been appealed to the Federal Court of Canada by both CN and CP and, at time of writing, no decision has been made on the appeal. Without discussing the merits of the case, the effect of the decision is a change in the policy regarding the sharing of productivity savings implicit in the WGTA and, if upheld, will further diminish railway incentives for grain transportation efficiencies.

3.4 Transforming the Crow

A paper with the above title [6] was issued in December 1989 by the Agricultural Diversification Alliance (ADA), a group of some 25 western Canadian farm organizations, which discussed problems created by the existing WGTA and made a series of proposals for improvement. Among the many problems and issues raised in the paper, it was recognized that "under the existing four year recosting system, the railway's incentive to introduce productivity changes and even more importantly, their incentive to share productivity gains with the industry and work with the industry to facilitate such gains through incentive rates is severely curtailed". Moreover, "if the NTA continues to try to capture cost decreases prospectively instead of retrospectively, the negative impact on the railway's ability and willingness to offer incentive rates will be increased."

As one of the many proposals for legislative change, the ADA paper suggests that the freight rate be paid entirely by the shippers with the subsidy from the Government of Canada being paid directly to producers instead of the railways.[1]

In concert with this change, the ADA paper suggests that the total freight rate remain the subject of regulation by the NTA on an annual basis. However, it is proposed that the annual estimated railway costs on which the freight rate is based be determined from base year costs which continue to be determined once every four years following a costing review by the NTA but which excludes grain traffic moving under incentive rates.

It is argued that the impact of this proposal would be to permit the railways to retain the ability

[1]This important and controversial proposal will not be pursued in this paper although its significance in creating an economic climate for inducing productivity savings should not be underestimated.

to continue to offer incentive rates after costing reviews because the productivity savings associated with the lower cost operations from incentive rates origins would not be captured and removed from the cost base. Productivity savings induced by efficiencies in transporting grain traffic moving under incentive rates would therefore continue to be shared between the railways and shippers involved, while productivity savings generated by the railways in overall transportation system efficiencies would be retained by the railways only until the next costing review.[2]

The difficulty with this proposal is that the existing railway costing methodologies are not sufficiently detailed to distinguish grain traffic moving under incentive rates from grain traffic not moving under incentive rates and to accurately measure the differences in the workloads and unit costs between the two types of traffic. The ADA paper recognizes this difficulty and suggests that the costing methodologies be enhanced to accommodate the proposal. Given the history of the review of railway costing in Canada by the MacPherson Royal Commission and subsequent Commissions of Inquiry, the suggestion that railway costing simply be enhanced may not be administratively realistic.

Overall, the two proposals to date for addressing the problem of the sharing of productivity savings appear overly complex and subject to the vagaries of the regulatory agency given the task of administering the proposals. Before outlining a new proposal for the treatment of productivity in determining a regulated freight rate for the transport of western grain, it is worth digressing to explore the issue of productivity and regulatory pricing in other jurisdictions in the U.S. and the U.K.

4. Regulatory Pricing in the U.S. and U.K.

In the U.S., since the passage of the Staggers Rail Act in 1980, the Interstate Commerce Commission (ICC) is required to publish a quarterly rail cost adjustment factor (RCAF) which is used to adjust rail freight rates. The rationale for the introduction of the RCAF was the avoidance of the regulatory burden and delays associated

[2]No explicit mention is made of the treatment of productivity savings from any future government investment in equipment or from branch line abandonment but it must be assumed that any such savings would be used to reduce the total freight to the benefit of the shippers.

with applications for general freight rate increases prior to 1980. The RCAF is based upon a composite price index published quarterly by the Association of American Railroads (AAR). This AAR price index is a weighted average of price increases for labour, fuel, materials and supplies, equipment rents, depreciation, and other expenses (including purchased services, selected taxes, insurance, lost and damage, and general administration) with the weights updated annually.

Shippers have argued that the AAR index is an input price index and as such should be adjusted for productivity increases to convert it to a cost index. A petition by coal shippers to the U.S. Court of Appeal for review of the ICC decision implementing the RCAF was rejected in 1982. This upheld the ICC practice of making no productivity adjustments other than those reflected in the changing composition of rail inputs through the updating of the weights. However, the Court did recommend that the practice be reviewed and revised as circumstances warranted, and the ICC completed a lengthy review of the issue in 1989 by deciding to adjust the AAR price index based upon an average of the productivity gains over the period 1982-86 a figure of 1.7% per annum. The adjustment is based upon a total factor productivity measure and with the recent inclusion of the productivity gain for 1987 (a substantial 17.6%) the adjustment has risen to 4.4% per annum. The methodology of productivity adjustment is currently under further review by the ICC.

Looking further afield, price cap regulation has become the preferred method in the U.K. for regulating the prices of monopoly services in recently privatized industries. This approach has been applied selectively to telecommunications, gas, airports and electricity as detailed in [8]. In these instances, efforts have been made to design an industry structure to promote competition but it was recognized that a need remained to regulate the price of services over which a firm continued to be capable of exerting significant market power. Price control was chosen in order to avoid the perceived adverse incentive effects and heavy regulatory burden that seemed inevitably associated with rate of return or cost of service regulation.

The general form of the price cap is referred to as RPI-X and involves subjecting an identified group of services to the constraint that their average price should not increase by a factor more than the rate of inflation measured by the retail price index (RPI)[3] less some fixed percentage X. With an appropriate choice of the value of X

[3]This is similar to the CPI in Canada.

it is argued that price cap regulation is superior to rate of return regulation since it permits the firm to retain at least some of the productivity savings from increased efficiency and thereby promotes and encourages greater operating efficiency and innovation, especially in less competitive markets.

The choice of the value of X plays an important role in curbing market power and encouraging efficiency and is generally set by a complex process of economic analysis and bargaining: in the U.K. the value of X is 3 for telecommunications (later increased to $4\frac{1}{2}$), 2 for gas and 1 for airports. Equally important is the question of how to revise X: by what criteria, by whom and how often?

In telecommunications, the regulatory agency Oftel examined British Telecom's rate of return on capital as part of its price review and it was also prompted to consider whether the value of X might vary directly with volume growth. The enabling legislation provides for a review of the price cap at the end of each five year period, and the Director of Oftel can also act before the end of a five year period by referring modification of the formula to the Monopolies and Mergers Commission. The frequency of review has been an issue in the U.K. with the recognition that frequent fine-tuning would undermine the intended incentive effect of RPI-X regulation.

5. A New Freight Rate Formula For Western Grain

Returning now to the issue of rail freight rates, there would appear to be a continuing requirement for a regulated freight rate for the movement of western grain. The railways have not demonstrated strong intra-modal competition for grain traffic through incentive rates and many grain shippers are presently captive. While some long-haul truck competition is likely under any change in the method of payment of the government subsidy directly to producers, strong inter-modal competition is not anticipated, and it is assumed that the grain industry would not welcome a move to value of service pricing by railways under complete rate freedom where higher freight rates could apply to higher valued grains.

It is therefore assumed that annual freight rates will continue to be determined by the NTA following a public consultative process. However, it is proposed to replace the existing rate setting formula by a much simplified price cap formula where the total freight rate for each range of distance is simply determined from the previous year's rate by an adjustment for railway price increases less a fixed downward adjustment (the X factor) to represent a sharing of productivity savings. The total freight rate may also be adjusted downwards to reflect

annual branch line abandonment with a possibility of upward adjustment to reflect any freight car acquisitions by the railways as a long time replacement for government-owned hopper cars. This proposal would require legislative change but is not necessarily bound to a change in the method of payment of the government subsidy. However, for maximum economic effect it is also recommended that the incentive rate provisions of the WGTA be relaxed to provide maximum flexibility for negotiations between shippers and railways while ensuring that rates remain compensatory to avoid predatory pricing.

In light of the discussion in Section 4, it is necessary to fix a figure for X and to outline a process for its review and revision as and when required. On the process side, it is suggested that a statutory review of the rate setting formula be required after five years but that the Minister of Transport may request the NTA to review and make recommendations on the value of X according to specified criteria at an earlier time. In order to avoid frequent fine-tuning by the NTA, it is suggested that the Governor-in-Council be given the authority to revise the value of X. What therefore of X and the criteria for revision?

In Table 2 is summarized the results of a number of studies of historical total factor productivity (TFP) for railways. The methodologies for the development of the figures are not identical and the differences have been identified in the technical Appendix and summarized in Table 2. Overall, it appears that TFP was higher in earlier periods 1956-75 rather than later; CN appears to have slightly higher annual rates of TFP; and there is considerable variation in the figures which highlights the traditional difficulties of productivity measurement but generally TFP is positive in the range 1%-4%.

In order to bring the results for CN and CP up to date, a simplified analysis was conducted for the period 1972-1988. On the input side, a cost index derived from total railway expenses was adjusted by a composite input price index involving labour, fuel, material and capital: the capital component involved the CP cost of capital rate applied to CN or CP net investment as appropriate, and the weighting factors were derived from the results of the 1988 WGTA costing review but without the cost reductions applied by the NTA for productivity. On the output side, the total revenue freight ton-miles for each railway was used as a single output. The results are summarized at the bottom of Table 2 and a graph of the indices of cost, composite input price, output and TFP appear in Figures 1 and 2 for CN and CP respectively.

TABLE 2: Summary of Results of Recent Studies of Total Factor Productivity for Railways

Source	Period	Average Annual Percent Increase in Total Factor Productivity: CN	CP	U.S. Rail-roads	Methodologies: Total Input Index	Total Output Index: Output Weights	Total Output Index: Outputs
1. Caves and Christensen [9]	1956-1975	3.1	2.7		Composite input quantity index	Cost elasticities from U.S. railroads	Revenue ton-miles
	1956-1975	3.4	2.8				Weighted revenue ton-miles
2. Freeman, Oum, Tretheway and Waters [10]	1956-1981	3.1	3.5		Composite input quantity index	Revenue shares	
	1975-1981	1.4	1.4				
3. Roy, Cofsky [11]	1956-1981	3.25	3.09		Composite input quantity index	Revenue shares	
	1975-1981	1.23	0.23				
	1956-1981	9.81	3.77			Cost elasticities from CN and CP	
	1956-1975	7.9%	3.90				
4. Rail Cost Adjustment Factor (RCAF)	1982-1987			1.7	Cost index adjusted by a composite input price index	Revenue shares	
	1982-1988			4.4			
	1972-1988	3.1	2.9		Cost index adjusted by a composite input price index	Single output only	Total revenue ton-miles
	1981-1988	3.3	1.4				

FIGURE 1

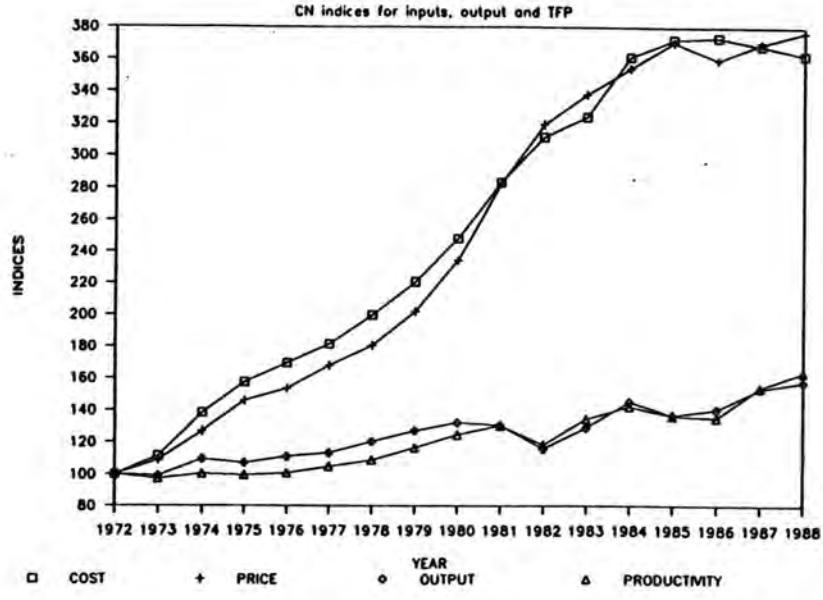
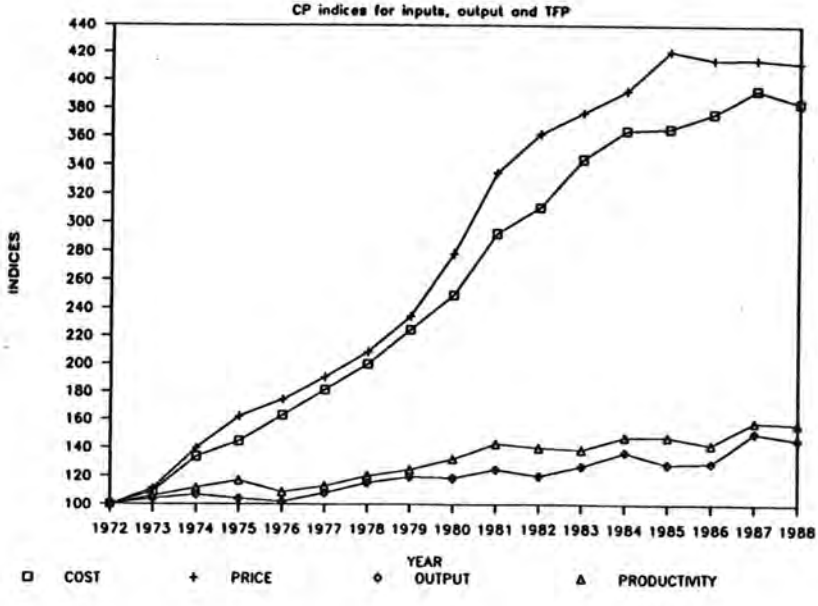


FIGURE 2



Overall the results were not sensitive to the choice of alternative weighting factors from the 1984 WGTA costing review or the corresponding figures for 1980, nor were the results sensitive to the choice of revenue ton-miles over gross ton-miles. While the choice of a single output measure may be criticized on methodological grounds, the TFP results for CN and CP of 3.1% and 2.9% annually over the period 1972-1988 are not out of line with the earlier studies. While the setting of the X factor is a policy matter relating to the sharing of productivity savings and must be determined from a combination of economic analysis and negotiation, a figure for X in the range 1%-2% may be appropriate.

On the issue of establishing criteria for a revision of the X factor, the annual TFP for CN and CP was examined for any discernable trends between 1972-1988. Since the annual changes in the indices of TFP, cost, price and output are approximately linearly dependent, TFP was examined as a function of price and output only. TFP showed little or no discernable relationship with the railway price indices, with the industrial product price/ industry selling price index (IPPI/ISPI) or with the consumer price index (CPI). The notion that measured productivity might rise during periods of high inflation was not borne out by the analysis. On the other hand, TFP did show a relationship with output as measured by railway revenue ton-miles (RTM) or gross domestic product (GDP) as indicated in Figures 3 and 4 for CN and CP respectively. A simple linear regression of changes in TFP against changes in RTM for the pooled data of CN and CP gave the result

$$\triangle \text{TFP} = 0.012 + 0.686 \triangle \text{RTM}$$

with an R^2 of 0.57 and a t-statistic for $\triangle$RTM of 6.4.

The result that productivity rises when output rises has been identified before [10] and may be indicative of economies of scale. However, the railways have little if any control of the volatility of grain traffic and the idea of penalizing a regulated company for achieving higher output by increasing the X factor (or decreasing the X factor for achieving lower output) appears somewhat perverse. This is related to one of the issues currently before the ICC where it has been argued that the productivity adjustment of the AAR price index should be made as a moving average over a complete business cycle because annual productivity tends to increase during the expansion phase of a business cycle and to decline in the contraction phase. The volatility of TFP and output in Figures 3 and 4 illustrates the likely difficulties in determining the length of a business cycle despite, for example, the observable effect of the recession in 1982.

FIGURE 3

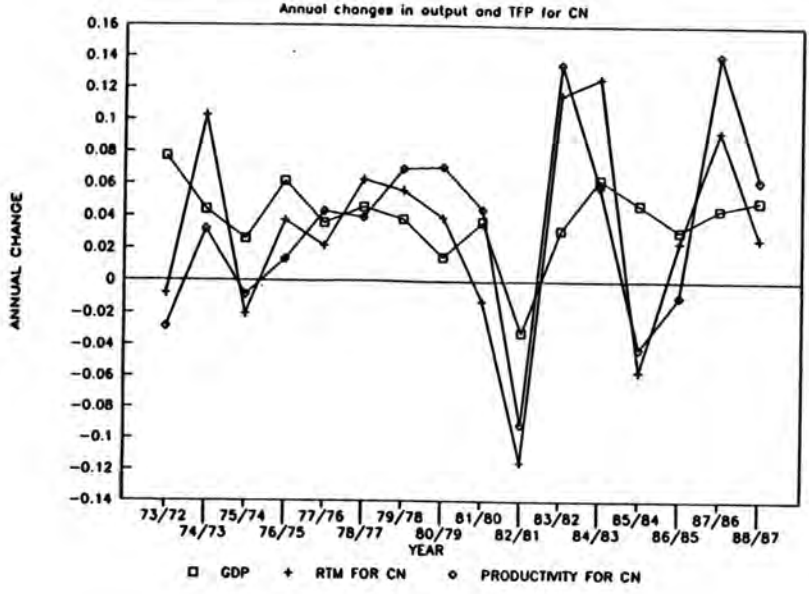
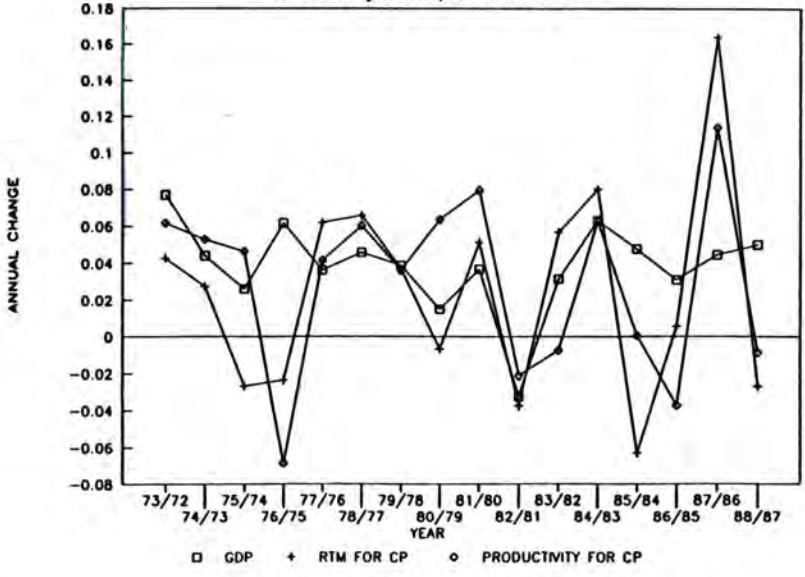


FIGURE 4



In the present context of western grain freight rates it would seem appropriate, given the volatility of measured TFP, to require as a criterion for revision of the X factor that a structural change in the underlying rate of technological change be demonstrated. This would limit the possibility of fine-tuning and require a review of TFP and its relationship with output and general economic activity over several years. In the U.K., experience has also suggested that the rate of return on capital and the quality of regulated service should feature as factors in assessing the operation of price cap regulation and the X factor. It is therefore recommended that an examination of the financial performance of the railways over time also be required as well as an assessment of the quality of service being provided in grain transportation.

In conclusion, once the value of X and the criteria for review have been set, the proposed new rate setting formula provides a simple and easily understood method for determining annual freight rates. An average rate of $30.31 per tonne in 1989/90 from Table 1 with a railway price increase of 3½% and an X factor of 1½% would give an average rate of $31.94 per tonne = 30.31 x (1.035-0.015) in 1990/91. Such a simplified process would reduce the regulatory burden, make it easy for the grain industry and the railways to project the future prices of rail transportation, provide a stimulus for continuing railway productivity and permit the negotiation of long-term incentive rates involving a sharing of savings between shippers and railways.

