COST OF TAKING OFF: AN EMPIRICAL STUDY ON THE DETERMINANTS OF AIR FARES IN CANADA

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Introduction

In a country as large as Canada, there is no alternative to flying that offers the ability to get across the country in a day. Air transportation is essential for travelling in this country and yet it is a cause of complaint due to the high fares. While this is an important issue, the domestic airline industry in Canada has not been given as much attention as domestic airlines in other parts of the world. The main literature on the topic has been centred on Europe and the United States. This paper will focus on an empirical examination of air fares within Canada and between Canadian airlines and the expected impact of competition and market characteristics.

Air fares in Canada have been found to be higher than in other parts of the world. Milke (2010) finds that for a group of flights covering approximately the same domestic distance the Canadian fares are approximately $560 higher than in the United States and $970 higher than in Europe. The sample from Milke (2010) found that in Canada 30% of the airfare was related to additional taxes while in Europe it was closer to 50%. This shows that government fees are not the primary cause of the high fares in Canada.

The impact of competition in the airline industry has been a highly researched topic since deregulated airlines have had to adjust their role in the market. One of the biggest transitions has been the easier access for new airlines to enter the market, and the creation of low cost carriers (LCC). O'Connell and Williams (2005) find that those

who preferred to fly on a LCC had fare as their main determinant with other inputs, such as reliability, having almost no impact. In comparison, they find that those who chose to fly on a full service carrier (FSC) did not have fares as their first consideration; instead, more emphasis was put on reliability and quality.

LCCs not only offer lower fares themselves, but also help to reduce the overall fares on a particular route due to the impact of increased route competition. Ayres (1988) finds that two additional airlines to a monopolistic route, for a total of three carriers, would bring prices to almost competitive levels on a given route (p. 7). This means that the creation of a LCC airline should lower prices of other airlines on the routes that they fly, which has been shown by Vowels (2006) and Fageda, Jimenez, and Perdiguero (1992). Canada's main LCC is WestJet, which aims to offer low fares while still offering a high level of service, such as light snacks.

The size of the airline is very important in how outside forces impact the air fares. Cilberto and Tamer (2009) find that the larger an airline's presence at an airport, the greater its competitive effect. A new small airline's competitive impact on an incumbent will be less if the incumbent is a large airline. A larger incumbent airline presence strengthens the barriers to entry due to these discrepancies in competitive effects. The size of the airline creates different reactions to changes in a market. Bornstein (1989) finds that while one airline, typically the larger airline, may be able to charge higher prices if faced with congestion, it does not mean that another airline on the same market can as well. Abramowjtz and Brown (1993) find that the national presence level, not just the airport presence, can have an effect on an airline's ability to maintain market power and to charge higher fares while maintaining passenger levels; this is due to brand awareness and loyalty.

Airlines must find the right balance when differentiating themselves from the market. The more differentiated an airline is from its competitors, the less impact the competition is expected to have on its prices. However, to be able to gain the largest customer base possible, it must offer comparable services to interest new passengers. One

area in which this differentiation concept is evident is in the timing of the flights. Salvanes, Steen, and Sograd (2004) and Borestein and Netz (1999) compare the effect of competition after deregulation on airline differentiation, especially within the context of flight times. In both studies, the findings indicate that markets that have more than one competitor increase the likelihood of flight clustering between firms. Lower price differentiation between the airlines leads to closer flight times. Business consumers are assumed to have the smallest elasticity when it comes to flight times, which is why flights aimed at business travelers are the most likely to be clustered.

To maximize profits, many airlines have adopted the hub-and-spoke model for their routes, which allows airlines to increase the traffic densities on the spokes (Bruckner, Dyer, and Spiller, 1992). In this model, airlines are merging passengers with different destinations at the departing spoke, and those with different departing airports on the later legs. Thus, the airline is able to maximize the number of passengers on each flight more effectively. Research such as Martin and Voltes-Dorta (2009), Bruckner, Dryer, and Spiller (1992), and Borenstein (1989) have emphasized the benefits of the hub-and-spoke networks, as it allows airlines to maximize profits.

