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Relative Impact of Income and Price on Scheduled Passenger Traffic in the U.S. and Canada

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ABSTRACT

This paper explains why U.S. jet airlines had a larger growth in scheduled revenue passenger-miles (RPM) than Canadian jet airlines between 1981 and 1993, even though the U.S. gross domestic product (GDP) increased less than Canada's GDP.

Regression analyses, using logarithmic transformations and adjusting to eliminate autocorrelation, imply that income (measured by GDP) and average prices (yields plus taxes) influenced RPM to different degrees in each country.

Using constant-dollar data for 1969-92, regression analyses calculate a Canadian GDP elasticity of 1.224 and a price elasticity of -1.028. In contrast, the GDP elasticity for U.S. carriers was 1.881 while their price elasticity was -.594. Thus, the U.S. airlines got larger RPM increases from smaller GDP increases. At the same time, a 32 percent decline in real prices between 1980 and 1992 increased U.S. RPM more than the 8.2 percent price decrease experienced by Canadian airlines. This despite the higher Canadian price elasticity.

Similar results were obtained using current-dollar data. Canadian elasticities were almost equal (1.391 for GDP and -1.385 for prices), compared with 1.087 and -.787 for the U.S. airlines. In this case, Canada's larger growth in GDP was substantially offset by a 75.2 percent increase in prices, compared with just a 15.4 percent increase in the U.S.

Both analyses imply that price changes served to overcome larger GDP growth in Canada. This has important implications for governments, especially those in Canada, in terms of the adverse impact that tax increases have on their airlines.

INTRODUCTION

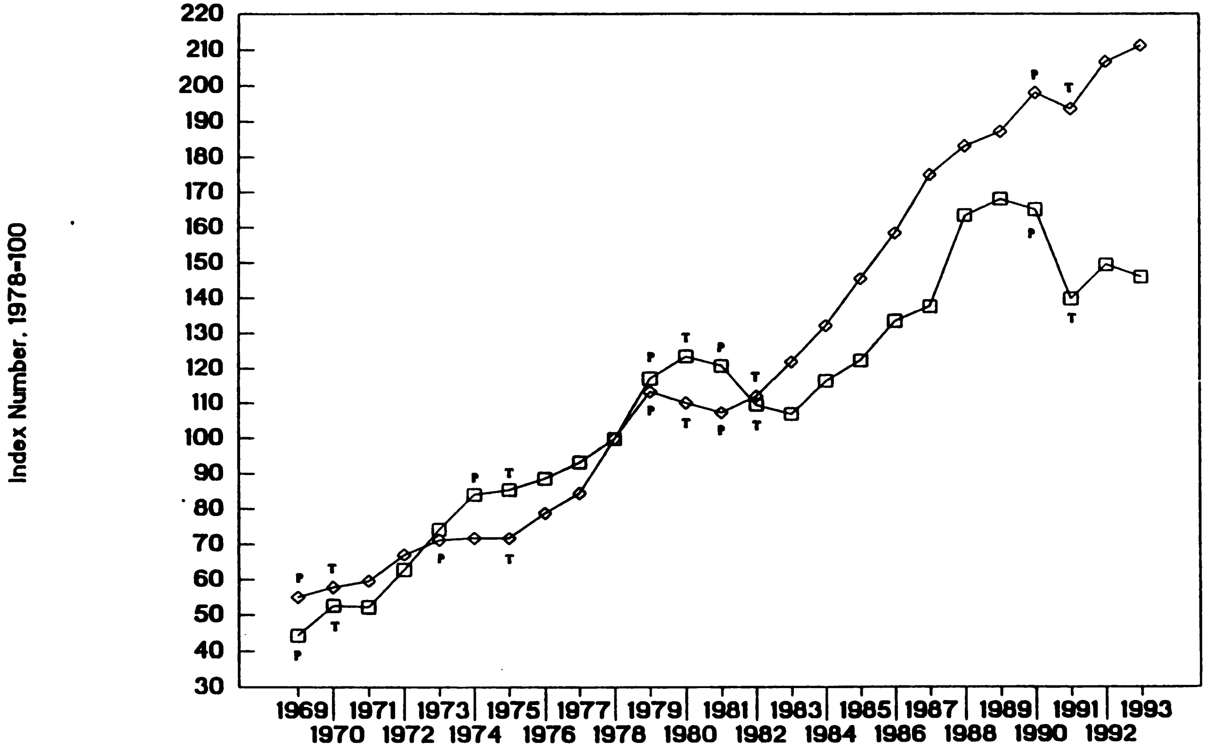
Leaders in the airline industry widely believe that both long-term growth and fluctuations in passenger traffic are due to changes in gross domestic produce (GDP), the most general measure of income.[1] While air transportation is a normal good and, therefore, certainly increases and decreases with income, comparisons between Canadian and U.S. scheduled RPM indicate that other factors also influence traffic, and that the importance of various factors differ between countries.