Appendix

Productivity analysis supposes that a railway is engaged in producing outputs $y_1(t), y_2(t), \ldots, y_m(t)$ using inputs $x_1(t), x_2(t), \ldots, x_n(t)$ at time t according to a long-run cost function

$$C = C(y_1, y_2, \ldots y_m; p_1, p_2, \ldots p_n; t)$$

where $p_1(t), p_2(t), \ldots, p_n(t)$ are input factor prices. It can be shown that

$$-\frac{\partial \ell nC}{\partial t} = \sum_{i=1}^{m} \frac{\partial \ell nC}{\partial \ell ny_i} \cdot \frac{d\ell ny_i}{dt} - \left(\frac{1}{C}\frac{dC}{dt} - \sum_{j=1}^{n} S_j \frac{d\ell np_j}{dt} \right)$$

where S_j is the cost share of the j^{th} input and this may be expressed as:

$$\begin{array}{c}\text{Rate of change} \\ \text{of productivity}\end{array} = \begin{array}{c}\text{Rate of change} \\ \text{of outputs}\end{array} - \left(\begin{array}{c}\text{Rate of change} \\ \text{of costs}\end{array} - \begin{array}{c}\text{Rate of change} \\ \text{of input prices}\end{array} \right)$$

An index of $-\frac{\partial \ell nC}{\partial t}$ is a measure of Total Factor Productivity.

On the input side it can be shown that:

$$\frac{1}{C}\frac{dC}{dt} - \sum_{j=1}^{n} S_j \frac{d\ell np_j}{dt} = \sum_{j=1}^{n} S_j \frac{d\ell nx_j}{dt}$$

so that a total input index can be constructed from a cost index $\frac{1}{C}\frac{dC}{dt}$ adjusted by a composite input price index $\sum_{j=1}^{n} S_j \frac{d\ell np_j}{dt}$ or from a composite input quantity index $\sum_{j=1}^{n} S_j \frac{d\ell nx_j}{dt}$.

On the output side, if outputs are priced at marginal cost and there are constant returns to scale then it can be shown that:

$$\sum_{i=1}^{m} \frac{\partial \ell nC}{\partial \ell ny_i} \cdot \frac{d\ell ny_i}{dt} = \sum_{i=1}^{m} R_i \frac{d\ell ny_i}{dt}$$

where R_i is the revenue share of the i^{th} output. A total output index can therefore be constructed as a composite output index using either cost elasticities $\frac{\partial \ell nC}{\partial \ell ny_i}$ or revenue shares R_i as weights. The studies referred to in the paper use different combinations of these input and output methodologies but none have considered a measure of Partial Factor Productivity $\left(\frac{d\ell ny_i}{dt} - \frac{d\ell nx_j}{dt} \right)$ as appropriate.

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Productivity Adjustment to Price Levels in Regulated Rail Markets: Recent Developments in Canada and the United States

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Recently there has been considerable interest in a new approach to regulation known variously as "price level," "price cap" or "incentive" regulation. This regulatory approach emerged in the public utility field, particularly in Great Britain and is now discussed primarily with reference to telecommunications regulation. Some aspects of this regulatory approach are being raised in connection with rail regulation in North America. In recent years, railways in North America have enjoyed considerable -- but not complete -- freedom from regulation. In Canada, railways have enjoyed extensive pricing freedom since 1967, with the conspicuous exception of export grain rates. The Staggers Rail Act of 1980 brought extensive deregulation to the U.S. rail industry, although there is residual maximum price regulation for shippers who face "market dominant" railroads.

The purpose of this paper is to review the concept of price level or price cap regulation and its application to rail markets in Canada and the U.S. The primary application of price cap regulation is taking place in the U.S.,[1] but some elements of this regulatory approach are arising in connection with the statutory WGTA (nee Crow) grain rates. The paper first introduces price level or price cap regulation, outlines its characteristics, and then its application to the North American rail industry.

I. Price Level or Price Cap Regulation

The regulation of price levels is not a new idea. For example, cost-plus regulation limits price levels to costs, but it is well-recognized that this approach to regulation suffers from providing an incentive to overstate or increase costs in order to increase allowable prices and profits. Rate base rate of return regulation places limits on allowable total revenues and prices, but is recognized as encouraging distortions in input use which lead to higher costs and prices.

The new emphasis on price cap regulation focuses on the dynamics of a regulatory process, i.e., how the regulatory mechanism works over time. As with all economic approaches to regulation, the goal is to limit prices to cover costs and try to prevent monopoly profits. Given any initial price level (or structure), price cap regulation focuses on the periodic increases in prices necessary to keep pace with cost inflation, and imposes a "cap" on these price increases. Even if initial price levels are not closely aligned with actual costs, they will become proportionately closer if annual price increases are closely linked to cost increases. If the regulatory-approved price escalation formula is based on

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[1] The authors have provided testimony on some of these issues on behalf of the Association of American Railroads (AAR). However, the views expressed in this paper are those of the authors and do not necessarily reflect the position of the AAR or member railroads.

rises in input prices, this gives incentives to firms to find ways of reducing costs because the firm will be allowed to retain, at least temporarily, productivity gains which result in costs rising more slowly than the allowable price increase.[2]

This regulatory approach is designed to incorporate two characteristics of nearly every industry. The first is persistent inflation in input prices. Ceteris paribus, costs of production tend to rise due to inflation, hence firms must periodically increase prices merely to maintain their real position. Second, many firms and industries experience productivity gains, which at least partially offset the rising costs of production. Price cap regulation imposes restrictions on price levels linking them to inflation and (in some cases) productivity, but hopefully in such a way that it leaves firms with an incentive to be efficient.

A. Illustration for a Single Product Firm

It is useful to begin the discussion with reference to a single product firm. The basic idea is to specify an allowable rate of price increase but one which does not quite keep pace with inflation. This pressures the firm to maintain control over costs. Indeed, the firm will have to make some productivity improvements or it will incur loses. If the firm succeeds in improving productivity such that costs rise less than the allowable price increase, the firm retains these profits, at least until a future regulatory review. Hence this regulatory approach gives the firm at least some incentive to be efficient and to improve productivity. At the same time, limiting price increases to less than a rate of inflation implies that at least part of productivity gains are being passed on to consumers, consistent with the outcome expected in competitive markets. If the firm is unable to achieve the regulator's productivity target, it will be penalized with revenues not keeping pace with cost increases.

Probably the most recognized application of this price cap regulation is from Britain. This is the regulatory model developed for British Gas and Telecom industries, known as "RPI - X." (It is also used to regulate the now privately owned British Airports Authority.) A firm is allowed to increase its price in keeping with inflation (the retail price index or RPI was adopted as the guide) less some amount "X" to reflect expected productivity gains.[3] This regulatory approach has now been adopted by the U.S. Federal Power Commission (1989), and a variation has been adopted by the ICC for rail markets where regulatory jurisdiction is still applicable. More on the latter application below.

B. Price Cap Regulation for Multiproduct Firms

Traditional regulation of multiproduct firms involved two levels of regulation. First was a limit that overall revenue not exceed costs. Second was the detailed regulation of individual prices. The latter raised problems of cost allocation, not to mention considerations about what was "fair" or "reasonable." The costly disputes and hearings in traditional rate regulation, combined with inefficiency and often futility of imposing rate structures inconsistent with competitive forces, were important sources of dissatisfaction which lead to deregulation.

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[2] It is important to distinguish between input "price" and input "cost." The price per litre of diesel fuel is an example of an input price, whereas the annual expenditure on fuel is an input cost. Costs may fall even if input prices rise if the firm is able to reduce its consumption of diesel fuel.

[3] A useful review is Cave and Hartley, 1989.

But if firms do possess monopoly power in many markets, there is still a case for some regulation. Price cap regulation is less detailed than traditional regulation. It imposes less control on specific pricing decisions of firms, and concentrates instead on overall limitations on the behaviour of the firm. As with the single product case, the regulatory approach is to allow the firm freedom to raise prices to cope with inflation, but to constrain the cumulative result of price increases so that firms do not have carte blanche to allow costs to increase. Price cap regulation essentially limits the overall or average price increase to an expected inflation rate (e.g., expected rise in input prices which face the firm) less some amount which reflects expected or required productivity improvements. As with the single product case, the firm has an incentive, indeed a necessity, of improving productivity to sustain its present financial position. The benefits of more rapid productivity growth will accrue to the firm, at least until a subsequent regulatory review.

Firms have the freedom to make differential price adjustments in response to differential cost and demand conditions in the multiple markets, but overall the firm is limited by the price cap regulation. In moving from an initial situation with detailed price regulation to a regime employing this general price cap methodology, the firm is free to alter the price structure to give greater weight to demand or value of service considerations.[4] It can be shown that this price cap regime is consistent with a move toward a Ramsey price structure, i.e., price marginal cost differentials which reflect demand elasticities with the cumulative result satisfying an overall revenue constraint (Vogelsang and Finsinger, 1979).

A useful corollary is that the regulated firm does not have an incentive to cross subsidize competitive (low markup) markets from relatively inelastic demands. If a firm raises prices well above costs in one market, the overall price cap or price level constraint would require that prices be lowered in other markets. Introducing a price actually below marginal costs in one market in order to increase a price elsewhere will not make the firm better off. This is an important attribute of this regulatory approach if it is to be applied to firms/industries which contain both monopoly and highly competitive sectors, such as in telecommunication and railways.

II. Incentives, Efficiency and Price Cap Regulation

The forgoing brief summary of price cap regulation is sufficient to show its appeal. It is a simpler regulatory regime than followed in the past. It allows pricing freedom to the firm for individual markets and is expected to lead toward efficient Ramsey-type price structures. The firm has an incentive to minimize costs via productivity gains. Finally, these productivity gains are shared at least in part with consumers (because prices are not allowed to rise equal to the full inflation rate).

Equity. Nonetheless, this regulatory regime is not devoid of controversy. There are both equity and some efficiency concerns which can be raised. On the equity side, price cap regulation will usually result in some outputs having higher markups over marginal costs than others. This "inequity" could put pressure on government to "reregulate" the industry, meaning to change from price cap regulation to a more detailed control. This is because the less onerous price cap regulation relinquishes the detailed control necessary for political rate manipulation. The counter argument to this is that if there are limited

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[4] This assumes that a traditional detailed regulatory structure would have limited the price levels in at least a few of the markets with relatively higher values of service.

markets where monopoly power is present, then there are limited prospects of pursuing non-economic goals through detailed rate regulation, at least in the long run. Any attempt to do otherwise would result in the deteriorating financial health of the industry.

Efficiency. The attractiveness of price cap regulation on economic efficiency grounds has already been outlined. However, it is possible to identify some potential distortions which could arise under this regulatory regime. For example, the basic price cap model--like most other simple regulatory models -- focuses only on price-quantity relationships; quality is not considered. Price cap regulation could give rise to a distortion whereby firms reduce quality as a means of restoring profits (Carsberg, 1989). As another example, allowable revenues are restricted, reflecting some expectation about productivity gains. Firms might engage in strategic behaviour, such as suppressing productivity advances shortly before review of the regulatory parameters (e.g., Sappington, 1980).

Incentives to Innovate. There is a more direct efficiency effect we wish to address. This concerns the incentive to innovate. As outlined, the basic price cap model is thought to leave a firm with an incentive to find ways to reduce costs. Partly this is a necessity because allowed price increases are set at less than expected rises in the costs of inputs. There is also the incentive that productivity gains above the norm will accrue to the firm, at least until the next regulatory review. The latter point raises a problem. If regulators set the productivity adjustment to equal full productivity gains, i.e., pass through 100 percent of productivity gains to consumers, where is the long run incentive for the firm? Some argue that an incentive still exists. There is an incentive in that firms essentially have no choice. If they do not innovate and thus experience cost increases exceeding the allowable price increases, the firm's financial position will deteriorate.[5] (We ignore the possibility of strategic behaviour of withholding productivity gains in hopes of influencing the expectations and requirements of regulators). Firms must innovate to avoid financial failure and some think this is sufficient motivation for efficiency.

In an industry consisting of several firms, it has been argued that specifying industry average productivity gains as the productivity adjustment still gives an incentive for firms to out perform the average (e.g., Baumol, 1982). Such firms will be able to retain profits from superior productivity gains. There is an incentive for above-average performance and a corresponding penalty of a revenue shortfall for those unable to keep pace with the industry.[6]

However, an issue here is the extent to which productivity gains can be regarded as largely exogenous to the firms as opposed to endogenous, i.e., influenced by the behaviour of the firms' management. An interesting case of endogenous gains in productivity is where firms seek out opportunities to reduce overall operating costs. For example, one of the major ways of reducing operating costs is by investment in new plant and equipment. A "front end" cost is incurred which results in a stream of reduced costs in the future. If full costs are recognized and properly measured by the regulatory agency, there should be no bias and no effect on incentives beyond the points raised above. However, if certain investments are not recognized by the regulator, then the firm will be penalized. For example, until recently, labour "buyout" expenses were excluded from calculations of total

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[5] This is particularly plausible if productivity gains are largely exogenous to the firm, e.g., productivity gains are embodied in inputs purchased routinely by the firm.

[6] However, in testimony, Baumol (1985) has argued that the conclusions of his 1982 article do not apply to an industry which is not yet revenue adequate, i.e., not yet earning competitive rates of return.

operating costs for U.S. railroads.[7] A similar problem arises in the discussion of possible productivity adjustments to grain transportation subsidies, below.

An impact on incentives can arise depending on the effect of productivity gains on the cost base used for rate setting. Prices generally exceed identifiable variable costs by some amount. This recognizes the need to cover common overheads (or to finance the deficit that would otherwise occur if marginal cost pricing was imposed on a decreasing cost industry). Suppose an investment produces productivity gains which reduce identifiable variable costs by 10 percent. If these productivity gains are passed on to customers, i.e., rates must reduce by 10 percent (assuming no inflation in this example), the firm making the investment is actually worse off. This is because the proportional markup to cover common overheads now applies to a lower (variable) cost base and results in a lower net revenue.[8] In this situation there is not only a lack of incentive, there is a penalty for innovation.

A more general version of this is any case where overall profit levels are linked to total costs. Innovations which reduce costs result in a lower cost base thus lower absolute profits. This is the converse of the traditional problem of cost plus regulation. A regulatory mechanism which penalizes an industry for cost reducing innovations will eventually have some effect on the rate of innovation. Further research is needed on the issue of incentives in price cap or incentive regulation. Previous authors have argued that the price cap form of regulation incorporates incentives for efficient operation which previous regulatory regimes did not have. But there are some situations where the incentive effects are questionable.[9]

III. Price Cap Regulation in the U.S. Rail Industry

The U.S. substantially deregulated its rail industry with the Staggers Rail Act of 1980. There are some residual regulatory restrictions on maximum rates. The maximum rate limit is not a simple application. First of all, many rail markets are exempt from rate regulation, e.g., confidential contracts, intermodal traffic, and box car traffic. For markets not exempt, a rate in excess of 180 percent of variable costs makes it a candidate for consideration of a maximum rate. But it is not an automatic rule. The railroad must be "market dominant" and the ICC must also give consideration to whether or not individual railroads are making an adequate return (termed "revenue adequate"). If Ramsey pricing principles were to apply, firms would be allowed to practice unrestrained value of service pricing (price to variable cost markups which reflect demand conditions) until overall earnings reached normal competitive levels. As is well known, most railroads do not earn rates of return comparable to other industries. Only a few railroads are at or near revenue adequacy. Nonetheless, a number of markets have been subject to maximum rate

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[7] A labour buyout is a lump sum payment to terminate employees. The reduction in employees lowers costs and raises productivity, but the "investment" to bring about this gain is excluded if treated as a "below the line" expense.

[8] Consider an initial position of revenues of $110 and variable costs of $100 for net revenue of $10. Due to the 10% reduction in variable costs, to $90, revenues must be decreased by 10% to $99. Net revenue is now $9, lower in absolute terms than before the productivity innovation.

[9] This paper abstracts from some other important issues including the choice of a measure of inflation and the measurement of productivity gains. These warrant extensive discussion which cannot be included in this paper.

limits. A stand-alone cost calculation is employed in setting the maximum rate, i.e., it is not set at 180 percent of variable costs. The amount of traffic subject to maximum rate limits is not known but is thought to be between 10 and 25 percent of total rail traffic.

Rates are allowed to increase in keeping with inflation. Until recently, the escalator was the RCAF, the Rail Cost Adjustment Factor, an index of the rise in rail input prices. Over the past few years a debate took place proposing to modify this index by deducting average productivity growth in the rail industry. This is the price cap regulatory model.

A. The ICC Price Cap Model

The basic model, ultimately adopted by the ICC (1989), was introduced by Caves and Christensen (1982). The object was to devise a formula which would allow rates to increase with inflation, but limit the allowable increase in rates to actual cost increases. The principle is applied using an industry average, i.e., the price escalator would be tied to the industry-wide average increase in costs from one year to the next.

Caves-Christensen's model can be summarized as follows. The allowable revenues in year 1, R_1, is to be proportional to the increase in costs between year 0 and year 1:

(1) $R_1 = R_0[C_1/C_0]$

They seek an allowable rate of increase for output prices, g, to produce the allowed increase in revenues. However, costs and revenues must also be related to output levels, that is, the allowable increase in revenues must be expressed on a per unit of output basis:

(2) $R_1/R_0 = g \times [Q_1/Q_0]$.

Next, substituting C_1/C_0 for R_1/R_0 and rearranging terms yields:

(3) $g = [C_1/C_0] / [Q_1/Q_0]$

i.e., the allowed revenue increase is constrained to the quantity adjusted increase in costs, i.e., the rise in unit costs.[10] The expression Q_1/Q_0 is an output quantity index.

The rise in costs between the periods deflated by an input price index (the RCAF) can be interpreted as an input quantity index:

(4) Input Quantity Index = $[C_1/C_0] / [RCAF_1/RCAF_0]$

Dividing an output index by an input index is a general measure of productivity. Therefore, the allowed increase in price between periods, g, can be expressed in terms of the input price index (the RCAF) and a productivity index:

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[10] "Unit cost" is an ambiguous concept in a multiproduct industry such as rail transportation. The Caves-Christensen model is easy to follow for a single product firm. For multiproducts, the expressions Q_1 and Q_0 must be expressed as indexes of output. The indexes are constructed based on annual traffic volumes by commodity type weighted by freight revenues. Now, changes in traffic mix will have effects on allowed price changes.

(5) $g = [RCAF_1/RCAF_0] / [\text{Output Quantity Index} / \text{Input Quantity Index}]$

$= [RCAF_1/RCAF_0] / \text{Productivity Index}$

i.e., the allowable increase in output prices is limited to the rate of increase in input prices deflated by the growth in productivity.[11]

The 1982-1989 ICC Ex Parte 290 hearings debated the validity of the Caves-Christensen model as well as the appropriate construction of an output index and measurement of productivity. In this paper we abstract from the debate over output and productivity measurement.

B. Problems with the ICC Model

The ICC's application of price cap regulation is a more restrictive application than envisioned in other applications of this type of regulation. As noted earlier, the concept of price cap regulation allows the firm discretion over individual price increases but subject to an overall limit on revenue increases (limited to actual increase in industry average unit costs in this case). The Caves-Christensen proposal starts out with recognition that the railroad industry is entitled to increase rates sufficient that the total revenue increase is equal to the increase in total costs of handling the same traffic volume. But when this single output model is applied to a multiproduct industry, the end result is quite different.

The particularly constraining feature of the Caves-Christensen model adopted by the ICC is that it sets the maximum allowable increase in individual rates equal to the industry average increase in costs. This is a major departure from price cap regulation in that individual rates are being capped, rather than overall revenues. Further, the industry will be able to recoup the increases in costs if and only if all prices increase by the maximum allowable amount.[12] If some markets experience below average increases in costs (and many will), and/or if some markets face competitive pressures so maximum allowable increases are not feasible, then the sum of revenue increases across the industry will be less than the increase in total costs. Conversely, traffic experiencing cost increases above average can only increase prices automatically by the industry average. Firms have the option of making special application to raise rates by more than the automatic allowable increase, but this involves separate specific action, not an automatic price increase. For traffic subject to maximum rate limits, the railroads must resort to traditional detailed price regulation procedures. The latter is not what was envisioned under deregulation. That is, there really are two layers of regulation of rates subject to maximum price limits: the price cap supplemented by detailed regulatory review for any traffic which experiences cost increases above the industry average.