The services offered in the airport are important as they can impact the airlines' costs. Airports have two ways to collect revenue; aeronautical revenue and commercial revenue. McHardy and Trotter (2005) find that unregulated airports potentially absorb a part of the benefits to the consumer that come from decreased fares related to airline competition and, in some cases, will even end up increasing the charges the passenger faces. In cases where only the aeronautical side is regulated, the airport is still capable of offsetting the lower fees with the commercial profits. Zhang and Zhang (1997) look at the effect of the commercial revenues on the aeronautical prices at the airlines. They find that allowing for commercial prices at airports to subsidize the aeronautical costs allows for better profit maximization. The cross-product subsidy has been found to increase the overall social welfare. As the aeronautical fees are potentially lowered from the commercial revenues, airlines costs are lowered, which leads to lower fares.

Methodology

For this paper the impact of a variety of routes and carrier-specific variables on air fares will be examined. To do this, the following model will be used:

$$(1) \quad LFare_{jik} = \beta_0 + \beta_1 LDistance_j + \beta_2 LLength_{jik} + X_{jik}\alpha + Y_{jk}\phi + \varepsilon_{jik}$$

where *LFare* is the log of the fare for *I* flight on route *J* and carrier *K*.
LDistance is the log of the distance between the two cities on route *K*
LLength is the length of time the total trip is expected to take.
X_{jk} is a vector of variables related to competition on a specific route, including the number of competitors, the total number of flights offered on that route, the number of stops for that flight, and which airline is offering the flight
Y_{jk} is a vector of variables related to the airports and cities on each end of the flight, including: number of services, itinerant movements in 2011, if the airport is a hub for the given airline, if the airport of departure is classified as international, the per capita GDP for both cities, and the tourism indicator for the arrival city
ε_{jik} is a normally distributed error term.

The data used in this model are a collection of future fares for two dates on routes between 15 Canadian airports. For each market[i] I have up to two observations per airline. The sample set is made up of 1,261 observations. The observations are focused on four main airlines: Air Canada, WestJet, Porter, and Bearskin, as these four make up over 99% of the sample set. I look at how the route, competition and market characteristics impact the Canadian industry as a whole, as well as the differences between these four main airlines.

Data

The variable of interest is the air fares for a given route. This was collected using future airfares taken from the Travelocity website. The data are for two different dates—November 10, 2012, and February 6, 2013—each with a return flight for one week later. The flights were chosen using the closest flight to noon. The preferred departure time was used to minimize the impact of an airline attempting to gain market share with cheap flights offered at low-demand times. Sixty-seven percent of the fares used in this data set were expected to depart within two hours of noon and 82% within a four-hour range.

The air fares are for each airline in a given market. For each market there are two flight classifications used: preferred and not preferred. If there is a nonstop option, it would be the preferred, while a flight with one or more stops would be not preferred. However, if there is no nonstop, then one layover would be the preferred type with two or more layovers being not preferred. For each airline, there are up to two data points for a given market. This occurs when the airline offers flights from both the preferred and not preferred category.

The route characteristics consist of the distance and the length of the route. Distance was determined using the Travel Math website, being the distance between the two end cities in kilometres. The distance does not take into consideration if there are layovers for the flight. The longer the distance, the higher the expected fare due to increased costs and decreased turnover ability for the plane being used. The length of the flight is the total number of minutes the flight will take; this includes the time spent in layovers. The lengths of flights range from 39 minutes to 20 hours and 50 minutes. Not including flights with layovers, the range for the length is much smaller as it goes from 39 minutes to 5 hours and 43 minutes. The length was collected on Travelocity with the air fares and the competition variables. The length is useful as it is the airline's perception of how long the flight will take that impacts costs and plane turnover.