Figure 1 depicts the 1969-93 index numbers (1978=100) of scheduled revenue passenger-miles (RPM) carried by Canadian and U.S. airlines operating jet aircraft in each of those years.[2] It shows that, overall, U.S. RPM grew more slowly than Canadian RPM from 1969 through 1981, but then generally had higher growth rates through 1993. If income were the key factor

Figure 1

INDEX OF CDN./U.S. SCHED.RPM (1978=100)

AIRLINES OPERATING JET AIRCRAFT,1969-93



Source: Appendix A.

P = Peak T = Trough

in traffic growth, this would imply that U.S. GDP grew less overall than Canadian GDP between 1969 and 1981, but then grew at appreciably higher rates on through 1993.

Figure 2 provides the index numbers (1978=100) for Canadian and U.S. constant-dollar GDP from 1969 through 1993. It shows that U.S. GDP did generally grow less than Canadian GDP between 1969 and 1981. However, contrary to expectations based on relative RPM growth, the U.S. economy continued to grow more slowly between 1981 and 1989. It wasn't until Canada experienced a deeper and longer-lived recession in 1990-91 that U.S. GDP grew more rapidly, while still falling short of equalling total Canadian GDP growth since 1969. Overall, the evidence for 1981-89 is inconsistent with the widely-held belief that income plays the primary role in causing traffic growth. Rather, it indicates that the faster growth in U.S. RPM after 1981 must have been due to factors other than GDP.

This conclusion is supported by the Peaks and Troughs of the Canadian and U.S. business cycles noted on Figure 1. They show that, during the first three of the five Canadian cycles in this period, scheduled RPM increased in the years having a trough (1970, 1975, 1980). They only declined during the 1982 and 1991 troughs. At the same time, the 1981 and 1990 business-cycle peaks saw declines in scheduled RPM. A similar pattern occurred in the U.S. Traffic failed to decline during the 1970, 1975 and 1982 troughs, but did so in 1980 and 1991, while the cyclical peak in 1981 saw a decrease in traffic. These inconsistencies raise additional questions about the dominant impact of GDP on airline traffic.

Economic theory predicts that passenger traffic should be influenced by price as well as by income. However, the role of price is generally downplayed as an explanatory variable by airline commentators. This paper will bring price into the analysis and endeavor to determine its relative importance in explaining the increases and decreases in traffic that occurred in Canada and the U.S. between 1969 and 1993.

PREVIOUS STUDIES

Several formal studies of airline traffic growth have been carried out and published by government agencies and aircraft manufacturers over the years. The primary purposes of these studies were to forecast the demand for government-provided facilities or the demand for new aircraft.