In brief, because roughly half of rail traffic will experience cost increases above average, and many rail markets are competitive so that maximum allowable price increases cannot be taken in all markets, the ICC's price cap model will systematically result in industry revenue increases not keeping pace with the increases in industry costs. For

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[11] Rewrite equation (4) to solve for C_1/C_0 and substitute that expression into equation (3). Expressed as growth rates, the allowable rate of price increase is the growth rate in input prices minus the growth rate of productivity.

[12] A mathematical proof is in Tretheway, Diewert and Waters, 1988, Appendix 6.

much traffic, price cap regulation must be supplemented by extra rate increases some of which will be subject to traditional detailed regulatory review.

C. An Alternative Framework.

A regulatory framework more in keeping with the price cap model would be to accept the overall limit constraining the change in total revenue to equal the change in total costs, but allow the railroads freedom to increase prices in different proportions. The weighted average of each firm's price increases (weighted by traffic volumes) would be limited to the industry average increase in unit costs.[13] There is still a potential problem in that tying allowable price increases to the industry average increase in costs will result in inadequate revenue increases to firms experiencing above-average increases in costs (and allow potential additional profits for firms whose cost increases are less than average). This is an unavoidable consequence of regulating individual firms by industry-wide criteria.[14] Note however, that this is not inconsistent with the idea of price cap regulation. Firms with above-average performance are rewarded while firms less able to control costs will lose profits or be forced to make special application for additional rate increases. The desirability of this arrangement depends on whether cross-firm variations in cost increases are endogenous or exogenous to the firms. In practice it is probably a mix of the two.[15]

In sum, the ICC has adopted a more restrictive version of price cap regulation than that proposed and adopted in other industries. On the other hand, for much traffic the capping mechanism is not completely binding. Firms may apply supplemental rate increases. In cases subject to maximum rate review, such increases are subject to traditional detailed regulatory review. The ICC price cap model, which limits automatic maximum price increases to the industry average increase in unit costs, by itself would lead to annual revenue increases which do not keep pace with annual increases in costs in the industry. Given the problem of revenue adequacy facing many railroads, this restrictive regulatory model could further aggravate the industry's financial picture. How serious this is for the rail industry is not clear. It depends on how costly it will be to apply supplemental rate increases; for traffic subject to maximum rate jurisdiction, traditional detailed regulatory reviews may be necessary which can be very costly. In addition, the ICC's new procedure may affect some rates otherwise exempt from regulatory review. The publication of a productivity-adjusted RCAF, and the publicity about the distinction between input price increases and actual cost increases, opens an additional item for discussion in confidential contracts. The selection of escalation formula is likely to receive more attention by both parties in future contract negotiations.

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[13] However, the immense number of services provided by railways may make it impractical to calculate a comprehensive average. In telecommunications, a "market basket" approach is used, i.e., a specified sample of markets is used to calculate the average. This leaves some markets essentially exempt from maximum rate protection.

[14] If one developed firm-specific productivity measures, then each firm's price increases could be limited to that firm's increase in unit costs. Note that this procedure would allow lesser price increases for more productive firms, and vice versa. This may eliminate the incentives for productivity gains which is sought by price cap regulation.

[15] As an example, suppose a carrier develops less costly procedures for hauling in mountainous terrain. This productivity gain is averaged over and applied to the whole industry, even though carriers operating only on flat terrain have no chance of exploiting the improved technology.

IV. Price Cap Regulation in Relation to Canadian Rail Markets

As noted earlier, Canadian railways have enjoyed extensive pricing freedom since 1967. This is continued under the National Transportation Act of 1987.[16] The well-known exception to Canadian rail pricing freedom is the statutory rate on export grain under the Western Grain Transportation Act (WGTA), 1983. Abstracting from some details, the rate structure on grain ought to rise as transportation costs rise. The specific rates in a year are also influenced by forecasted volumes for that year (i.e., transportation costs are volume sensitive). The total costs for moving grain are calculated for a base year. Estimates for subsequent years apply an escalation based on the rise in prices of rail inputs. The costing system is re-based every four years. Productivity gains which emerge in between the base periods accrue to the railways, but then are embodied in the costing system of the most recent base period. In effect, the productivity gains are then passed on to the grain customers every four years. This was recognized in setting up the WGTA procedures as a source of incentive for the railways to pursue productivity improvements.

A. Productivity Adjustment to WGTA Rates

Recently the National Transportation Agency (NTA, 1989) proposed a procedure in which some productivity gains which have accrued subsequent to the base year would be deducted from current cost estimates.[17] The productivity gains at issue are those which could be foreseen in the base year. These include labour downsizing as well as the impact of upgraded capacity, specifically the opening of CP Rail's tunnel. The capacity improvement lowers operating costs, e.g., fewer locomotives are needed for hauling trains through the mountains. The tunnel was not in place in the base year, 1988, therefore the base year costs did not take into account the cost reductions which would accompany the capacity upgrading. The NTA ruled that these costs should be excluded because they were not costs that would persist in an ongoing basis.

The NTA's actions can be viewed as a variation of the price cap type of regulation: productivity gains are substracted from the escalation of base year costs. But rather than apply a simple overall formula for a productivity adjustment, such as the British RPI-X or the U.S. ICC's model, the NTA makes specific modifications to the cost calculations.

We see some conceptual problems with the NTA's application of the price cap model to the grain transportation system. The formula for determining grain transportation costs, hence rates, is an incremental approach. Only costs directly attributable to grain movements are included. A specified markup (20 percent) is included in recognition of the need for all traffic to contribute to the shared overheads or common costs of the rail system. As a static model, the approach is consistent with economic principles (although whether or not the specified markup is appropriate for the elasticity of demand is an

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[16] The traditional concern for maximum rate limitation now relies on mediation, final offer arbitration and the availability of competitive line rates (CLRs). CLRs are government prescribed rates for movement of a captive shipper's traffic to the nearest competing rail line. There is no maximum rate or price cap regulation for non-grain traffic.

[17] The NTA decision was appealed but the Court had not rendered its decision by the time this paper was written.

unanswered question[18]). However, applying the concept of price cap regulation introduces a distortion. This is illustrated in the following model.

Consider a simplified model of rail costs consisting of overheads and other "constant" or "system" costs, a, in addition to costs directly attributable to quantities of different traffic volumes V_i:

$$TC = a + \sum_i b_i V_i$$

The first term in the cost function is written as a constant but part of it could vary with the overall level of rail operations. The key point is that these costs are not identifiable with individual traffic movements. The second expression is written in linear form although this is not necessary. Note that b_i, the variable costs of movement i, may include traffic-specific capital expenditures. The key point is that some rail costs are not directly attributable to specific traffic, but they may influence the costs of handling specific traffic.[19] More specifically, railways may be able to undertake expenditures in the overall system which reduce the costs associated with transporting individual traffic. There are tradeoffs between the function "a" and the size of the variable cost coefficients, b_i. CP Rail's tunnel investment is an example of this. A large indivisible investment is made which affects the costs of all traffic in that region, one of which is grain. The variable costs of handling traffic is reduced to b_i'. Presumably the railway undertakes the investment on the expectation that the capital expenditure will be recouped through the accumulated savings in operating costs, i.e.,

$$PDV \sum_t \sum_i (b_i - b_i') V_{it} \geq \text{capital cost of improvement}$$

where t denotes time, and PDV is present discounted value.

The problem which arises in connection with incorporating productivity adjustments to grain rates is that they are based exclusively on the variable costs b_iV_i. If operating cost savings are passed on to consumers in the form of lower freight rates before the investment expenditures are recouped, there is an obvious loss of incentive to the firm to carry out system investments which reduce operating costs (unless the savings in operating costs on other traffic were still sufficient to warrant the investment). Further, there is an actual penalty imposed on the firm for productivity improvements. The grain rate includes a fixed markup over variable costs. By lowering the measure of variable costs, the absolute size of the contribution to fixed or overhead costs is reduced. The firm is penalized for the productivity improvement.

B. An Alternative Framework.

It would be possible to eliminate the latter perverse consequences of a productivity adjustment by allowing the contribution margin to rise in proportion to the reduction in operating costs. For example, suppose the initial incremental cost per tonne is $30. With a contribution margin of 20 percent, then the rate would be $30 x 1.20 = $36. Suppose

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[18] Efficient Ramsey pricing principles call for differential markups of price over marginal costs which reflect elasticities of demand.

[19] It may be argued that system capacity investments ultimately are linked to traffic aggregate traffic volumes, but there can be substantial indivisibilities which obscure the link between total volumes and investment levels, and in any case it is not likely that all system capacity investments can be linked incrementally to individual traffic volumes.

productivity reduces the variable cost to $25. With the same contribution margin the rate would now be $25 x 1.20 = $30. The railway now receives a contribution of $5 per tonne compared to the previous $6, i.e., a $1 penalty per tonne for having improved productivity. To eliminate this perversity, the contribution margin could be inflated by the extent to which operating costs were reduced, i.e., the new rate would be $25 + $6 = $31. Exhibit 1 compares the results. The full operating cost savings of $5 are still passed through to customers rather than being retained by the firm, but the contribution margin remains the same in absolute terms.[20] This still leaves the firm without the incentive to invest in system improvements unless the benefits can be recouped from other traffic, but this formula at least eliminates the penalty for productivity improvements.

In sum, the overseer of the WGTA rates has the same task that faces other regulatory agencies: how to insure that price escalation formula are not used by firms to circumvent real regulated prices, while at the same time providing the firm with incentives to improve performance. If productivity gains were largely exogenous (i.e., not affected by incentives) and arose solely in their effect on variable costs, then the price cap model of deducting productivity gains from an input price index could be an appropriate regulatory model. However, productivity gains need to be computed on the basis of total costs, not just variable costs. The effect of price cap regulation on incentives is still subject to some debate in the literature. The more serious matter in applying this principle to WGTA rates is the problem noted above. The grain rate formula is founded on an incomplete perspective of total rail costs and productivity, and imposed productivity adjustments may result in distorted incentives to the railways.

Exhibit 1
Comparison of Allowed Rates and Markups

	Current Framework		Proposed Framework	
	Initial Case	After Productivity Improvement	Initial Case	After Productivity Improvement
(1) Variable Cost	$30	$25	$30	$25
(2) Allowed Contribution Margin	20%	20%	20%	24%*
(3) Allowed Rate [(1) x {1+(2)}]	$36	$30	$36	$31
(4) Contribution [(3)-(1)]	$ 6	$ 5	$ 6	$ 6

* 20% reduction in variable cost results in contribution margin increasing by 20%.

[20] The formula is as follows, we want the new absolute size of the contribution margin to equal the old one. Designate the initial markup as K (1.20 in the above example). The old contribution is b(K - 1) or $30 (1.20 - 1) = $6 in the example. We require that the new contribution b'(K'-1) equal the old:

$$b'(K' - 1) = b(K - 1)$$

Solve for K':

$$K' = \frac{b}{b'}(K - 1) + 1$$

In the example, K' = (30/25) (1.20 - 1) + 1 = 1.24. The 20% reduction in variable cost allows the markup to increase by 20%, from .20 to .24.

V. Conclusion

This paper has examined the basic principles of price cap regulation and explored its emerging application to railways in the U.S. and Canada. The ICC's application of price cap regulation is curious in that it employs a restrictive price cap model but allows supplemental price increases. The usual price cap model sets an overall revenue target for the firm and allows the firm to determine how to recover that revenue among the various outputs. The ICC applies the same cap to all traffic subject to maximum rate legislation, rather than cap overall revenues. It employs the industry average cost increase as a maximum for all regulated traffic. This will systematically result in industry revenues not keeping pace with industry average costs, unless railroads apply for further price increases some of which will be subject to traditional detailed regulatory review.

The NTA's recent decision to deduct anticipated productivity improvements from the calculated costs of moving grain between the four year base periods is a variation of the concept of price cap regulation. But because the allowed increases in grain rates are based on identifiable variable costs only, a productivity adjustment reduces the incentive for system improvements which reduce variable costs. The NTA's approach would penalize an innovating carrier because the contribution to system costs shrinks with reductions in grain-specific variable costs. An alternative formula was proposed here which does not have this flaw. The absolute overhead contribution would be held constant while productivity gains in variable costs are passed through. This eliminates the penalty for productivity improvements but there is still a dilemma that price cap regulation might limit the incentive for firms to make productivity improvements.

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United States and Canadian Railway Labour Productivity

RUNNING FAST TO STAND STILL

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1. INTRODUCTION

The purpose of this paper is to provide background on the role of labour in the Canadian railway industry. The context is one of concern about the future of railways in Canada. The industry faces stiff competition from other modes. Labour faces the prospect of continued job losses. Some regions face the threat of abandonment of service as the railways seek to rationalize and reduce costs. Shippers face uncertainty about their distribution options. Meanwhile, Canadian National and Canadian Pacific also face competition from American railways, which — after almost a decade of partial deregulation under the Staggers Act — have made important strides in cost reduction.

The competition from American carriers is of special interest. Not only is there a significant volume of trans-border traffic at stake, American railways are in a position to compete for Canadian overseas traffic. In addition, the disparity in transportation costs results in market competition which worsens the problems of Canadian producers and carriers. Thus the focus of our analysis is on a comparison of the levels of output per employee achieved by in Canada and the United States.

Another important issue is how this "productivity pie" is shared among the shareholders, because that affects the probability of achieving consensus on future productivity improvement measures. On the basis of data concerning labour productivity in the U.S., we estimate the labour force which would be required — at U.S. productivity levels — to move the 1988 volume of Canadian

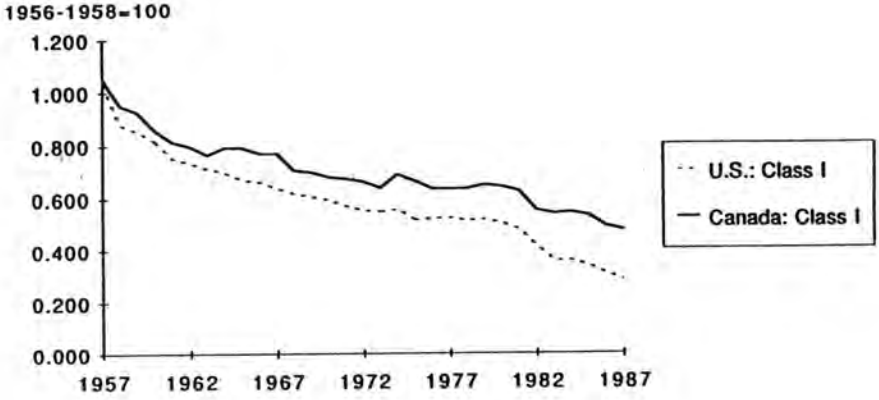


Figure 1: Railway Employment in Canada and the United States

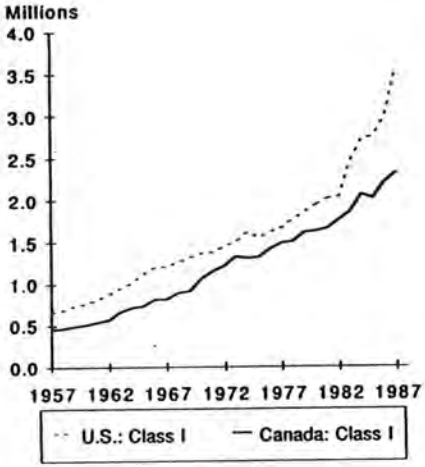


Figure 2: Traffic units/employee*

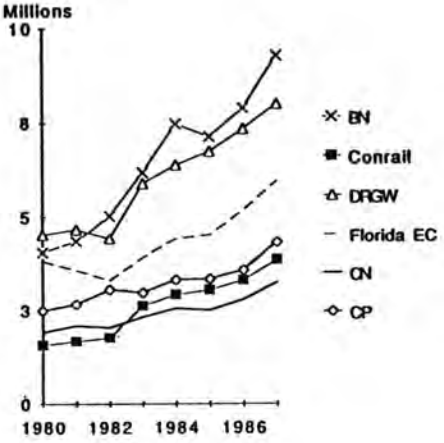


Figure 3: Tonne-km/employee

* A traffic unit is defined as one tonne-km of freight or one passenger-km.

rail traffic. The potential for productivity improvements is also addressed at the micro level, by assessing the impacts of train crew reductions, and by presenting evidence about the comparison between short line and main line costs in the United States.

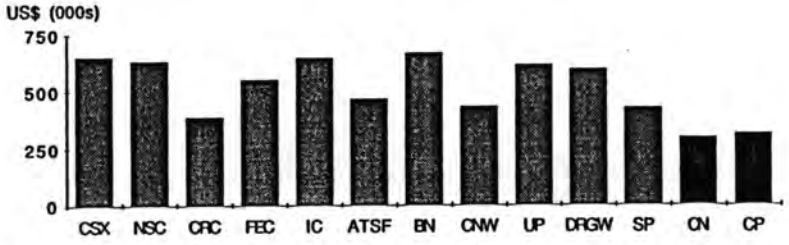
2. ESTIMATES OF PRODUCTIVITY DIFFERENCES

For most of the post-war period, Canada's Class I railways have been among the best performers in North America. Traffic growth on Canadian railways has been greater and operating and financial ratios have been healthier than for all but a handful of American railroads. Railways in both countries have had to contend with increasing modal competition; they have undergone similar technological changes, and — given that American railroad labour is well organized, both on the job and in Washington — the institutional climate of human adaptation to this change has also been similar. If the shedding of labour has been greater in the United States (see Figure 1), it is due primarily to the more sluggish growth in traffic. In 1929, there were 1.6 million Class I railway workers in the United States: today there are barely 200,000.

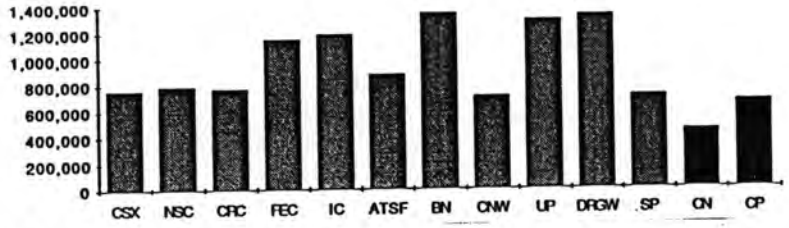
Labour productivity, as measured approximately in terms of traffic units per employee, has improved steadily on both sides of the border during the past thirty years. As Figure 2 illustrates, Canada has traditionally lagged the United States. However, this gap, which narrowed to little more than 10% during the 1970s (when Canada had a more liberal regulatory regime than the United States), has opened up dramatically in the past decade to about 35%, because of dramatic gains in output per employee in the United States. Faced with the opening up of competition as a result of the passage of Staggers, American carriers have acted vigorously to reduce labour costs. One important measure has been the spinning-out of short line companies, accompanied by the reopening of contracts. In addition, management has increased pressure on the brotherhoods to modernize the workrules as a means of addressing competition from trucking.

This contrast is further illustrated in Figure 3, which compares the growth in ton-kilometres per employee for six railways during the 1980s. Burlington Northern and Denver Rio Grande, which were among the most productive U.S. roads in 1980, opened up the productivity gap with the other four railways over the course of the decade. Despite the impressive improvements in output per employee (74% at CP and 70% at CN), the cost differentials between the major U.S. and Canadian railways remained, and are a serious cause for concern in view of the growth in competition between railways.