Competition variables were also collected from Travelocity. These competition variables consist of the number of airlines offering flights, the total number of flights available, and the number of flights the individual airline is offering, all for a given market. The number of airlines serving a market ranges from one to four. In total there are nine airlines that offer services to a minimum of one of the markets observed. Four airlines offering 99% of the observed flights are Air Canada, WestJet, Porter Airlines, and Bearskin Airlines.

The market characteristic variables consist of variables that are about the specific airports and cities that make up the endpoints of the flight. The city characteristics are a tourism indicator of the arrival city and the per capita GDP (2010 values). The tourism indicator used is the number of person-trips (in 1000s) in 2010 for each city, computed to a daily average. The per capita GDP is used for both the city of departure and of arrival.

The variables that refer to the airports in the market are: the amount of commercial services at the airport, the number of itinerant movements, if it is a hub, and if it is an international airport. The number of commercial services available at the airport refers to the number of restaurants and retail shops at the airport. The number of itinerant movements is the computed daily average from 2011. The airport's status as a hub is two dummy variables, one for departure airports and one for arrival airports. Of the observed flights, 40% include a hub at one or both of the endpoints, with 3% of the flights having a hub at both endpoints. The international airport is a dummy for the departure airport, which equals one if international airlines are permitted access to the airport. If an airport is an international airport then it expected that there is increased demand for the airport's slots due to international airlines being allowed to use the airport.

Results

This section will present the results from estimating model (1). All results are robust due to heterogeneity in the data.

Overall Results

Table 1 shows the regression results for the overall market. The results indicated that for 10% increase in distance prices increase by 1.3% while the same increase in length increases price by 2.3%. Given the average airfare is found to be $701.77, a 10% increase in distance would be an approximately 200 kilometre increase from the mean, would add an extra $9.12 to the ticket price, and a 10% increase in the length, or an increase of 36.5 minutes from the mean, would increase fares by $16.14.

Table 1: Regression Results

Distance	0.1339***	Length	0.2383***
Total Flights	-0.0081***		
Number of Competitors:		Number of stops:	
Two	-0.1876***	One	-0.0693***
Three	-0.2952***	Two	-0.0546*
Four	-0.3340***	Three	0.1176*
		Stops 4-7	0.1708**
Departure city:		Arrival city:	
Services	-0.0012***	Services	-0.0005**
Itinerant Movements	0.0000	Itinerant Movements	-0.0001**
Hub	0.0370**	Hub	0.0118
International	0.0752***	Tourism	0.0024***
GDP	0.0095	GDP	0.0672***
Constant	4.7697	Observations	1261

Results are not weighted.

*significant at 10%, **significant at 5%, ***significant at 1%

As the results indicate that the length has a larger impact on price than distance it suggests that the length of layovers may be of more importance than initially expected. To check this possibility, I have rerun model 1 using only nonstop flights. Length and distance are both found to have a similar impact on the price, approximately an increase of 1.8% price increase from 10% increase. The fact that

when no layovers are included in the model, the distance and the length have the same impact indicates that the length of layovers has a positive relationship with the air fare.

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The economic significance of the number of flights is found to be small when considering a single additional flight; however, if a large number are added, the economic effect is notable. An increase of one flight would decrease that market's prices by 0.8%. When a new airline enters the market or a current airline tries to gain a large percentage of the market share and increases the total number of flights by 10, which is the average number of flights an airline offers in one market, the prices would decrease by approximately 8%. An 8% decrease of the average fare would be a decrease of $56.

For the competition dummy variables the base groups are a monopolistic route for the number of competitors and a nonstop route for the number of stops. The number of competitors on a route ranges from one to four. The number of stops ranges from none to seven, with no flights having six stops. However, Bearskin is the only airline in the model to have more than three stops. As only one airline and 2% of the flights have more than three stops, all stops of four or greater have been combined into one dummy variable, while all stops three or fewer each have their own dummy variable.