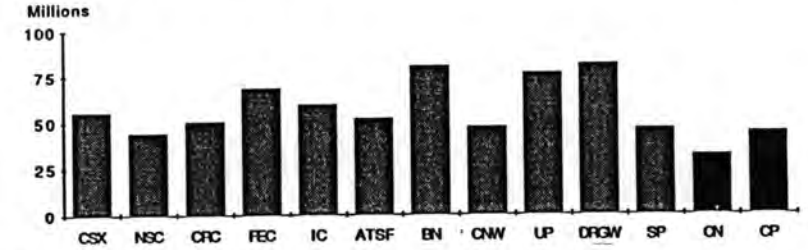
In order to better understand the reasons for the higher American productivity, comparisons were made of productivity measures in the major functional areas:



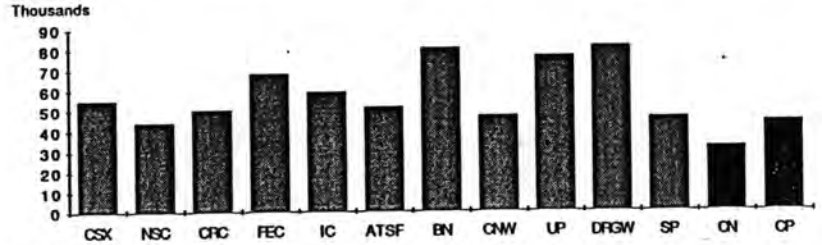
(a) Operating revenue generated per general employee



(b) Car-km per equipment maintenance employee



(c) Gross-tonne-km per maintenance of way employee



(d) Train-km per transportation employee

Figure 4: Railway Labour Productivity by Function

general, maintenance of way, equipment maintenance and transportation. These data must be interpreted with caution. The results for a particular line depend on a wide range of factors, including:

- the nature of the network (mix of mainlines and branch lines);
- the nature of the traffic (mix of bulk, intermodal, way freight);
- the extent of contracting out of activities (this was controlled for by comparing operating cost per unit of activity for the main functional areas).

Figure 4 indicates that by most objective measures CN and CP lag the major U.S. roads in output per employee. This figure presents benchmark indicators for a number of functional employee groups. (Other indicators were also measured, e.g. maintenance of way employees per kilometre of track, with similar results.)

3. DISTRIBUTION OF PRODUCTIVITY IMPROVEMENTS

So far, we have estimated the extent of productivity improvements (or, to be more precise, the increase in output per employee) and have itemized the main technological factors responsible for these improvements. The *distribution* of these productivity gains between the main stakeholders, the consumer, labour and the shareholders, is another key question. Managers in any firm promote productivity improvements in order to add value to the company, and thereby improve earnings for the shareholders.

However, other factors enter into play. In competitive environments, some or all of the productivity gains may have to be passed onto consumers in the form of lower prices. In regulated industries, firms may face ceilings on the allowable rate of return (Bell Canada) or public pressure to control prices or extend services (Canada Post). In 1988, the Interstate Commerce Commission via its "pass through" rulings, ordered the U.S. Class I railways to transfer some of the benefits of improved productivity to consumers in the form of lower rates.

The other key player is labour. Workers bear the brunt of technological change, particularly in a mature industry, and especially those workers whose skills are not readily transferable, for example firemen, brakemen or hostlers. The ability of organized labour to obtain compensation for job losses varies from industry to industry, and is primarily a function of the degree of implantation and organization of the unions and the political sensitivity of the industry. The railways are both politically sensitive and well organized, and measures to ensure job security and compensate workers for technological disruption have been adopted in both

Canada and the United States. The main findings are summarized in Figure 5. The method of calculation is explained in Annex 1.

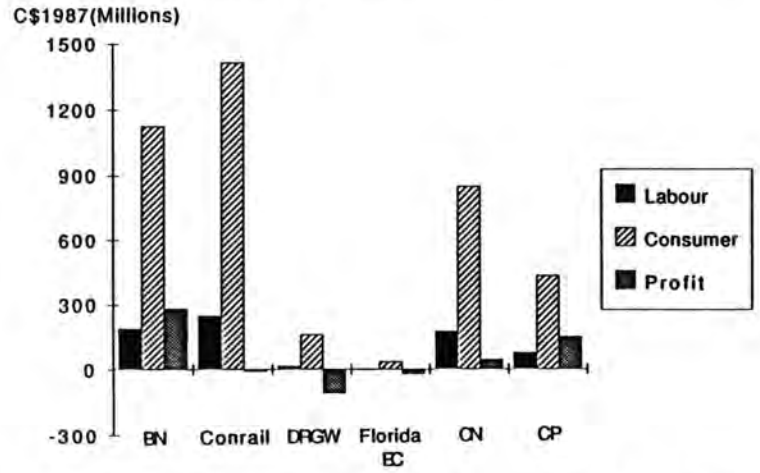


Figure 3: Distribution of Railway Productivity Gains, 1980 to 1987

The most striking result is that in all cases the biggest winners were the shippers. The productivity gains were made against a backdrop of growing competition, both modal (primarily the growth of medium- and long-distance trucking) and market (depressed commodity prices on world markets). These conditions have translated into a steady decline in yields (freight revenue per tonne-kilometre): in constant dollars, the decrease has ranged from 14% for CP to 30% for Denver & Rio Grande.[1] Labour's piece of the pie ranged from 12% at Burlington Northern and CP to 24% at Denver & Rio Grande (the mean for the six companies was 14%). This estimate is preliminary and probably understated. It includes increases in the average real wage, but does not include buy-out provisions. The productivity improvements contributed to improved profits at only three of the six railways: Burlington Northern, CN & CP. In general, the companies were constantly playing catch-up: decreases in the yield jeopardised profitability; labour productivity had to be increased to avoid crisis, and the workers who were retained by the company were rewarded by wage increases.

Two of the three companies which were able to improve profits through productivity gains were Canadian. This was due to the fact that the share which went to the shippers was smaller in Canada than in the U.S. In Canada,

[1] As might be expected, in view of the fact that the Staggers Act preceded Freedom to Move, the decreases in yield were greater in the US than in Canada from 1980 to 1987.

however, the pressure from the shippers has *increased* since 1987, as a result of the new NTA. Hence the challenge of eking out gains for shareholders and workers from productivity improvements is likely to be greater in the future.

4. THE POTENTIAL FOR FURTHER LABOUR FORCE REDUCTIONS

This question could be addressed from two perspectives:

- a "bottom-up" approach of looking in detail at each job category to identify opportunities for productivity improvements; and
- a "top-down" approach based on establishing productivity targets and determining the implications for labour force requirements.

Because this is above all a scoping study, the second approach has been adopted here. In addition, we present some estimates of the impact of train crew reductions and of implementation of short lines.

Impact of Achieving U.S. Productivity Levels

The "top-down" approach was to estimate the labour force which would have been required to move the 1988 volumes of traffic at CN and CP assuming that the two railways had been operating at the mean productivity levels achieved by the U.S. Class I railways in 1988. Two approaches were followed: the labour force requirements for each major employment category were calculated, using the appropriate performance indicators for each category. The total employment requirements were simply calculated as the sum of employees in each category. The second method was to calculate the *total* employment needs for each railway on the basis of a single productivity measure: tonne-kilometres per employee. As Table 1 *(next page)* shows, the results were comparable.

The results of this table should be interpreted with care. The message is that if Canadian Class I railways achieved comparable productivity with their U.S. counterparts at current traffic levels, a substantially smaller labour force would be necessary: 22% smaller at CP and 42% smaller at CN. This analysis does not provide a route map to get from the status quo to parity with the U.S. Nor does it take into account factors which explain differences in productivity, for example, the requirements imposed by coast-to-coast operations in Canada and the continued existence of unprofitable branch lines in Canada. Crude as it is, the message is important: Canadian railways are entering the competition with American lines at a competitive disadvantage. It also suggests that there will be a painful adjustment process as the railways struggle to overcome their handicap. And given the experience of the last few years, it is reasonable to expect continued improvements south of the border. The target will be a moving one.

Table 1: Employees Required at US Class I Productivity Levels

	Actual	Potential	Difference
CANADIAN NATIONAL			
A. General	10,208	5,534	-4,674
B. Maintenance of Way	8,352	4,519	-3,883
C. Equipment Maintenance	9,455	4,459	-4,996
D. Transportation	11,385	8,222	-3,163
Total A-D	39,400	22,733	-16,667
Total based on employees per tonne-km	39,749	23,069	-16,680
CANADIAN PACIFIC			
A. General	6,921	3,989	-2,932
B. Maintenance of Way	4,533	4,276	-257
C. Equipment Maintenance	4,693	3,336	-1,357
D. Transportation	8,158	6,392	-6,312
Total A-D	24,305	18,990	-5,315
Total based on employees per tonne-km	24,305	17,042	-7,263

Train Crew Changes

Considerable attention is being given to changes in train crew size and the basis for pay; a casual examination of current railway literature suggests that this is **the** only significant labour issue in the industry. Yet the statistics show that operating crew compensation accounts for less than 10% of CN and CP's total operating expenditures. Why are crewing changes so important? The reasons vary:

(a) The potential savings is significant. Removal of a brakeman from every CN/CP freight train would have resulted in a savings of roughly $90 million in 1987.

(b) Given current technologies, there appears to be considerable scope for improvement; such crew cost improvements must be undertaken if the railways expect to come to grips with labour issues in other areas.

(c) Crew costs are a significant component of the newer, shorter, high-productivity type of railroading that is needed to compete in the current marketplace. It is also significant that, at the margin, crew costs are an important part of the short-run avoidable costs. It is these costs which are important in many marketing decisions.

Short Lines

The topic of short lines is sufficiently important that it warrants a separate discussion. They have been advanced as a solution to the provision of rail service in low density markets. As yet, with the exception of the Central Western Railway in Alberta, the short line formula has not been implemented in Canada. The interest shown by prospective buyers seldom survives a close perusal of the books. It is unlikely that genuinely private sector short lines will become feasible until the issue of "successor rights" is resolved, in other words, until it is clear that short line operators are not bound by the labour contracts which were in place before the Class I railway sold the line. "Successor rights" are designed to protect employees from "flips" in corporate ownership, the intent of which is primarily to cut labour costs.[2]

In the United States, the development of regional and local railroads, after fifteen years of very slow growth, has accelerated dramatically since 1984: from 35,000 km to 54,000 km in three years[3]. The main features of short lines in comparison with Class I lines are:[4]

- Lower wage scales. Wage scales are negotiated locally, based on the going rate in local labour markets. In an example from Burlington Northern, short line wages ran from 34 per cent to 60 per cent less than Class I wages.[5]

- Work rules are much less restrictive: it takes only one short line worker to change a headlight compared to three on a Class I line, and workers engage in many different functions.

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[2] Care must be taken in comparing productivity of Class I railway carriers between the United States and Canada. CN and CP are the only true transcontinental railways in North America. Major US carriers are either Eastern or Western or a blend. None go from Atlantic to Pacific and serve all areas of the country. CN and CP are also different in that they include lines that in the US would be operated by regional and short-line carriers.

[3] The pace of creation of short lines has slowed considerably since a ruling of the 3rd U.S. Circuit Court of Appeals in April 1988 imposed negotiation and mediation between sellers and employees of the line (*Modern Railroads*, February 1989).

[4] Casavant, K., G. Griffin & J. Lenzi, "Rationale for Regional Railroads in the Northern United States", *Canadian Transportation Research Forum: 23rd Annual Meeting: Proceedings* (Minaki Lodge, Ont., May 1988, pp.27-35).

[5] Tolliver, D.D. & F.J. Dooley, "Short Line Rail Labour Costs," *CTRF: 23rd Annual Meeting: Proceedings* (Minaki, Ont., May 1988, p.7).

- The potential for improved job satisfaction because of the smaller scale of the operation and the erosion of traditional job demarcations. Against this should be set the reduction in morale which would occur if the employees were former Class I workers who took a substantial pay cut to work on the short line.

In addition, the Tolliver and Dooley point to the operational flexibility and willingness to go after smaller traffic lots. The reduction in labour costs as a result of the creation of short lines can be impressive: the authors demonstrate a twenty-eight percent savings in branch line operating costs.

5. WHAT ARE THE IMPLICATIONS FOR THE INDUSTRY?

The picture which emerges of the Canadian railway industry is of three stakeholders — management, labour and government — who, in attempting to win individually, risk losing collectively. The goals of the stakeholders are summarized below:

Management	• achieve acceptable return on capital for shareholders • identify and exploit profitable business opportunities • improve job satisfaction by improving labour relations
Labour	• improve job security • achieve good standard of living • achieve increased job satisfaction
Government	• maintain a viable national rail transportation network • achieve balance between equity and efficiency • avoid industrial relations strife

There appears to be an almost inexorable logic at work pushing the industry in a direction which enables none of the stakeholders to achieve their objectives. Competitive pressures cause the railways to seek ways of reducing costs. In theory, they could do this by:

1 changing work rules, to enable them to do the same or more work with less people;

2 persuading workers that it is better to keep their jobs and accept concessions than lose their jobs altogether;

3 buying labour-saving technology and employing a smaller number of workers at the old wages; or

4 getting out of business altogether.

In practice, option 1 is sometimes used, but generally requires protracted negotiations between management and labour, 2 is almost never used, leaving options 3 and 4 as the general approach. The capital-intensive approach represented by options 3 and 4 served the Canadian railways quite well until recently. The industry made important gains in productivity and, although achieving fairly low returns on capital, provided a relatively good livelihood for a large workforce and a national passenger and freight transportation service.

However, the capital-intensive strategy will face its toughest test in coming decade. Despite the progress which the railways have achieved, they will need to make major reductions in costs business in order to remain competitive with the trucking industry and the U.S. railway industry. As noted earlier, a reduction of 37% in the workforce of our Class I freight railways would be needed for them to achieve the current levels of output per employee of the U.S. Class I railways. Labour's primary objective of job security is in jeopardy.

In order to remain competitive, the trend whereby traffic is concentrated on a minority of profitable routes will be accentuated, and the railways will apply to abandon other routes as fast as the regulations allow them. *The continued existence of a national rail transportation system can no longer be taken for granted. One of government's primary objectives is in jeopardy.*

Yet there is no guarantee that if the strategy is implemented that management's primary objective will be accomplished. The U.S. railways are continuing to make progress in productivity improvement. A new generation of high productivity trucks is coming onto the roads, and discussions of harmonizing provincial trucking standards continue towards ever increased size (currently 53 ft trailers). CN's objective in its last corporate plan was not to increase its return on capital, but to roughly maintain present levels.

The resolution of the labour/productivity issue will require a distinctively Canadian approach. This should be based on the following considerations:

- *the pain should be shared equally.* That is, all parts of the railway workforce should participate proportionately in any reduction in the workforce; and

- *the benefits of increased productivity should be shared on a reasonable basis by the railways and the unions.*

This approach could take a number of forms. One model worth considering is the Canadian Steel Trade & Employment Congress, which was created by Canadian steel companies and the United Steelworkers of America in 1985 to develop a common approach on trade issues. The key is to open up forums for dialogue other than collective bargaining.

There is both a carrot and a stick to encourage such a dialogue. The "stick" is the scenario described above, under which nobody — except the competition — will realize their objectives. The "carrot" differs somewhat for each player. For the railways, it is the possibility of spreading their fixed costs over a wider range of profitable business, and reducing the frustrations of sterile, adversarial bargaining sessions. For the unions, it is the possibility of maintaining a larger membership than might otherwise have been possible. For the government, either as participant or observer, it is the reduction of labour strife in a highly visible industry, and the possibility of a reprieve for some of the marginal rail lines.

ANNEX 1 A Note on the Distribution of Productivity Gains

In order to evaluate the distribution of productivity gains, the following approach was taken. The performance of four Class I American railways, CN and CP were compared over the period 1980-1987. The following measures were tracked:

- Freight traffic (tonne-kilometres);
- Freight revenue (constant dollars);
- The yield, that is, freight revenue/tonne-km;
- Wage bill;
- Number of employees;
- Tonne-km/employee.

In order to estimate how the productivity improvements generated over the period 1980-1987 were distributed, the following calculations were performed for 1987.

- wage bill for 1987, that is compensation actually paid in 1987 (A);
- wage bill for 1987, assuming 1980 wages inflated to 1987 levels (B);
- Wage bill for 1987, with 1987 wages, but the number of employees who would have been necessary assuming 1980 productivity levels (C);
- The actual freight revenue for 1987 (D); and
- What the freight revenue for 1987 would have been assuming the 1980 yield (E).

The *aggregate gain in productivity* = C - A, because C represents the labour cost of moving the 1987 traffic at the productivity levels which existed in 1980.

The *gains accruing to labour* = A - B, representing the increased real wages for

workers currently on the payroll. (This tells part of the story; it would also be necessary to obtain estimates of the cost of buyouts of employees who were made redundant as a result of technological change.)

The *gains accruing to consumers* = E - D. This analysis assumes away competitive factors or changes in the traffic mix which may have caused the yield to decrease over the decade. The fact remains that yields have been driven down in real terms, and that it is only as a result of the shedding of labour and investment in improved technology that the railways have been able to survive at these new yields.

The *contribution to profit* is the residual which remains once the gains of labour and the consumer are subtracted from the aggregate productivity gain.

This approach was designed to provide an economical way of assessing the distribution of productivity gains. Its purpose was to outline broad trends, for example that the main beneficiary of improved productivity in both Canada and the US had been the shippers. The results should be interpreted with caution, because the approach does not measure the effects of changes in the efficiency of capital and changes in the composition of traffic.

This paper is based on background research carried out by on behalf of Transport Canada. The opinions expressed herein are those of the authors and not Transport Canada.

SOLID WASTE BY RAIL : A RESEARCH OPPORTUNITY

by

Robert L. Banks, Crew S. Heimer and Charles H. Banks*

Most of us in the transportation research community are familiar with the bleak rail freight traffic prospects of North American railways. With remarkably few exceptions, such as the surge in bulk traffics in Western Canada a few years ago and the growth in carriage of low-sulphur Powder River Basin coal in the U.S., the trend in rail market share, commodity after commodity, has been depressingly downwards for over forty years. It is therefore a refreshing change to report on the impending rise of an important new market opportunity for railways -- one which is a significant research opportunity as well.

The efficient transportation of solid wastes produced by post-industrial Canada and the U.S. represents tremendous opportunities for rail carriers struggling to improve their financial returns. In addition, it poses intriguing and complex challenges to public policy makers, equipment suppliers and transportation researchers.

Solid waste is an ideal candidate for movement by rail; it fits perfectly into the traditional traffic profile:

1) increasingly, large volumes are moving long distances;

2) waste movements are relatively heavy, especially if compacted; and

3) the commodity is so low in value that time is not critical.

Given these characteristics, it is not surprising that there are several existing and more planned waste-by-rail systems in Canada and the U.S., some of which are described on the following pages.

THE DEMAND DYNAMIC

The volume of solid waste now being generated in North America is immense. Estimates of the U.S. volume of trash alone ranges upwards from 160 million tons annually.[1] Such figures are so incomprehensible that it is easier to express them in analogous or unit terms. For example, "The year 1985 was ... the first time in the region's history, annual per capita waste generation exceed one ton for every man, woman and child in Southeastern Virginia."[2]

By far the largest and most visible waste stream element is commonly referred to as garbage. "Each of us contributes an average of 1,300 pounds a year to the growing mountain of garbage...."[3] Household garbage production is influenced by a number of factors, especially affluence, culture and population density. So it is not surprising that residents of New York City in a recent year produced almost four pounds of garbage per person per day, an amount almost one-third more than that attributed to the more densely packed residents of Tokyo and almost four times as much as citizens of Calcutta, India (1.12 pounds) or Kano, Nigeria (1.01 pounds).[4]

The waste stream flows from numerous sources. Measured by weight, the major components of the municipal solid waste (MSW) stream in 1986 in the U.S. (and by inference, Canada) were:

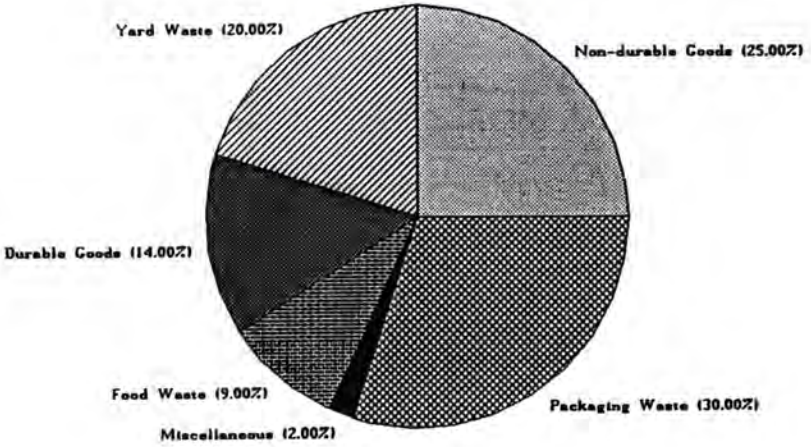
- Container and packaging waste - 30 percent (comprised primarily of paper and paper board, glass, plastics, steel, wood packaging and aluminum, etc.);
- Non-durable goods - 25 percent (comprised primarily of newspapers, office papers, books and magazines, commercial and printing paper and other non-packaging paper, etc.);
- Yard waste (leaves, grass, twigs, etc.) - 20 percent;
- Durable goods - 14 percent (comprised primarily of miscellaneous durable furniture and furnishings, major appliances, rubber tires, etc.);
- Food waste - 9 percent
- Miscellaneous organic and inorganic wastes - 2 percent[5]

The U.S. distribution of solid waste by type is set out in Figure 1.

The volume of solid waste is not only immense, it is growing. While Canadian and U.S. business and political leaders express increasing concerns about lagging productivity increases, there is one sector where both total and per capita production keeps rising, namely the rate at which both nations are producing garbage. For example, "[I]t is estimated that solid waste generated in the United States will grow at an average of 1.8 percent per year between 1980 and 2000. While two thirds of this will be due to population growth, a third will come from the increased amount of garbage generated per individual."[6] Since Canadians share the same material culture, it is assumed here that these numbers are not inapplicable to Canada.

FIGURE 1

TOTAL SOLID WASTE BY WEIGHT



Source: U.S. Environmental Protection Agency.

THE SUPPLY SIDE

A radical shift is beginning to take place in major Canadian and U.S. urban areas as increasing volumes of solid waste flowing into the waste stream conflict with a landfill capacity decline of even greater magnitude. Last year it was noted, "[F]rom an available pool of 20,000 landfills a few years ago, US capacity to dispose of MSW has declined to some 5400 landfills today and by next year Wisconsin alone will close 800 landfill sites."[8] Since 1984, "... the number of landfills for municipal solid waste in the United States has dwindled by 30 percent.... According to the 1973 report of the U.S. Conference of Mayors, over half our cities will run out of landfill capacity by 1990."[8]

More critical than the exhaustion of existing landfills is that regulations are retarding the permitting of new landfills and constraining the development of mass burn plants both of which are major alternatives to landfilling. In addition, "not in my backyard" concerns prevent landfill siting in urban areas and likewise severely restrict new mass burn facility construction. "No effort illustrates better how difficult it has become to build large public works than the city's [New York's] plans for disposing of its garbage. In 1979, the [Mayor] Koch administration proposed to build eight large incinerators. Ten years later, construction has yet to begin.... The plan has been delayed by environmental, technological, legal and political concerns."[9]

In the short term, the combination of more waste and fewer disposal and mass burn sites, especially in and near heavily populated areas is resulting in skyrocketing tipping fees.[10] For example, New York City, concerned that the capacity of its major landfill, the Fresh Kill facility on Staten Island, was being used up too rapidly, deliberately sought to divert approximately one-quarter of its usual waste stream by increasing tipping fees from $18.75 to $40.00 (U.S.) per cubic yard (2 compacted cubic yards = 1 ton) in one rate increase.[11]

It is not surprising then that heavily and densely populated provinces, cities and states in North America are exporting garbage to other locales. Canadian solid waste is shipped by rail and truck to mass burn facilities and landfills in northern New York, while New Jersey sends half its waste to Pennsylvania, West Virginia and Ohio.[12] Because of the long lead times necessary to develop landfills, permitted rural landfills with spare capacity are experiencing a seller's market.

High tipping fees are encouraging the development of new landfills in rural areas. This activity should cause an intermediate term glut (albeit perhaps a temporary one) of rural landfill capacity which, in turn, should encourage waste-by-rail activity. In the longer term, increased recycling and mass burning in combination

with moderating tipping fees may slow the growth in long distance waste rail hauls.

The saying that one man's waste is another man's wealth is now becoming a reality, with transportation enterprises among the chief beneficiaries. Railways, which are advantaged by being well versed in bulk materials transport, have within their reach the potential to tap numerous existing and rapidly developing waste handling markets for hauls to distant landfills and waste-to-energy (mass burn) plants. If acted upon adroitly, these opportunities will position railways to realize large and rapidly growing volumes of business. For example, Conrail is extremely well positioned to take advantage of the waste market, since its network serves nearly all major metropolitan areas in the U.S. Northeast and Midwest, with half that country's population. That railway expects its waste hauling market to catapult from a 1987 revenue of virtually zero, and only $.13 million (U.S.) in 1988 to approximately $4 million (U.S.) in 1989. It forecasts revenues of $10 million (U.S.) in 1990 and $100 million (U.S.) in 1995.[13]

An important factor in realizing such revenue growth is the capability to handle numerous types of waste. The generic term waste brings to mind household waste and other more common forms, each of which has different natural properties.

Although the great mass of household-originated solid waste would seem to be particularly suitable to rail transport especially if compacted, many smaller volume wastes, for example construction debris or yard waste, which increasingly are separated from other wastes, also may be markets for rail transport. Since the specialized facilities at which such wastes are disposed may be limited in number, lengthy movements are required which tend to increase the competitiveness of the rail mode. For example, "Waste Management, Inc. is building a construction and demolition debris landfill in Ohio that will be accessed primarily via rail. Railcars (open-topped hoppers and gondolas) will come right onto the site via Norfolk Southern's line."[14]

MODAL CHOICE DECISION FACTORS

The principal factors which determine the ability of rail carriers to compete with trucks in the hauling of municipal solid waste are length of haul, rail accessibility, experience and image, equipment selection, backhaul philosophy, and reliability.

Length of Haul - As local landfills close, solid waste is forced to travel further. Since rail transport incurs significantly higher terminal costs and lower line-haul costs than motor carriers, the longer the haul, the more competitive rail is. The shorter the rail haul, the more critical the impact of terminal handling costs on the rail mode's ability to compete and the more demanding the fit between equipment selection and loading/unloading/transfer system requirements.

Rail Accessibility - Assuming a moderate or longer haul, the most important determinant of favourable rail economics is that the origin, destination or both be on or near a rail line. It is fortunate, therefore, that most large solid waste movements originate in large metropolitan areas where rail access, even intramodal competition, often is available. Furthermore, our research indicates that many transfer station sites are adjacent to rail lines, either by design or because the land use zoning which permits such operations is likely to be in the older, industrial parts of metropolitan areas dotted with enterprises that historically relied heavily on rail service.

Today, proximity to a rail line is considered good rail access; because existing technology favours truck movement of solid-waste containers which are loaded and unloaded at nearby rail yards. So lack of direct rail access is of little consequence. However, to maximize transportation options and ensure low rates, future landfills and mass burn facilities will feature direct (not nearby or adjacent) rail access. New transfer station technology may take one or both of the following approaches: 1) mechanized loading of containers from compactors onto rail cars or 2) direct loading of solid waste into rail cars. In particular, direct rail access offers the opportunity to eliminate large staffs now engaged in jockeying trucks/chassis and loading individual containers at waste facilities, to free up the capital costs associated with trucks and chassis themselves, and to realize lower rates through improved railway equipment utilization associated with faster turnaround times at loading sites.

Unfortunately, many facilities with apparently good rail access are on hills adjacent to, but above (or below) nearby railway lines. The steep grades and sharp curves characteristic of rail access to hillside facilities may be impractical for future unit train formation in light of their implied increase in capital and operating costs. These hillside locations will be forever wedded to container technology with a host of trucks and drivers. Even current facilities with "good" rail access designed to accommodate the transfer of recycled materials to/from rail cars may be too limited in land or track configuration to accommodate the movement of solid waste in unit trains.

Experience and Image - Assuming access and length of haul issues are resolved favourably, perhaps the biggest challenge facing the rail mode today as it competes in solid waste transport market is that it is a latecomer. First, it is handicapped in the competition for movements to/from landfills, incinerators or waste-to-energy facilities whose original designs and engineering never even considered the rail transport option. Therefore, railways often face the threshold dilemma of competing for significant capital expenditures from often constrained corporate treasuries, or persuading potential customers to fund such investments before rail service can be initiated. Second, the

rail mode must compete with decades of solid waste movement experience and innovation enjoyed by truck haulers.

As real and significant as these disadvantages are to rail carriers competing to haul waste materials to and from existing facilities, railways should not be discouraged given the radically improved efficiency which may be achieved through rail car innovations, improved rail technology and the promise of new facilities constructed to load and unload both modes with equal efficiency.

Equipment Selection - The railway equipment selection decision should be driven by the nature of the waste material to be handled as well as the load/unload/transfer system technology. While the essence of waste and the vehicle in which it is transported make the mundane chore of loading and/or unloading a transportation focal point, all three should be considered simultaneously to maximize a systems solution. Critical waste material factors including composition, density, weight, compactibility, smell, noise, leakage, dust, and toxicity are determinants of the choice among loading and unloading methods. As an example, smell and dust must be kept to a minimum while containers are in unloading or loading stages. Public ordinances governing both noise and smell regulate when and how shipments can be unloaded. These ordinances largely determine operational characteristics of any rail transfer facility located near a residential section. Given the wide variation in each waste stream component's physical properties, it is obvious that each waste type demands specialized transportation attention. As Charles N. Marshall, Conrail's Senior Vice President-Development stated, the problem is "[W]e need a really good garbage carrying vehicle. This traffic now moves in boxcars and containers. A specialized car is needed."[15]

While there is not yet a standard equipment type employed in rail movements of solid waste or ash, containers appear to be the most commonly selected option. Container movements are most favoured because they represent the simplest adaptation to rail movement of existing waste technology, which is geared toward truck movement. Available equipment can compact more refuse into a forty foot truck than over the road weight limits will allow. Since four containers moving over a railway can move the same refuse as five trucks, rail movement offers an opportunity to reduce truckloads. Further, as garbage movements usually are closed systems with dedicated equipment, chassis control is not an issue as it is in conventional freight container movements. Thus the lower tare weight advantage of containers versus trailers on rail cars can be exploited. If terminal space is tight, containers can be double-stacked in yards and on rail cars. However, as double-stack movements mandate 125 ton capacity cars, the choice of rail routes is severely constrained by railway bridge restrictions.

Special situations require specialized equipment. A system which employed rail bogies with a well for trailer wheels to move waste by rail from Long Island across New York Harbor to northern New Jersey received praise because of its pioneering nature, but it is really a special system to move truck trailers by rail through low clearances. As yet untried for solid waste in North America, but with substantial promise, is the RoadRailer system where special trailers can be mounted and joined on rail wheels (a single truck bogie) to form trains of trailers. That system's strongest advantage is the minimal terminal facility investment required, making it ideal for small daily shipment volumes and constrained loading and unloading sites. However, the difficulty in mixing such equipment with conventional rail cars implies terminal-to-terminal dedicated service.

Modification of conventional rail car designs also may be promising for long hauls or movements with direct rail access at each end, provided technology dedicated to rail car compacting is developed. Because uncompacted garbage is relatively lightweight, conventional bathtub hopper cars exhaust their cubic capacity at less than 50 tons, thereby underutilizing potential shipment weight by at least 40 tons per unit. However, one railway added removable roofs to rebuilt surplus boxcars to facilitate loading and unloading (by rotary dumper), an inexpensive innovation in which the extra cars required by the absence of a compacted load apparently are justified by low car modification costs.

The principal obstacle to overcome in respect of employing conventional railway equipment is that as a result of truck loading tradition, compacting equipment works through end doors to fill a long box. By contrast, rail cars cannot be end loaded or unloaded without extensive individual switching of each rail car at both origin and destination. A compacting system to bale waste for top (or side) loading rail cars is the necessary next step.

Backhaul Philosophy - One of the major reasons motor carriers have been able to strip long and medium haul traffic from rail carriers is that they have found backhauls to minimize their uncompensated mileage, while rail systems often do not. This difference is at least as great in the movement of solid waste as in other commodities. Solid waste truck shipments often are the backhaul leg of another truck movement. The railway industry position is the exact opposite. Specifically, North American rail carriers are typically unwilling or unable to solicit front hauls to match up with the generally low rated trash movements. However, a recent public furor following disclosure that many trucks hauling food stuffs to the New York City area were backhauling refuse suggests that both modes soon may compete on a more level economic playing field.

In deference to the rail carrier position, we recognize that finding a backhaul for a single container which is part of waste-by-rail system is difficult enough but pales in comparison

to the logistics challenge of selling trainloads of container space from rural landfill, incinerator or mass burn facility locations. Possibly a more fruitful approach would be to try to match waste movements in rail cars with bulk coal or aggregate movements; commodities that tend to move toward metropolitan locations. The opportunities to realize such balanced moves seem particularly attractive in the U.S. context of moving waste from East Coast cities in the direction of Appalachian Mountain coal fields. We suspect that the rail movement of aggregates used in highway construction in the vicinity of Canada's major cities may provide comparable opportunities.

Reliability - A key concern of most waste management systems is reliability; trash arrives daily at transfer stations whether or not the waste transportation system is operating on schedule and according to plan. Such systems simply cannot tolerate late or inoperable trains.

Unfortunately, railways bear the burden of perceived general unreliability. In addition, as all North American waste-by-rail systems are new and, therefore, generally perceived as risky, reliability is being maximized through conservative design, often supported by a backup truck system -- just in case. The overdesign and backup flexibility impose costs on the rail system which offset inherent competitive advantages.

EXISTING AND PLANNED WASTE-BY-RAIL MOVEMENTS

In Canada, negotiations are underway for a refuse movement by rail from Toronto to a distant landfill. No doubt other opportunities will arise as increasing demand and decreasing landfill supply conflict. In the meantime, it is useful to look south of the border to examine existing and planned waste-by-rail ventures.

Eastern Massachusetts

The first railway in the United States to haul solid waste by rail on a large-scale was the Bay Colony Railroad. On June 26, 1989 this 122 mile long shortline began carrying solid waste from the Upper Cape Regional Transfer station at Otis, to SEMASS, a trash-to-energy plant in Rochester, both in eastern Massachusetts. "Recently Bay Colony's solid waste handling system has been hauling six to eight carloads per day, six days per week, with each car carrying 40 to 45 tons"[16] or more than 50,000 tons of trash annually.

The waste moves in 50-foot boxcars, modified by NRUC Corporation to incorporate a removable roof made from the original boxcar roof. "Interior dividers and lining provide strength and create the smooth free fall area necessary for handling solid waste. In transit the cars are totally sealed."[17]

"The $208 million (U.S.) SEMASS plant is a 1,800 tons per day facility that employs a 'shred and burn' process," designed to generate 52 megawatts of electricity, enough to power about 18,000 households. A second phase should increase capacity to 2,700 tons daily. Fuel is provided by means of rail-delivered refuse collected at two principal locations. The towns of Mashpee, Falmouth and Sandwich built a $1.8 million (U.S.), 150 tons per day transfer station adjacent to Bay Colony trackage in Falmouth, at which a front end loader pushes the waste into the Bay Colony rail cars. A second refuse-providing facility at Yarmouth, MA accepts inbound trucks which dump waste on a tipping floor. Waste is then dumped into the rail car below by a front end loader."[18]

New York

All three of the rail carriers that serve the largest U.S. city are either already moving or actively soliciting waste-by-rail shipments. Present rail efforts are hampered by low truck rates caused by the heavy terminating imbalance in the region. This prompts teamsters to move garbage at backhaul rates towards the U.S. Midwest from which westbound loads can be solicited more easily. Such backhaul truck rates so far have been a major factor in hampering the efforts of rail carriers seeking the headhaul rates commensurate with their pricing philosophy. On the other hand, the avoidance through rail shipments of congested river crossings is a big plus for the railways.

Los Angeles

The Los Angeles County Sanitation Districts is evaluating a short list of waste-by-rail proposals from among the 10 responses it received to an RFP it recently issued. The most ambitious of those proposals is designed to move as much as one-third of the 48,000 tons per day of trash generated daily in the County, nearly all of which presently is trucked to 10 rapidly filling public and private dumps.

Seattle

In 1989, the Seattle City Council selected Waste Management Inc., to move that city's garbage via truck and rail in a twenty year contract which has been estimated to be worth $230 million (U.S.). Garbage is gathered from four transfer stations compacted into 'slugs' of approximately 7.5 x 7.5 x 37 feet, weighing approximately 25 tons each, loaded into containers and on to rail cars hauled in trains operated by Burlington Northern Railroad to Portland. At that point, the freight cars and their loads are interchanged to Union Pacific Railroad, for movement to WMI's landfill in Arlington, Oregon where the containers are taken off the rail car, placed on a Columbia Trailer tipper, unloaded, and placed back on the rail car. The reported initial charge of $38 (U.S.) per ton includes the 37 hour, 320 mile roundtrip by rail.[19]

The two million tons annually and $15 to $20 million (U.S.) in initial freight revenue associated with this one move suggests the tremendous potential represented by the waste-by-rail market.

Montgomery County, Maryland

The Northeast Maryland Waste Disposal Authority is constructing a two-way waste-by-rail system through the northern suburbs of Washington D.C., in which an ash residue movement to a landfill resulting from and originating at an MSW mass burn facility will return by rail to the transfer station from which backhaul solid waste rail movements originated. Rail movement totaling only 36 round-trip miles was chosen to ameliorate various adverse impacts on the County and its residents including the avoidance of constructing a mass burn facility in the neighborhood adjacent to the transfer station.

The crucial reliability of this new rail movement is being addressed by designing a container system with spares and sufficient truck chassis for direct movement to the landfill in event of rail service interruption. In addition, to maximize regular movement, reliability was designed into all system components under Montgomery County's control. Train length had to be minimized not only because of constraints on yard track length on the loading area, but also because of the need for on-site runaround tracks at both facilities, so a double-stack container system was selected. The system will be capable of moving over 2500 tons of refuse per day.

Research Potential

The opportunities for market, economic and technical research related to the movement of solid waste by rail are patent. Railway managements may not like passengers *per se*, but the solid waste which they generate is another commodity altogether.

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Linking the Disciplines of Engineering and Economics in Transportation Infrastructure Planning

by

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1.0 Introduction

Engineering and economics have more in common than their first letters - in fact, some may view both as dismal sciences. Among other similarities, both disciplines deal with measurement, forecasting and recommendations, yet the two are not always integrated in an adequate manner when it comes to financing issues in transportation. Decisions based on pure engineering analysis without regard for the value of resources consumed or for their changing value over time is as serious an omission as the calculation of the economic cost of building a structure without regard for its engineering integrity. In the first case, the transportation planner may find that funds run out before the project is completed while a failing in the second case may result in the structure simply collapsing.

With rising costs of capacity maintenance and expansion in transportation infrastructure, Canada is faced with difficult choices in determining which elements of transportation infrastructure supply will be rehabilitated, which upgraded and which allowed to decline. When transportation issues are arrayed against health, education, pension and other important areas, and when all of these choices are further constrained by the problems of untenable public debt levels and growing environmental concerns, the extent of this major dilemma may seem unresolvable at times.

Within such a system of financial envelopes and constraints, transportation planners must do more than calculate costs. Traditional approaches dealing with supply side solutions are not sufficient in this changing environment. Methods of transportation planning that deal with demand modification will be important for the future. Yet, even within the supply side, further advancements can be made in the quality of the financial estimates. This paper deals with the question of financial discounting and optimizing of transportation infrastructure. It analyzes the impact of differing discount rates on expenditure choices, using recent highway costing analysis as the data base. The results apply with equal weight to airport facilities, the seaway, ports and rail lines.

1.1 Investment Strategies and Discounting

Private businesses make investment decisions based on discounted values of future costs and benefits. The discounting process is necessitated for such comparisons since the future streams of costs and benefits are not equal year after year and do not occur in the same patterns. Public sector investment decisions may not always be subjected to the same discounting rigour. This may be due, in part, to the fact that government expenditures do not give rise to asset creation in the same sense that a private company annually amortizes expenditures on long-lived assets. Public expenditures are simply costs for the year in which they occur.

The arithmetic process of discounting is not complex. The chosen discount rate represents the estimated difference between values today and in future periods.

For private business, the discount rate may represent the cost of borrowing funds, the cost of generating internal funds or some other measure of the cost of acquiring the asset over time. Choices of preferred investments may change due to the selection of discount rates, since irregular dollar flows in future years will have different discounted present values. Investment projects with heavy costs in later years may be preferable to those with higher front end costs when discount rates are high, even though the latter project appears less costly when future values are not discounted. Selection of the discount rate can predetermine the results of the investment analysis.