The results show that increasing competitors on the route decreases the prices. If the market changes from a monopoly to having two, three or four airlines offering services in the market, the fares are expected to decrease by 15%, 23% and 28% respectively. Testing

shows that the difference between two and three competitors is statistically different, while three and four competitors are statistically equivalent. This result is consistent with Ayers (1988) who reports that when there were two additional carriers, for a total of three, prices began to converge to competitive price levels.

The results show that changing from a nonstop flight to one or two stops will decrease the fares while increasing to three or more stops is found to increase the fares. Flights that are made up of one or two stops generally make use of the hub-and-spoke system. It is of interest that the nonstop flights are statistically equivalent to the flights with two stops. This indicates that the optimal usage of the hub-and spoke system is when the trip has only one stop.

The majority of market characteristics only have a small economic significance in determining air fare. However, through running the model with and without the market characteristics I have found that they are highly correlated with, and impact on, the competition variables. This indicates that the market characteristics are important to understanding the fares due to their impact on the airlines' decisions to supply a specific market. While the market characteristics may not be of great economic or statistical significance, the fact that they impact the competition variables indicate that not including them would create an endogeneity issue.

The results for the market characteristics are in line with economic theory as well as previous research. I find number of services at the airports as well as the number of itinerant movements is found to decrease the expected fares. Research such as Zhang and Zhang (1997) found that the number of services decreased the fares due to cross-product price substitution decreasing the fees from the airport. The current model has already shown that the more total flights on a given day, the lower the fare and so it can be concluded that the larger number of itinerant movements will lead to lower fares. For the other aspects that were examined, including international airports, hub airports, tourism levels, and per capita GDP, the fares are found to increase. Each of these factors is expected to increase fares as each leads to increased demand for that route.

Results by Airline

As the airlines have different objectives, from the level of services they offer to the areas of the country in which they operate, it would be expected that they would have different responses in their fares to market determinants. To examine how the four main airlines are affected by the determinants I have run the model for each airline, these results are presented in Table 2.

When broken down by airline, the results show that the fares react very differently to the market characteristics. The two variables that are found to be of statistical and economic importance to each of the four main airlines are the distance and the length. Flight distance and length are found to have the smallest impact on Air Canada flights and largest on Bearskin. The airline response to flight length is found not to be statistically different across airlines; however, the response to flight distance is.

As not all the airlines have routes where they are a monopolist, I have altered the base group for number of competitors to be two. For all four airlines, having two competitors is found to be statistically equivalent to having three competitors, which is expected given the results for the overall market as well as research done by Ayres (1988). For routes with two or three competitors, Air Canada is expected to have a larger price decrease than WestJet.

The market characteristics have the most effect on Air Canada's fares. For the arrival cities' characteristics, only the airport's status as a hub does not have a statistically significant effect on Air Canada's fares. For both WestJet and Bearskin, the per capita GDP are found to be statistically significant. The largest economic impact that any of the arrival city characteristics has on one of the given airlines is the per capita GDPs, specifically for WestJet. For Porter, the only arrival city characteristic that has statistical significance is the level of tourism, though it is of low economic significance, as a 10% increase in tourism would increase Porter's prices by 7 percentage points.

Table 2: Regression Results By Airline

	AC	WJ	PO	BS
Distance	0.1172***	0.1881***	0.1255**	0.3238***
Length	0.2208***	0.2371***	0.3327***	0.2739***
Total Flights	-0.0087***	-0.0055**	-0.0000	0.0053
Number of Competitors				
None	0.1441***	0.3440*	--	--
Two	-0.1273***	-0.0712***	-0.0532*	-0.5385*
Three	-0.1638***	-0.0964*	-0.1082*	-0.209***
Number of stops				
One	-0.1031***	-0.0399	-0.0802	-0.1451
Two	-0.1257***	0.0005	0.0437	--
Three	-0.3183***	-0.0061	0.1493	-0.0548
Four-Seven	--	--	--	-0.0547
Arrival city:				
Services	-0.0009*	-0.0002	-0.0000	-0.0048
Itinerant Movements	-0.0001*	-0.0001	-0.0005	0.0000
Hub	0.0151	-0.0601	--	--
Tourism	0.0027***	0.0227	0.0078**	0.0012
GDP	0.0405**	0.4821***	0.1256	0.0946***
Departure city:				
Services	-0.0029***	-0.0005	-0.0018	0.6042***
Itinerant Movements	-0.000	-0.0000	-.0001	-0.0636***
Hub	0.1574***	-0.0073	--	--
International	0.0961***	0.0409*	0.2323**	--
GDP	0.0031	0.1111	-0.4214*	--
Price	748.20	635.05	448.94	1035.56
Price/KM	0.59	0.39	0.46	0.81
Price/Min	2.84	2.08	2.31	2.46
Constant	5.0145	5.1797	2.7176	12.0149
Observations	677	454	74	45

Results are not weighted.
*significant at 10%, **significant at 5%, ***significant at 1%

The statistical and economic significance of the departing city characteristics is greater on Air Canada's fares than the city of arrival. However, if a departing city's airport is an international one, then it is expected to increase Air Canada's fares by 9.6%, and if it is a hub it is expected to increase fares by 15%. The only departure variable that is statistically significant for WestJet is if the airport is an international airport, which is found to raise the fares by 4%. Porter also has fares increased by 23% if the airport is designated as international. A 10% increase in per capita GDP for the departing city will increase Porter's fares by 4 percentage points.

Conclusion

While the Canadian fares are higher than those in other parts of the world, competition and market determinants are found to impact the fares in a way that is consistent with the previous literature, which has been focused internationally. My results indicate that the route characteristics (distance and length) consistently have a significant impact on air fares for the overall industry and for each of the four main airlines from the sample. When looking at further possible determinants, I find that there is less consistency in the Canadian industry. For the industry as a whole, I find that the number of competitors, as well as the total number of flights offered on a given market, has a large negative impact on the fares. The number of stops for a flight has differing impacts on the price depending on the number; there is a slight decrease for flights that have one or two stops. Flights with three or more stops are found to have a substantial impact on increasing the fares.

When market characteristics are added to the sample it is the changes in the competition characteristics that have the biggest impact. I theorize that this is due to the fact that it is unlikely that any of the market characteristics would have an economically significant impact on what the airline is able to charge, but will instead impact the airlines' level of supply to the market, which in turn will impact fares. This theory is strengthened by the changes to the competition variables, as well as the correlations that are found between the competition and market characteristics. Overall, the market

characteristics are found to have the most direct impact on Air Canada, the largest of the airlines. For each of the other airlines, only a select few of the market characteristics have a direct impact on the fares. The differing results that are found when the sample is broken up by airline reaffirm the fact that each of the airlines approaches the market differently and with differing strategies.

This paper represents an initial look into the determinants of Canadian air fares. I suggest that future research attempt to take a more in-depth look at this topic. There are a few areas where additional research would increase the understanding of this subject greatly. First, it would be of use to have a larger sample set, covering more flight dates. If more dates were examined then the potential weekend bias could be accounted for, which would allow for a comparison of how fares respond to which day of the week the trip is taken. Second, it would be useful to have more information about the stops, such as which city they are in and the length. This would allow for a better discussion on the impact of the hub-and-spoke system in Canada. Third, including an estimate for load factor, as well as the plane's size, would allow for a further discussion on the hub-and-spoke system. A possible proxy for load factor could be made using the data for number of annual passengers and itinerant movements, though this would be airport load factor, not airline. Finally, the impact of average flight delays for a given route or airline, depending on data availability, as well as people's perceptions of the airlines would allow for a discussion on how the airlines' past market behaviour impacts their fares as well as their market power.

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Endnote

[i] The market is defined as unidirectional route on a given day.