The actual discount rate to be used needs to be justified on its own without regard for its impact on the results. Choosing a discount rate of zero percent implies the incorrect conclusion that money has no value over time. Such a rate cannot be justified any more than one could justify an inordinately high discount rate that makes all future costs virtually disappear when viewed from the present.

1.2 Choice of Discount Rate

The choice of a discount rate depends on where the funds will be secured for the expenditure. In its purest sense, the discount rate reflects the opportunity cost of the funds. In the case of private investments, a company looks at all of the alternatives for the use of its funds and all of the sources available to it. The "hurdle rate" established by the company simply reflects the internal rate of return for the last investment undertaken from the pool of funds available, where investment opportunities are ranked according to their profitability. This "hurdle rate" simple means that the cost (financing rate) of acquiring additional funds for one more investment

exceeds the internal rate of return for the next available investment. The source of funds for the firm is not unlimited and eventually the cost of borrowing exceeds the returns achievable from undertaking another investment.

For the public sector, the source of funds is equally important. Raising funds through added taxes has the same effect as depriving a private sector investor of the returns that could be achieved from investing the money now being taxed away. Consequently, the public cost of funds, at the margin can be equated with the private cost of funds. The impact of taxation on public versus private entities can modify this, as can the "ability" of the public sector, through policies - affecting the future of the economy, it may be argued, could cause a difference between the public cost of funds versus the private cost.

Alternatively, when choosing between available public sector investments within a budget envelope, the opportunity cost may be seen simply as the returns that could have been achieved through other public investments. Studies done for Treasury Board and the Economic Council of Canada have developed a variety of rates ranging up to 10 percent. Glenn Jenkins has suggested that the real rate of interest has been quite stable through time, ranging from 2.8 to 4.2 percent. This would be the rate applied to the future capital and operating dollars, stated in constant dollars, to discount to a current period. Ibboston and Sinquefield, well-known for pioneering work in this area, have forecast that the real rate of return on long-term government bonds (U.S.) is in the order of 4.67 percent. The Canadian Transport Commission, in decisions affecting future investment in railway infrastructure and operations, chose a number of real rates of return for discounting: 4.0, 5.3 and 6.9 percent; the differences arose from the entity under examination (CN or CP) and the different data available when decisions were made. Interestingly, Glenn Jenkins, recommended to the CTC, in 1976, that for railway relocation purposes, a real interest rate of 4.0 be adopted.

Clearly, there are a variety of rates and the choice depends on the question being evaluated. In general, we would expect to use a rate in the 4.0 to 6.0 percent range. The purpose of this paper is not to argue for the use of a particular rate, but to demonstrate that the choice of rate is, itself, important. Further, this paper is asserting that use of a zero percent real interest rate for capital projects is wrong. For this reason the results of the RTAC Roadway Infrastructure Study should be reexamined to recognize the impact of not looking at the time value of public funds. These matters are reviewed more fully in the following sections.

2.0 RTAC Roadway Infrastructure Study:

In 1987, the Roads and Transportation Association of Canada (RTAC) embarked on a financial study of Canada's road and street system(1). It encompassed all federal, provincial and municipally funded roadways ranging from urban freeways to those with earthen or gravel surfaces. Its primary objective was to identify the historical level of expenditures on the network from a national perspective vis-a-vis those levels required to maintain minimum acceptable levels of service and rideability.

The analysis was conducted based on actual expenditures during the ten year period from 1975 to 1985. It revealed a consistent level of funding at approximately $7.7 billion in constant 1985 dollars, until 1981. Coincident with the economic recession , expenditures declined to approximately $6.4 billion by the 1984/85 fiscal year.

The corollary to this analysis was the determination of the funding required to maintain the system. These needs were identified using a model of the life cycle of a "typical" section of roadway.

The RTAC study assumed a 45 year life for the road and proceeded to focus on the downstream costs required to preserve it, including those needed for its operation, maintenance, resurfacing and eventual reconstruction. A similar analysis was carried out for bridge structures in the system. The total annual requirement was then estimated by applying these average unit costs to the entire road system. This figure was approximately $8.1 billion (constant $1985).

Using the projected annual funding requirements of $8.1 billion and the actual expenditures of $6.4 billion, during 1984/85 fiscal year, the study identified a significant shortfall of $1.7 billion. The most important finding however, was that this shortfall existed in the annual government budgets for maintenance and resurfacing. In effect, the shortfalls were the result of a structural budget deficit and could not be corrected with a one-time funding increase.

Given the serious implications of these findings this section attempts to discuss the sensitivity of the underlying assumptions.

The life cycle approach used in the study lends itself favourably to financial cash flow analysis. Indeed, public investment in a highway is the economic equivalent of a particular stream of cash flows over the life of that road. It also raises the question of whether the highway is optimally invested. In other words, is greater investment in the initial construction of the highway justified by even greater savings in maintenance and

resurfacing expenditures further downstream. This trade-off is examined in greater depth in section 3.0 of this paper.

The RTAC study addressed this to some extent by recognizing that the timing of roadway expenditures is fairly critical. This stems from the fact that inadequate maintenance expenditures tend to cause the road to deteriorate at an accelerating rate. As a result, larger expenditures will be required at a later date. However, delays in maintenance and resurfacing expenditures have significant offsetting benefits if one incorporates an appropriate discount rate.

The RTAC study assumed that it would be resurfaced after 18 years. A second resurfacing would be required 15 years later in year 33, and a reconstruction at year 45. Total resurfacing and reconstruction expenditures were then divided by 45 years to determine the average unit cost per kilometre (2-lane) of road for each type of surface (paved, gravel, etc.). It should be noted that the RTAC study did not apply a social discount rate in the calculation of annual costs.

In this paper, the authors converted the RTAC average unit cost of the resurfacings and reconstruction back to the actual expenditures which would take place at years 18, 33 and 45. These expenditures along with those required annually for operations and maintenance (snowplowing, patching, etc.) were assimilated to form a cash flow profile for each type of road.

Once the cash flow profiles were developed, it was then possible to test the sensitivity of the annual requirement and shortfall to varying discount rates. The analysis was extended to examine the effect of varying pavement life cycles on the present worth of life cycle costs. By comparing the present worth of costs for two different design life cycles, it is possible to estimate the incremental investment in initial pavement strength which can be justified in order to realize the savings (lower present worth of downstream expenditures) which would accrue from a longer life cycle.

Table 2.1 shows that there is no benefit in being able to delay the downstream expenditures when using a discount rate of zero percent. In this example, for a one-kilometre section of paved provincial highway, the present value of the annual maintenance, periodic resurfacing and reconstruction expenditures is constant at $829,000 ($1985). In other words, any funds spent on strengthening the highway would be greater than the present worth of the future savings. A much different picture develops when the discount rate is increased. At 5 percent, the present worth of the downstream expenditures is approximately $223,000 for the base case (first resurfacing at t=18 yrs.). If the first resurfacing could be delayed for five

years however the present worth of the expenditures is $20,000 less.

Table 2.1
Present Worth of Downstream Expenditures
For 1 Kilometre of Highway
(Thousands x $1985)

		Years Before First Resurfacing is Needed					
		10	12	15	18	20	23
Discount Rate (%)	0%	829	829	829	829	829	829
	5%	275	253	237	223	215	204
	10%	128	117	106	98	94	89

Notes:

1) Assumes a paved provincial roadway (2 lane-km)
Source: "RTAC Road Infrastructure Study", p.5. in CTRF Proceedings (1988), p.531.

2) Cash flows are as follows :
O & M: $ 7,400 for t = 1,2,3 ... 45
1st Resurfacing: $ 94,500 at t = 10,12,15,18,20 or 23
2nd Resurfacing: $ 94,500 at t = 1st Resurfacing +15
Reconstruction : $ 270,000 at t = 2nd Resurfacing +12

3) All unit costs are in constant 1985 dollars.

4) Time horizon is 50 years.

The concept is more important than the actual numbers here if one considers that adding strength during the initial construction period is only an incremental cost to the whole project. Thus, any additional strength that could be added at a cost of less than $20,000/km would provide savings in the long run. This is even more pronounced if the first a resurfacing occurs before 18 years. For example, if the initial resurfacing must be done after 10 years it is worth approximately $20,000 to be able to delay this by just 2 years by increasing the initial design strength.

Table 2.2 shows the equivalent annual cost (EAC) taking into account varying design life cycles and discount rates. The present worth and EAC measures forge a much stronger link between engineering and economics than average annual cost in the pursuit of optimal highway investments.

Table 2.2
Equivalent Annual Cost of Downstream Expenditures
For 1 Kilometre of Highway
(Thousands x $1985)

		Years Before First Resurfacing is Needed					
		10	12	15	18	20	23
Discount Rate (%)	0%	18.5	16.6	16.6	16.6	16.6	16.6
	5%	15.1	13.9	12.9	12.2	11.8	11.2
	10%	12.9	11.9	10.7	9.9	9.5	8.9

Notes:

1. Assumes a paved provincial roadway (2 lane-km)
   Source: "RTAC Road Infrastructure Study", p.5. in CTRF Proceedings (1988), p.531.

2. Cash flows are as in explained in notes to Table 2.1.

3. All unit costs are in constant 1985 dollars.

4. Amortization Period = 50 years.

Other highway engineering factors are also implicit in the definition of an optimal highway investment. For instance, the terminal riding comfort index (RCI) which is the standard or trigger value determining when to resurface the road, will have a major impact. Setting a higher terminal RCI will signal the need to resurface earlier and more often than a lower RCI. Note that with a lower RCI, highway administrators are transferring a greater portion of the total social costs to the motoring public in the form of increased vehicle operating costs. Limited latitude is available in altering this terminal RCI however, as it is determined to a great extent by the traffic volumes which are expected on the route. Highly travelled routes suggest a corresponding higher terminal RCI in order to minimize vehicle

operating costs. A truly optimal investment plan will incorporate these costs as well, so that the lowest total social cost alternative is implemented.

Another factor has received relatively little attention in the literature, that is the total size of the highway network in terms of length (2 lane-km). Table 2.3 below employs the unit costs given in the original RTAC study and the total road network length in 1985. In that study the minimum annual roadway expenditures attributable to road needs was $7.5 billion or 93 percent, with bridge structures accounting for the remaining 7 percent of the total $8.1 billion. In Table 2.3, the $6.82 billion equivalent annual cost corresponds to a discount rate of 0 percent and 18 years before the first resurfacing, roughly approximates the $7.5 billion figure calculated in the RTAC study as the roadway "needs". Discrepancies in the figures are due to conversion of average annual cost back to expenditures and then discounting to present value.

Table 2.3
Equivalent Annual Cost of Downstream Expenditures
For Entire Canadian Road Network
(Millions x $1985)

		Years Before First Resurfacing is Needed					
		10	12	15	18	20	23
Discount Rate (%)	0%	7,250	6,820	6,820	6,820	6,820	6,820
	5%	5,900	5,580	5,330	5,100	4,970	4,790
	10%	5,080	4,820	4,530	4,320	4,210	4,080

Notes:

1. Source: Table 1: 1985 Road Network Length &
   Table 2: Average Annual cost per 2-lane km,
   "RTAC Road Infrastructure Study", pp. 4-5.

2. Total Roadway Length = 841,411 km.

3. All unit costs are in constant 1985 dollars.

4. Time Horizon = 50 years.

5. Bridge structures are not included.

One may still observe that by using the EAC and an appropriate discount rate the annual requirement is dramatically reduced. Note that a relatively small increase in the discount rate to 5 percent pares approximately $1.5 billion or more than 20 percent off the total annual funding requirement.

Table 2.4 illustrates the further dramatic impact on the EAC or annual funding requirements by changes in the physical length of highway infrastructure. For example, if the network was rationalized by 10 percent the road maintenance and resurfacing needs could be trimmed to just under $ 4.6 billion, assuming a 5 percent discount rate. Conversely, an increasing network of paved roadway will continue to inflate the annual requirements.

Table 2.4
Equivalent Annual Cost of Downstream Expenditures
For Entire Canadian Road Network
(Millions x $1985)

		Percent Change in Length of Total System				
		-20%	-10%	0%	10%	20%
Discount Rate (%)	0%	5,460	6,140	6,820	7,500	8,190
	5%	4,080	4,590	5,100	5,610	6,120
	10%	3,460	3,890	4,320	4,750	5,190

Notes:

1. Assumes base case :
   Annual O & M, resurfacings at t = 18 and 33,
   with a reconstruction occuring at year 45.

2. Total Roadway Length = 841,411 km.

3. All unit costs are in constant 1985 dollars.

4. Time Horizon = 50 years.

5. Bridge structures are not included.

Historical increases in traffic volumes have served to obscure the total system length as part of the optimal highway investment equation. Railways on the other hand are quickly coming to grips with this problem and have already begun to rationalize uneconomic branchlines and move towards optimal networks. While this may be somewhat premature in the case of highways, the proportion of the network comprised by each surface type (earth, gravel, paved) should receive close scrutiny.

The National Highway Policy initiative is closely linked to the concept of optimizing the total roadway inventory. As part of the Phase 2 report (2), the cost of upgrading the designated National Highway System to set of prescribed minimum standards was estimated. The total capital costs required were $12.7 billion. This compares with estimated highway user benefits of $10 to 17 billion using 10 and 5 percent social discount rates respectively.

A second scenario was also considered which would bring the entire System up to the maximum geometric design standard of a fully access controlled and divided four lane highway. Implementation of the maximum standard was estimated to cost $17.5 billion or an additional $4.8 billion ($1989). One may also note that the downstream expenditures required to maintain this facility are not included in the cost estimate. Incremental user benefits expected to result from this scenario ranged between $590 million and $960 million.

The RTAC Road Infrastructure Study and the National Highway Policy initiative have made a significant contribution to defining the road funding crisis. However, both studies appear to be based on two critical assumptions: 1) that the size of the network is optimal; and 2) that design standards are optimal.

The analysis presented above demonstrates the sensitivity of investment requirements to assumptions about the social discount rate, design life cycles and the size of the system. It is clear that much work remains to be done in developing an optimal highway investment strategy for Canada.

3.0 Transportation Infrastructure as an Investment

In a fiscal environment characterized by growing deficits and increasingly scarce financial resources it is critical that investments in transportation infrastructure are subjected to rigorous economic evaluation. Is the investment justified? How large should the investment be? Are design trade-offs optimized? How should the investment be staged? What costs should be recovered from users and how?

Recent research published by The Brookings Institution examines these and other economic decision criteria in relation to the U.S. highway system. Particular emphasis was given to the linkage between highway pricing and investment policy.

Before examining the major concepts and findings of the Brookings research it is useful to have some appreciation of the relative level of investment and cost recovery on the Canadian versus U.S. highway system. The most recent data available for both countries is 1985 data.

Table 3.1
Highway Expenditures and Recoveries
Canada vs. United States
1985

	Canada(1)	United States(2)	US/Canada
Expenditures($ billion)			
Capital	$2.649	$26.570	10.03
Maintenance	$1.621	$16.590	10.23
Other	$0.821	$14.300	17.42
Total	$5.091	$57.460	11.29
Road Tax Revenues($ billion)(3)			
Federal	$2.057	$11.570	5.62
Prov/State	$4.245	$24.030	5.66
Total	$6.302	$35.600	5.65
Recovery Ratio	124 %	62 %	
System Size (miles)	520,000	4,000,000	7.66

Notes: (1) Source: National Highway Policy for Canada: Phase 2 Report (ref. 2)
(2) Source: Road Work: A New Highway Pricing and Investment Policy (ref. 3)
(3) Includes fuel taxes, licenses, registration, permits, tolls

To the extent that 1985 is representative of typical expenditure/revenue patterns, one might conclude that the U.S. is investing more in its highway system and recovering less from highway users on a relative basis than Canada. The U.S. network is approximately 7.6 times larger than the Canadian system in terms of mileage (note:this may be understated in terms of 2-lane equivalent mileage), yet they are spending in excess of 11 times more than Canada. Is Canada underinvesting or is the U.S. overinvesting? Are Canadian road users paying too much or are American road users paying too little, or both? In the remainder of this paper the authors will attempt to demonstrate that aggregate revenue/expenditures such as the one presented in Table 3.1 prove little if anything about the optimality of highway investment and pricing policies.

3.1 Optimization of Investment Concepts

The issue of "optimality of investment" is the central theme of the Brookings research. The researchers proposed a new direction in highway policy which would incorporate a program of optimal investments in road durability, a set of pavement-wear taxes for heavy trucks and a set of congestion taxes for all vehicles.(3:7) While some of their findings and recommendations may be somewhat controversial, their work provides an excellent illustration of how the disciplines of engineering and economics should be linked in transportation infrastructure planning.

The economic principles underlying their proposals are summarized below:

> **"The best way to economize on maintaining and using an existing road is to apply a user charge equal to the actual cost each user imposes on society through his effect on the road's condition and on the speed that other users can travel. Such a charge, known as the marginal-cost user charge, ensures that the independent decisions by users reflect the interests of all. Marginal cost is defined as the change in total social cost of travel on existing roads, including costs of road maintenance and costs incurred by all its users, brought about by adding one vehicle of a particular type and weight at a particular place and time. If road users are required to incur this entire amount themselves, they will use the highway (at that time and place) only if the value to them of doing so exceeds the amount society must pay, in aggregate, to accommodate them. Low-priority uses are thereby deterred and high-priority uses are accommodated with fewer deleterious effects from crowding or pavement deterioration.**

> **The social cost of road use depends also upon the design of the road. The better the road, the smaller the cost of use and the associated marginal-cost user charge. Optimal investment policy focuses on this trade-off: capital is initially invested in the design and construction of the highway up to the point where any further investment would cost more than the resulting savings. This trade-off ties investment policy to user charges, or pricing policy, and points to another advantage of marginal-cost user charges: the resulting revenues provide a tangible signal to public officials as to whether additional investments to provide more or better service are likely to be worthwhile." (3:9)**

The linkage between road pricing and optimal investment is the most unique feature of the Brookings research. The concept of marginal-cost user charges is widely supported in the literature, but this is the first research which addresses in a significant way the relationship between marginal costs and optimal investment. The message is that marginal-cost user charges alone will not maximize economic efficiency. Such charges must be derived from an "optimally invested" facility.

As the researchers point out, road investment has two dimensions: capacity and durability:

> **"Capacity is needed to accommodate the vehicle flow without excessive congestion and is typically increased by adding lanes, making them wider, improving shoulders, improving intersections, building a median, or adding overpasses. Durability__long-term pavement serviceability__ is needed to accommodate a cumulative flow of heavy vehicles without excessive pavement damage and the accompanying extra costs to both the public treasury and highway users. Durability is typically increased by making the pavement thicker, improving the base beneath the pavement, improving drainage, using better materials, using steel reinforcing rods, improving joints between sections of concrete,or tightening construction tolerances.**
>
> **Because both types of road investment are expensive, optimal investment will involve some scarcity, both of capacity and durability. Pricing is a natural economic response to scarcity, and the two types of scarcity lead to two types of user charges. Charges associated with scarce capacity, which causes congestion, should reflect a vehicle's contribution to congestion. Charges associated with scarce durability, which causes road wear (that is, pavement deterioration), should reflect a vehicle's contribution to this wear." (3:10)**

Although there are several categories of road-wear costs which must be considered, the periodic overlays which are required when a pavement becomes worn tend to be the dominant component. Pavements are designed to withstand a certain number of axle load repetitions, with the damaging power of an axle related to a standard 18,000 pound single axle, commonly referred to as an ESAL. The equivalence factor for an axle rises steeply with its load__ ie. to the fourth power (note: recent research has questioned the "fourth power" relationship and indicated that it may more closely approximate a third power relationship (3:11)).

In optimizing pavement durability design the objective is to find the pavement thickness which will minimize annualized maintenance costs, vehicle operating costs and equivalent annual capital costs. Incremental pavement thickness causes a higher initial capital cost, but this is offset by reduced expenditures on maintenance and resurfacing taking into account the time value of money (ie. resurfacing expenditures are deferred due to longer pavement life and are therefore discounted more heavily). At some point the downstream savings arising from incremental thickness are equal to the incremental cost. This represents the theoretical optimal investment in pavement durability.

The optimization of capacity investments is somewhat more complex because highway capacity is typically added in large increments (eg. addition of a climbing lane, twinning etc.) and furthermore traffic conditions on a particular road can vary widely from section to section and by time of day. Highway capacity utilization is measured in terms of "passenger car equivalents" (pce). Each vehicle is assigned a pce value which relates it to an average car in terms of its impact on capacity utilization.

The primary determinant of road capacity is the number of lanes. Adding lanes raises capital and maintenance costs but reduces congestion costs. The Brookings researchers define optimal capacity as follows:

> **"At the margin, it makes sense from an efficiency standpoint to add width (or other capacity-improving measures) until the incremental cost of additional capacity equals the incremental congestion-cost saving that it brings about. That incremental saving is just another facet of the incremental cost of congestion, so the user charge forcongestion can be viewed as a charge for providing the capacity needed to keep congestion to a tolerable (that is, efficient) level." (3:14)**

3.2 Brookings Research Conclusions

Using the economic principles outlined above and a variety of econometric analysis techniques the Brookings researchers the following major conclusions and recommendations:

1) If the propsed pavement-wear taxes for heavy trucks (based on axle loads not vehicle weight) and congestion taxes for all vehicles were adopted, and, if a program of optimal investments in road durability were implemented, net benefits to society of approximately $13 billion (1982 $'s) annually would be generated.

2) Pavement-wear charges and optimal investments in road durability would generate $8 of the $13 billion in benefits largely due to the downstream savings from stronger pavements. The $5 billion in net annual benefits from congestion charges are due primarily to time savings to motorists.(3:7)

3) It was estimated that even with no changes in user charges, increased investment in road durability to the extent of an annualized value of $2.2 billion would lower annualized resurfacing costs by $8.5 billion for a net saving of $6.3 billion annually.(3:116)

4) The impact of increased durability and road-wear pricing together on the trucking industry would be approximately neutral, yet the two would reduce the highway budget deficit by an estimated $6.3 billion annually. It is estimated that the proposed user charges will cause some shift of traffic loadings to truck types with more axles and some shift from truck to rail. With the recommended pavement strength improvements, the proposed marginal-cost user charge for a typical 80,000 lb fully loaded five-axle tractor-semitrailer in inter-city use would be less than two-thirds the average fuel and weight-related taxes and registration fees currently paid.(3:117)

5) Revenues from marginal-cost user charges would road expenditure recovery ratio to approximateley 80 percent of long-term capital and maintenance costs for major urban roads (3:113). Increased cost recovery from pavement-wear and congestion charges combined with reduced expenditures would permit a reduction in traditional road charges (eg. fuel taxes, licenses, etc.). However, the proposed marginal-cost user charges would still leave a substantial overall highway budget deficit.

6) Capital and maintenance costs for increased pavement durability are dwarfed by the cost of providing sufficient capacity to accommodate peak-period travel. Congestion charges could generate tens of billions of dollars of annual revenues and annual time saving benefits of approximately $5 billion per year with minimal capital spending.(3:117)

4.0 Conclusion

It is impossible to judge the extent to which the Brookings research findings are transferrable to Canada. To be sure there are significant differences in the characteristics of the two highway networks, including traffic volumes, exposure to freeze-thaw cycles, use of rigid pavement, weight and dimension regulations, etc.

The research does demonstrate however that we can ill afford to use "straight line thinking" in determining the appropriate level of investment in transportation infrastructure in today's fiscal environment. The extrapolation of past trends on the demand side and the application of unit costs and existing design standards on the supply side has the potential to distort the true picture of infrastructure needs which can be economically justified.

The analysis presented in section 2 of this paper is only a superficial examination of the sensitivity of the assumptions upon which the RTAC Road Infrastructure Study is based. However, when combined with the findings of the Brookings research it is clear that the pay-off from linking the disciplines of engineering and economics in the formulation of highway investment and pricing policies is potentially enormous. If Canada is to remain competitive in a global economy it must have an efficient, low cost transportation system. On the infrastructure side this means that we must not overbuild the system and attempts should be made to optimize the economic trade-offs inherent in design standards.

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THE WAY

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History/Background

In the beginning, the transportation infrastructure consisted of a system of waterways and trails. Canals and locks were constructed to overcome escarpments. At the time of Confederation rail was the state of the art in transportation technology. Land was abundant and inexpensive. To tie the nation together, large public investments in the form of rail infrastructure and land grants were made. The establishment of such things as the Crow Rate and Crown corporations indicated the importance of transportation to a sparse population spread over large distances.

As time passed and technologies developed, highways were constructed at public expense. Air travel evolved with government intervention by provision of terminal, ways and vehicles.

A number of royal commissions on transportation reported to Parliament at various times. Recommendations were accepted and implemented, or disregarded. The different levels of government played important roles and influenced every aspect of transportation. Government decided where and when infrastructure would be constructed (for defence or other reasons) by controlling the purse strings since governments were the only entities with the necessary largesse to undertake the massive investments. Boards of Public Utilities and Motor Carrier Boards were established to protect the public interest. Through the test of "public convenience and necessity", governments ensured everyone received an acceptable level of service at reasonable rates and assured the limited number of carriers financial viability-reasonable rate of return-by restricting entry. Schedules, fares, rates, tariffs, equipment, goods carried, points served, levels of service, etc., were controlled by one or another government or quasi-government agency.

As the nation grew and prospered, private individuals, corporations, conglomerates, entrepreneurs, etc., saw markets and had the expertise and the financial capability to overcome start-up costs. These local carriers evolved into provincial or regional operators and some became national and international carriers.

These private enterprises came into competition with Crown corporations, and were restricted by the various economic regulations. A number of age-old subsidy programs, implemented as regional economic development initiatives or for other reasons, reflected the great degree of government involvement in transportation systems and services.

NOTE: The views expressed in this paper are those of the authors and do not necessarily reflect the policy of the Newfoundland Department of Works, Services, and Transportation.

National Transportation Act, 1987 (NTA)

The National Transportation Act, 1987 promised to deregulate the transportation industry, by reducing the entry restrictions to a "reverse onus" test and eventually to a "fitness" test. The NTA proclaimed the philosophy of competition within and between modes as being the most effective means of providing the most efficient, equitable allocation of resources to transportation systems. The NTA established the National Transportation Agency (Agency) as the authority in dispute resolution.

Voyageur applied to the Agency for a roll-back of VIA Rail discount passenger fares charging unfair competition since VIA, as a federal Crown corporation, could price below cost and recover any and all losses from the taxpayer in its annual subsidy. The Agency proceeded by way of an inquiry into VIA's pricing policy. The discount fares were suspended pending the outcome of the inquiry. (Voyageur experienced a labour dispute and VIA carried the traffic at full fare.) The Minister of Transport announced massive cutbacks in VIA service to enable the reduction of the federal subsidy. The NTA inquiry was suspended. A federal Royal Commission on Passenger Transportation has been launched.

On the freight side, railway companies have complained of an alleged unfair advantage for trucks, citing infrastructure cost allocations. As the argument goes, truckers do not pay their fair share of construction and maintenance costs of the highways, whereas the entire cost of the rail bed, track and right-of-way are borne by the railway companies. A number of analyses have been conducted and scholarly papers delivered on the topic of highway cost allocation. Efforts continue to ascertain the appropriate truck user fees based on their contribution to the deterioration of pavement structures, safety and level of service (congestion). Weight-distance taxes are proposed.

Vehicles, Ways and Terminals; Taxpayers, Users/Carriers, Consumers

The extent and method of government (taxpayer) intervention into provision of infrastructure (way); ports, air terminals (terminal); and Crown corporation subsidies (vehicle) is the underlying problem in the above debates. Fair competition can only occur when the rules of the game are the same for each competitor, regardless of mode.

The taxpayer supplies the highway infrastructure, construction and maintenance; traffic control devices, signs, pavement markings, signal lights; traffic law enforcement; accident investigation; and safety regulations.

The waterways are dredged; ice breaking carried out; channels marked by buoys; Loran C coverage provided; policed by the Coast Guard; safety regulated; and accidents investigated at public expense.

Airways and jet ways are established and maintained by the taxpayer. Aids to navigation; air traffic control, safety regulations and accident investigation are provided at public expense. Security is also publicly funded.

In the rail mode, the taxpayer provides safety regulations and accident investigation. The rail carriers are responsible for infrastructure maintenance and construction, and traffic control.

In the road, water, and air modes, vehicles can be supplied and operated by anyone who can avail of an appropriate vehicle and qualify for an operator's licence. Highways, waterways, and airways are open to everyone. Entry of commercial carriers to these three modes has been eased. Terminals are accessible to any vehicle and operator, subject only to various operational considerations. Terminals: laneways, private driveways, parking lots, yacht clubs, anchorages, airfields can be maintained and operated by any entity. Rail ways and terminals are different.

All transportation costs are eventually borne by one (or more) of three groups - taxpayers, users and consumers. Little analysis is necessary to recognize truckers, bus operators, water-borne carriers, railroad companies, and airlines do not pay any portion of the costs associated with the transportation network. So called user fees; fuel taxes, registration and license fees, landing fees, etc., are passed on to the consumer by the carriers, possibly with the addition of a markup or profit margin.

An examination using basic Set Theory reveals each and every one of us is a member of all three populations. We are all users, taxpayers, and consumers. The question is reduced to one of paying now or paying later. Or, from which pocket should we pay what costs?

Summary and Conclusions

This paper asserts that, rather than tinkering endlessly with weight-distance taxes, landing fees, modally specific direct or indirect subsidies, provision of the way in all modes as a public good would be of great benefit in levelling the playing field. The naturally inherent advantages of each mode would interact in an open market instead of decisions being made on some arbitrary or political basis.

Reversion to public ownership of the railway would not only ensure fair inter-modal competition but could foster competition within the rail mode. Rail transportation might experience rejuvenation, reduce the amount of rail line abandonment and relieve some of the pressure on other modes.

The public purse would maintain the way, i.e., infrastructure, provide traffic control, applicable navigational aids, ensure safety and security, pay for traffic law enforcement and accident investigation.

The recent initiatives of airport transfers and privatization of Crown corporation carriers are positive steps toward competition and free enterprise in the provision of terminals and vehicles by whomever has the desire and wherewithall.

Economic development subsidies should be paid directly to farmer, producer or manufacturer where warranted and justifiable under the FTA and GATT instead of to carriers under terms of the current MFRA, ARFAA, WGTA, etc., which distort modal distributions.

Adopting a uniform approach to provision of the way as a public good should serve to resolve a number of issues and will probably create other problems such as how to decide when to spend public funds on which way.

GOODS AND SERVICES TAX: IMPACT ON TRANSPORTATION

Beckett, W.T.; Lutz, G.L.; Pumphrey, V.L.; and Tufts, G.E.

On January 1, 1991, the Federal Government proposes to replace the existing Federal Sales Tax (FST) with a Goods and Services Tax (GST). Proponents of the new tax system cite the following major reasons as the anticipated improvements to the taxation system.

Elimination of Tax Cascading

Taxes applied to business inputs became embedded in prices of goods produced resulting in multiple taxation upon taxation. The use of business input tax credits and movement of the tax point to the final consumer is to eliminate this problem.

More Competitive Exports

Presently the application of FST to business inputs embeds a tax component in export goods making such goods less competitive on international markets. The business input tax credit system overcomes this problem.

Appropriate Taxation of Imports

The application of FST to imports rarely taxes the costs of marketing and distribution associated with such goods. For domestic goods in many cases the marketing and distribution costs attract FST. Moving the taxation point to the final consumer provides equality of treatment and ensures marketplace competitiveness for domestic goods.

Reduction of Tax Avoidance

Some manufacturers have been able to structure their corporation so as to avoid or partially avoid the application of FST. The GST will be applied to all transactions in the production chain and will thereby be unavoidable.

Broad Tax Base

Tobacco, alcohol, automobiles and automobile parts, and motive fuels currently represent 16% of consumer expenditures yet account for one-third of Federal sales tax revenue. Although there will be some exemptions such as food and prescription drugs under the proposed GST, the wider base is more economically sound and equitable.

Reduced Complexity

The FST is applied at four different rates and with a host of exemptions. In a system with some 75,000 firms there are more than 22,000 special arrangements and interpretations required.

NOTE: The views expressed in this paper are those of the authors and do not necessarily reflect the policy of the Newfoundland Department of Works, Services, and Transportation.

The GST will apply to transactions at 7%, with only a few exemptions.

The further potential improvement, tax visibility, appears to be slipping away, Full details of the GST are found in the Government's White Paper of August 1989.

Despite the anticipated benefits associated with the change from FST to GST, there exist a number of problems for the transportation sector which require attention.

Tax Cascading

The Federal government proposes to retain both the Federal Excise Tax on motive fuel and the Air Transportation Tax on passenger air fares. In both cases these taxes will form part of the base price subject to GST. The resultant tax cascading, despite small dollar values on any individual purchase, violate the basic principle of tax reform.

Government revenues may be augmented by adjustment of either the GST or the Excise Tax Act in future with resultant double taxation.

Carriers in all modes have been vocal in requesting tax reform conform to the basic principles and eliminate tax cascading through elimination of both the Excise Tax on motive fuels and the Air Transportation Tax. The taxation regime in which Canadian carriers operate is more burdensome than that in which American carriers operate. Double taxation to be passed along to the final consumer simply worsens an already large problem.

Tax on Distance

In highly competitive markets the elimination of FST should result in somewhat lower prices to consumers for goods and services including transportation. The Department of Finance has indicated to the Standing Committee on Finance that transportation is estimated to bear a 2% burden associated with FST. In highly competitive markets consumers may experience cost savings of up to this amount.

The assumption of this benefit due to removal of FST being passed on to consumers in areas such as Labrador and the Territories, where thin and fragile transportation systems exist, becomes more tenuous. In such areas, where transportation plays a significant role in the final price of goods and services, the application of GST at the consumer purchase reflects a tax on distance which will worsen the presently existing regional disparities in Canada.

For those carriers regulated by the National Transportation agency of Canada, mechanisms involving review and approval of fares and tariffs may need to be invoked by consumers or their representatives to ensure full removal of the FST from transportation services.

Advance Reservation Systems

Tour operators, charter companies, and others associated with transportation for the tourist industry will require early education and training in the application of GST in order to operate appropriately in early 1991. These companies should be an early priority for the Federal Department of Finance.

Transportation Invoices

Unless transportation invoices bear a separate indication of the GST from the transportation service, carriers, shippers, and consignees will experience significant confusion leading to increased administration costs.

Diversion to American Carriers

Personal travel, which is not eligible for the business input tax credit, is likely to divert in a greater proportion than present to American carriers in both transborder and long haul east/west moves. The non business traveller is more sensitive to price increases than time delays than is the business traveller. Hence the 7% increase in cost compared with the few hours necessary to access American transportation systems could increase the diversion of passengers.

In the longer term such diversion could weaken load factors on Canadian carriers to the point where service, frequency, or fares change to the detriment of all users.

Transportation Service Delivery Mechanisms

Provinces, municipalities, and government agencies such as school boards and transit authorities use a variety of delivery mechanisms to provide transportation services. The GST will be applied differently to different agencies and to different mechanisms. Provinces will receive full GST rebates while others will receive a rebate to leave them globally no worse off than under FST. In-house, contract, subsidy, cost-sharing, and other mechanisms will attract different applications of GST. Expectations exist for dynamic changes in the methods of delivery of transportation services at the local level.

Continuous Outbound Movement

In order to ensure competitiveness in international markets, transportation costs for exports will not attract GST when accompanied by an appropriate declaration by the exporter. Such a system is to reduce the administrative costs as well as ensure the exporter does not suffer a cash flow problem associated with applying GST.

Canada's transportation and distribution system traditionally provides a number of activities at the port of exportation which are not charged by a carrier and hence would attract GST. These include cleaning of grain, spraying of lumber, weighing of fish as well as pilotage fees, stevedoring costs, port charges, etc.

The declaratory statement, and rules governing same, should be broadened such that these traditional activities and ancillary charges remain zero rated even when not invoiced by a carrier. As well, the domestic transportation component of the outbound movement should retain zero rated status when such activities are invoiced by a non carrier.

Continuous Passenger Journey

International transportation, except to the United States and St. Pierre, is to be zero rated under the proposed GST given that the movement is continuous. Unfortunately, from many of the remote areas of Canada an international trip through such gateways as Vancouver,

Toronto, Montréal, and Halifax often involves an overnight stop at the gateway city. This rule should be clarified to permit such an overnight stop when necessitated by the carrier's schedules.

Departments of Transportation

The Provincial and Territorial Departments responsible for Transportation are likely to experience a number of negative impacts associated with the proposed GST. If a tax rebate system is implemented for Provincial Governments, those Departments without direct access to the rebates, or a budget increase to cover anticipated GST, may experience a reduction in program delivery to the extent the GST acts as an increase in expenditure.

Departments will be forced to reevaluate the methods of delivery of programs to ensure under the new tax methodology the delivery mechanisms are appropriate from a financial aspect. Options involving privatization and contracting out may become less attractive.

Those Departments involved in cost shared agreements with the Federal Governemnt for delivery of transportation infrastructure will find the delivery component of the agreement reduced by the amount of inflation associated with the implementation of the GST.

As most Departments perform some work for others on a cost recoverable basis, lease equipment, or undertake other similar activities deemed to be of a commercial nature, a new administrative structure will be required to collect and remit the GST to the Federal Government.

SUMMARY

The current proposal for implementation of the GST carries with it numerous irritants and significant problems for provincial departments responsible for transportation, for shippers and consignees, for passengers, and for carriers. Revisitiation to the recommendations of the Carter Commission would reveal the option of a more equitable, less problematic, taxation system.

Regulatory Reform and Remaining Structural Problems in Canadian Rail Transport

By
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1. Introduction

After twenty years of considerable stability in the Canadian rail industry, a number of major changes were introduced with the National Transportation Act, 1987. The railways lost their ability to engage in collective rate-making but gained the right to enter into confidential contracts. By removing "rate transparency", these changes were expected to foster intramodal price competition. The introduction of competitive access provisions, extended interswitching limits and competitive line rates, were aimed at helping captive shippers who had little protection under the ineffective maximum rate provisions. Another area where the new Act introduced important changes was branch line abandonment; streamlined abandonment procedures were aimed at promoting "plant rationalization".

While firmly supporting the thrust of the regulatory reform legislation, in previous writings I had expressed some reservations about the extent to which the new provisions could promote competition in the Canadian rail industry. At the time, I had acknowledged that the course of the legislation could not be influenced a great deal, but maintained that the debate on regulatory reform should be sustained to ensure that policy makers did not enter into another two decades of complacency as they had following the National Transportation Act, 1967. Although it has been only little more than two years since the proclamation of the new Act, lack of debate on its impact is already worrisome.

The purpose of this paper is to examine some basic concepts, review previously advanced proposals, and offer some new thoughts for future consideration. In the next section, elementary theoretical principles are examined to reveal the nature of competitive forces in rail transportation. Following a brief background on recent regulatory history, key provisions of the new Act and their limitations are reviewed. The fourth section refers to the recent experience and comments on the continuing problems facing the railways and shippers alike. Finally, the policy challenges are stated and some new initiatives suggested.

2. Theoretical Principles

In order to understand the scope for competition in rail transportation, industry's cost structure has to be examined. Although this topic is often dealt with in a great deal of technical jargon, the underlying concepts are simple. We can begin the theoretical expedition into "competition" by looking into "density economies", a topic which has received considerable empirical attention in the railway economic literature going back to the early part of this century.

The question is whether unit costs (per ton-mile) decline with increasing traffic density (ton-miles per mile of track). The earlier studies yielded mixed results (e.g., economies of density for southern and western railroads, but diseconomies of density for eastern ones) but mainly due to estimation problems. Later efforts revealed increasing returns up to densities of about 3 million revenue ton-miles per mile of track, but these results were also questionable due to measurement problems. In a more recent survey of the literature, it was observed that the more refined econometric efforts yield cost functions that flatten out (i.e., exhaust density economies) in the range of 8 to 10 million ton miles per route mile.

It should also be borne in mind that these statistical analyses rely on fairly aggregate data. If unit cost estimates for a given track section are estimated (using parametric techniques since dissagregate data for econometric approaches would not be available), it is likely that increasing returns would

be realized into even higher density levels. Common sense suggests that unit costs would continue to decline until the capacity of the track is reached.

The presence of density economies would give higher density railroads an advantage in handling traffic (i.e., at lower cost) over their competitors. The next key question is whether density economies have implications for industry structure; in other words, whether railroads can expand their output to establish a monopoly position. On any given route, a railway will try to continue to increase its traffic as long as unit costs are declining; if total traffic is less than the capacity of that line, a monopoly might result. This, however, is a geographically confined phenomenon with limited industry wide implications from a structural standpoint. The actual cause of monopoly that threatens market competition should be searched elsewhere.

A natural monopoly situation resulting from density or scale economies (in any event, there is little evidence that the latter exists in the railway industry) is not a necessary evil in and of itself, as long as the monopoly is contestable. In the absence of barriers to entry or exit (but with free access to the same technology), a monopoly would be operating under the threat of "hit-and-run" entry, which would impose the same discipline (albeit under ideal or perfect conditions) on the firm as perfect competition. The conditions of contestability in railway operations should be tested with respect to two aspects: carriage and track.

Increasing returns to density can in part be attributed to scale economies involved in linehaul operations. Although the empirical evidence from the econometric literature is scarce, operational considerations clearly suggest that most cost items (e.g., crew, fuel, switching) decline with train size. As traffic volumes increase, railways can assemble larger trains and utilize equipment more efficiently. These types of density or scale economies will in no way inhibit the contestibility of a railway; there is nothing inherent in the nature of the rail carriage business (or linehaul operations) that would pose an entry or exit barrier. The resources that are committed to the carriage business are quite mobile, allowing the firm engaged in these operations to exit without having to incur any significant costs.

More significant density economies arise from fixed costs associated with the rail infrastructure (i.e., the right of way and track). These costs are "sunk" in the strictest sense of that concept, since once the resources are committed they basically become immobile. In other words, infrastructural investments in rail transport violate the basic conditions of "free exit", and by the same token, represent "barriers to entry". In railways' current cost accounts, sunk costs may represent relatively small items since fixed assets might have already been largely depreciated. From the stand point of contestibility, however, the more important consideration is the replacement cost of the basic infrastructure, since it is this amount that the new firm would have to invest in order to enter the market. From an economic perspective, therefore, sunk costs in rail infrastructure are indeed large in magnitude, representing a significant barrier to entry (if not an insurmountable one in already built-up areas).

Since the conventional rail firm is in the business of both track and carriage, the next pertinent theoretical question to pose is whether the two can be produced more efficiently by one firm than separately by different firms (i.e., testing for conditions of a multi-product natural monopoly). In other words, the question is whether there are inherent "scope economies" between track and carriage that might have given rise to the particular industry structure observed today, i.e., a structure that consist of integrated rail firms performing both track and carriage functions. In the absence of any real data (since there are no cases of strictly track or carriage operators, other than those of passenger services both in Canada and the U.S.), the condition cannot be tested empirically, but it is hard to think of any operational causes of significant scope economies.

In these conceptual terms, the railway firm can be characterized as a producer of two vertically integrated products or services. At the track end of the business, large sunk costs give rise to uncontestable natural monopoly conditions, which are extended by the railway to the provision of transportation services by virtue of being able to restrict access to the railbed. If this entry barrier did not exist, the cost characteristics of the carriage business are such that effective competition (or at least contestibility) could be sustained. In other words, there is nothing inherently

monopolistic in the carriage end of the business; if it could be separated from the ownership of the railbed, or "entry" secured through regulatory means (i.e., mandated running rights), rail carriage can become competitive.

The concept of separating the ownership of track infrastructure from the carriage business has been examined and advocated throughout the century, but naturally resisted by the railway industry. In defiance of conventional wisdom, a number of industry experts have supported the concept and proposed specific applications, which never caught the imagination of public authorities even at times of crisis (e.g., after the collapse of the northeastern railroad system in the early 1970's, when a roadbed utility concept was suggested as an alternative to Conrail). The railway industry has been quite persistent in raising operational objections, but there appears hardly any substance to these concerns, particularly in view of all the joint-track operations and trackage-rights agreements the railways currently participate in. The railbed utility concept is in principle no different than a multi-user public highway.

3. Regulatory Background

Prior to 1967, the Canadian railways were subject to extensive rate regulation. Lack of pricing freedom continually undermined the railways' financial viability. At the same time, rail services were made instruments of public policy; non-compensatory elements in the system gave rise to considerable need for cross-subsidies. The railways gained their pricing freedom with the passage of the National Transportation Act, 1967, while the Railway Act permitted them to engage in collective rate-making. As a result they gained sufficient freedom to fend for the competing modes, while being protected from price competition among themselves.

The Railway Act had required all freight rates to be compensatory, which was determined by the CTC to cover at least variable costs. The Railway Act also had maximum rate provisions, set at 250% of variable costs, mainly to protect captive shippers. Even this rather generous margin, however, was not rigorously enforced; it was up to grieving shippers to make a case in front of

the CTC. Whether the railways routinely abused the minimum or maximum rate provisions of the Act or not, the regulatory practices were not effective enough to protect shipper interests.

The regulatory philosophy embodied in the 1967 Act placed a great deal of emphasis on the discipline of intermodal competition. Intramodal competition was not seen to be healthy, thus discouraged, in the fear that it would undermine the railways' financial viability. In cases where the railways did not face formidable competition from the competing modes, the shippers were left at the mercy of the maximum rate provisions of the Railway Act (the enforcement of which remained questionable). The regulatory regime encouraged the railways to price their services according to what the market could bear.

In cases where alternative modes were available, rail rates were set low enough to undercut the competition. In the absence of intermodal competition, shippers had to bear rates which the railways deemed acceptable in view of conditions facing shippers in their own end markets; in such cases the railways were clearly extracting "monopoly rents" from shippers. Under these circumstances, many critics accused the railways of gouging shippers; in all fairness, the railways were behaving in their best commercial interests within the established regulatory parameters.

Outside some disgruntled segments of the shipping community, the regulatory principles governing rail transportation in Canada in the post-1967 era appeared acceptable to most observers, and even received praise from many. Comparison of Canadian railways' financial health to the dismal state of the U.S. railroad industry (reaching crisis dimensions with the financial collapse of the northeastern railroads in the early 1970's) was taken at face value as evidence of successful economic regulation. This favorable assessment was even reflected in some quarters of economics literature, which of course, was probably justifiable in comparison to the state of the U.S. railroad industry. Shipper concerns, and the implications of "monopoly rents" for export segments of the economy, appeared to be overlooked.

Prior to 1980, stringent rate regulation exercised by the Interstate Commerce Commission in the U.S. crippled the railroads' ability to compete with trucking and undermined their financial viability. After a series of bankruptcies and a financial crisis looming over the entire railroad industry, some form of regulatory response become inevitable by the mid 1970's. The reform process began with the 1976 Rail Road Revitalization and Regulatory Reform Act, 1976. The Staggers Act, 1980 introduced the rate freedom that the railroads were waiting for, a freedom that the Canadian railways enjoyed since 1967. The railways were given the right to enter confidential contracts, removing the "rate transparency" that prevailed under the published tariff system. After many decades of malaise and stagnation, the lifting of regulatory controls marked the beginning of a very dynamic era in the U.S. rail industry. In a fairly short period of time, the financial health of the railroad industry was restored and substantial productivity gains were observed.

The regulatory changes introduced in the U.S. soon had their impact on Canadian railways. With the ability to enter into confidential contracts, the U.S. railroads gained a distinct advantage and quickly started to increase their share of international business. Since transborder traffic constituted about one quarter to a third of their total revenue base, the Canadian railways were quick to respond by requesting the regulatory authorities to grant them confidential contracting ability in handling transborder traffic. In 1983, the Minister of Transport ordered the CTC to examine the effects of U.S. rail deregulation. The scope of the enquiry was later expanded to investigate the advisability of introducing more intra-rail competition in the domestic system as well. The enquiry commission could not justify differential treatment of transborder traffic and instead recommended the introduction of confidential contracting practices to all movements.

The CTC enquiry was overshadowed by the attempts of the new government, whose Minister of Transport had given economic deregulation top priority in his policy agenda. As first outlined in Freedom to Move, the new policy emphasis was clearly on "competition", and accordingly, the government's intention was to eliminate economic regulation to the greatest extent possible in an effort to expose the transportation industry to market forces. Modelled

after these principles, the new National Transportation Act introduced far-reaching regulatory changes. In rail transportation, key changes included:

- confidential contracts (without collective rate-making powers) were aimed at removing "rate transparency" and promoting intramodal competition.
- extended interswitching limits and competitive line rates were aimed at providing captive shippers with greater bargaining power.
- improved dispute resolution procedures were aimed at making the regulatory process more accessible to shippers and more responsive to their needs.
- streamlined branch line abandonment procedures were aimed at encouraging greater "plant rationalization" in an effort to reduce the cost burden of the railways.

The above changes constitute a radical departure from the regulatory philosophy embodied in the 1967 Act. They reflect a firm committment to protect shipper interests, and a clear recognition of the need for greater intramodal competition. However, they are not adequate in dealing with the more fundamental structural problems plaguing the railway industry. The opportunities missed during the regulatory reform exercise are probably as significant as the achievements of the new legislation. The most critical opportunity in this regard concerned running rights, which could have been used as an effective tool to promote competition in the industry.

The terms of reference of the earlier CTC enquiry included the investigation of extending running rights to other carriers where terminals or transhipment facilities were served by only a single railway. Under the existing legislation, running rights could be exercised either by agreement between the railways in question, or by order of the Commission. The issue during the enquiry was whether expanded running rights granted to parties other the railways themselves could be used to promote more competition. To this end, the Director of Combines (i.e., Director of Investigation and Research, Combines Investigation Act) intervening in the enquiry build his entire case around this issue. His submission included the following statements:

"There should be expanded opportunity for existing and new carriers to obtain running rights over existing infrastructure... As long as an applicant

> were fit, willing and able to perform safe railway operations, he should be granted a certificate by the commission... This would allow new entrepreneurs, shippers or others who had invested in or leased railway rolling stock to bid for the traffic of shippers or carry their own goods to destination... The Commission should first consider the pro-competitive impact of granting the running rights to the user railway..., have regard to the potential benefits to shippers against the potential impairment of the operations of the railway which would be compelled to grant those running rights..., give prime consideration to the objective of maximizing intramodal competition."

A number of major shippers, industry organizations and other parties supported the concept in their submissions. At the end, however, all this evidence appears to have been ignored by the Commission in concluding that no changes were required to the existing legislative provisions relating to running rights. The matter did not receive much attention in Freedom to Move either. The necessity for running rights or joint track usage was recognized in exceptional circumstances where significant efficiencies and cost savings would be certain to result. There was no consideration given to running rights or joint track usage in a more general effort to promote intramodal competition.

4. Remaining Problems

As noted already, the main thrust of the new legislation was to promote greater competition between the railways. The provisions of the new Act have no doubt given shippers greater bargaining power, but have done very little to change the railways' competitive behaviour. This is not at all surprising; it was unrealistic to begin with to expect the new provisions to foster effective intramodal competition in today's industry structure. The Canadian rail industry remains a duopoly with no threat of new entrants; conditions of uncontestability hold in the strictest sense. There is, of course, some scope for competition between the two major railways to the extent that their networks overlap and they can handle the same traffic from origin to destination. Even in cases where these conditions hold, however, it is not in the railways' best interest to aggressively compete over each others traffic.

After so many years of collective rate-making in a fairly "transparent" system (from both pricing and costing points of view), the railways understand each other very well, and recognize the potentially devastating impact of aggressive price competition on their commercial viability. In this context, there is a no implication of conspiracy or collusion; aversion to aggressive price competition is in their best interest, thus represents rational business behaviour. As a result, we only observe subtle shades of difference between the two railways' respective pricing behaviour; CP appears to be projecting a "take it or leave it" attitude, while CN is posturing in a slightly more compromising manner. If even such subtle differences were to result in notable shifts in traffic patterns, the losing railway (in terms of traffic or revenue) would no doubt quickly respond.

Rates are, of course, also cost-driven; in order for shippers to benefit from lower rates, the railways have to reduce their own costs. Although the railways might have experienced healthy operating margins in the last few years, they certainly do not enjoy large enough profits that could be past back onto shippers to insignificantly lower rates. New contracting arrangements and enhanced bargaining powers on the part of captive shippers no doubt impact on rate differentials, but across the board discounts cannot be contemplated within the railways' existing operating margins.

Rate reductions have to come in large part from efficiency improvements and cost savings. Recently, the railways have taken major steps to improve labour productivity and operating efficiency, but further strides have to be made before shippers can find themselves in a position to bargain for major rate discounts without undermining the viability of the entire system. The most significant cost savings can probably be achieved through plant rationalization, both within the railways' own networks and through shared or jointly operated track arrangements.

The need to relieve the railways from the cost burden of operating poorly utilized sections of the system have long been recognized. However, the branch line abandonment provisions and the associated subsidy arrangements did not work very effectively under the old legislation. Although there has been a tendency to attribute this to the cumbersome regulatory practices of

the CTC, it is still difficult to understand why the railways themselves had not been more aggressive in their abandonment and subsidy application efforts.

The much streamlined procedures under the new NTA were designed to expedite the abandonment process, but the NTA still places an annual abandonment limit on each railway of 4% of its total route mileage. In the case of CN, this ceiling would translate to about 825 miles, and in the case of CP about 575 miles. In 1988, the National Transportation Agency had 73 applications for abandonment, 19 of them following notices of intent filed that year and the remaining carried over from the CTC. Since the Agency has six months to render a decision, only 43 of the 73 applications had to be ruled on in 1988. According to its Annual Review, the Agency issued decisions on 20 of these and postponed the remaining 23 (which were reconsideration applications) to 1989. Although the review report does not indicate a specific figure, it would appear that abandonment orders issued during this year totaled 664 miles. In 1989, the Agency expected to clear all the back log and consider new applications covering about 1300 miles.

In the NTA branch lines are defined as segments of the railway that, "relative to a mainline within the company's railway system in Canada of which it forms a part, is a subsidiary, secondary, local or feeder line of railway, and includes a segment of any such subsidiary, secondary, local or feeder line of railway". More than one half of total track miles in Canada would fall under this definition; the latest estimates indicate approximately 50% for CN and 55% for CP. Of this total more than half are protected, grain dependant branch lines guaranteed to operate to the year 2000. Prior to the WGTA, most of these received branch line subsidies. Under the WGTA, the cost of operating these branch lines have become a component of the system-wide costs of handling grain.

The remaining (i.e., non-grain dependant branch lines) still constitute significant mileage across the country; although it is difficult to determine the proportion of these branch lines that would be deemed uneconomic, it is safe to assume that the Agency would be processing abandonment applications for quite some time. If the railways were not encumbered by labour shedding

constraints and the statutory annual limit of 4%, they would be abandoning lines at a much faster rate than that currently observed. Moreover, the network rationalization is by no means limited to branch lines; many mainline segments would be candidates for abandonment as well, particularly if there were opportunities for network rationalization through joint or shared track arrangements.

According to the latest statistics (1987), the two national railways achieve an average traffic density of approximately 4.4 million revenue ton-miles per mile of line haul track. In the U.S., on the other hand, Class 1 railroads achieve an average of more than 7 million ton-miles per track mile, while Burlington Northern achieves a figure of close to 10 million. An expedited process of uneconomic branch line abandonment (both grain and non-grain) will no doubt significantly improve the average traffic density in Canada. In order to achieve the traffic density levels already attained by some of the more efficient American railroads, however, considerable mainline rationalization will be required as well.

Another means of improving track utilization is, of course, to increase revenue traffic. In the last couple of decades, Canadian railways have concentrated their efforts on bulk transportation, loosing considerable share of general freight traffic to the truck mode. Although, the railways tended to dismiss the potential in these more competitive markets, as either insignificant or unattainable, there appears a more recent emphasis on intermodal traffic (piggyback trailers and containers). Compared to developments in the U.S., intermodal traffic increases reported by the Canadian railways are very modest. Although the prevailing opinion these days is that Canadian railways have already missed out on the "container train revolution" (staged through the cooperation of steamship lines and railroads in the U.S.), there remain considerable opportunities in this area.

5. Ideas for Consideration

When the Bill C-18 was being debated, I acknowledged that it was futile to try to influence the course of the new legislation, but still did not refrain from advancing the following proposal:

The seperation of CN infrastructure from carriage can be seen as a logical extension of the current government's national transportation policy. If the government wants to give market forces and competition primacy in its long term rail policy, a strategy can be developed to transform CN from an integrated railway company to a publicly owned roadbed utility. The first stage of this strategy would involve permitting new carriers to operate on CN's system, which has already been proposed as an effective means of promoting intramodal competition. The later stages of this strategy would involve CN divesting itself gradually from the carriage business. In the process, some large shippers may start to perform their carriage functions dealing directly with the roadbed utility, or with CN at the earlier stages of this strategy. Other companies may establish themselves as specialized carriers engaged in the movement of containers or providing other intermodal services. It is also possible that a new grain transportation authority could be established operating its own trains, or contracting to other independent carriers. VIA Rail can enter into contracts with the roadbed utility operating like AMTRAK does outside of the northeast corridor. New branch line operators may come into existence, operating as shortline railways without direct responsibility over infrastructure. In sum, the monolythic crown corporation, CN, can be transformed into a roadbed utility supporting a diversed, multi-firm rail carriage industry.

This strategy has implications for the privately owned Canadian Pacific, but does not affect the company's ownership structure. CP can be left intact, operating as a conventional railway in competition with other privately owned carriers operating on public railbed. In order to protect CP's captive shippers, however, the government may have to oblige the company to offer running rights to other carriers or introduce the same competitive line rate provisions already contained in the proposed legislation. The latter will serve the interest of captive shippers much more effectively with a wider choice of carriers than in the present duopoly structure. At the same time, CP can be offered running rights on the public roadbed providing the company with opportunities to rationalize its own network by abandoning routes and/or lines as it sees fit.

The experience of the last four years has not changed any of the opinions expressed above. It was, and still remains, unrealistic to expect competitive forces to flourish in a duopolistic industry structure plagued with "uncontestibility" problems, unless scope of competition can be expanded with the introduction of new carriers. The only difference between now and four years ago is that there was greater scope to consider new ideas and concepts when major regulatory changes were already being contemplated. Now, confirming the earlier fears based on the post-1967 experience, even the debate on economic regulation has simmered down, if not dissipated altogether. The first step towards any change has to be the rejuvenation of a meaningful policy debate.

The following problems remain with respect to rail transportation in Canada:

- Adequate intramodal competition cannot be fostered within the existing industry structure and regulatory framework.
- The process of network rationalization is unfolding too slowly, continuing to place a significant cost burden on the system.
- The railways cannot seem to cultivate new markets with their "retail" approach to transportation and distribution, at least not within their current organizational structure.

Based on the above, the prescription seems obvious: mandate third-party running rights and encourage more network rationalization. The first remedy will basically take care of the third problem, since other agents (forwarding, distribution or transportation companies) could start developing new intermodal markets, exercising third-party running rights themselves or rely on others to form that function. None of this will happen, of course, without strong action on the part of all interested parties. In this regard, the following steps should be considered:

- The Agency should expand on the scope of its monitoring efforts to make more meaningful observations about the state of intramodal competition, rather than confirming the obvious that the shippers are now better off than under the old legislation.
- The shipper interests themselves should fuel the debate on further regulatory changes in order to break the duopolistic structure of the rail industry through the introduction of new carriers.
- Transport Canada should embark on a comprehensive study of the Canadian rail network with the objective of developing rationalization scenarios based on both revenue and cost considerations.
- Transportation and distribution companies should actively pursue arrangements whereby they can use the existing rail infrastructure for linehaul purposes.

These pressures may culminate in expanded running rights and joint/shared track arrangements even within the framework of the existing legislation. Further changes (particularly, the institutionalization of third-party running rights) can be contemplated pending on the results of the fifth year NTA review. Accordingly, all interested parties should prepare for the review in a pro-active way, rather than simply defend the changes already introduced in 1987.

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