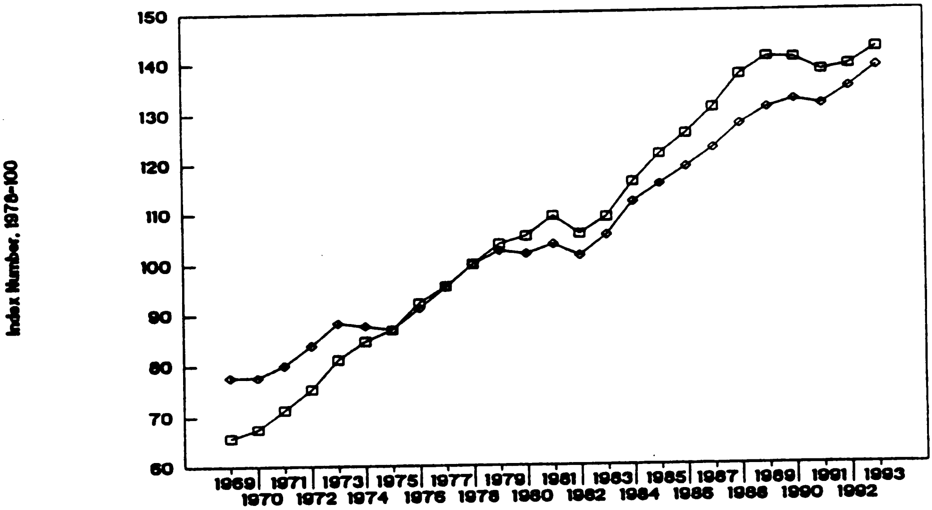
Early studies were carried out by the Civil Aeronautics Board (CAB) staff who, for example, estimated a fare elasticity for certificated U.S. airlines of -1.35 and an income elasticity of +1.09, based on U.S. data for 1946-71.[3] Using constant-dollar worldwide data for 1960-90 (excluding the USSR and China) in a logarithmic model, the International Civil Aviation Organization (ICAO) calculated a yield elasticity of -0.66 and GDP elasticity of 2.08.[4] Using the same model and worldwide data for 1970-89, the Boeing Company obtained a yield elasticity of -0.363 and GDP elasticity of +1.995.[5]

Each of these studies concluded that both income and price influence scheduled RPM. However, contrary to the CAB results, the ICAO and Boeing studies indicated a relatively high income elasticity and a much lower yield elasticity. Findings such as these are probably the source of the belief that income (GDP) is the primary explanatory variable in traffic growth.

Figure 2

INDEX OF CDN./U.S. GDP (1978=100)

CONSTANT 1978 DOLLARS, 1969-93



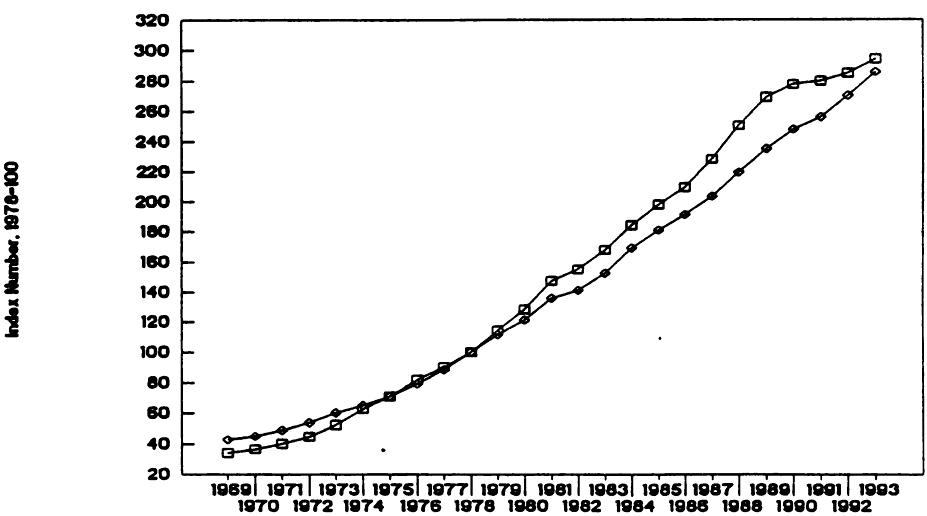
Source: Appendix A.

□ Canada ◇ U.S.

Figure 3

INDEX OF CDN./U.S. GDP (1978=100)

CURRENT DOLLARS, 1969-93



Source: Appendix A.

□ Canada ◇ U.S.

Yet they still fail to explain the differences in RPM growth experienced by Canadian and U.S. jet operators since 1981.

AUTOREGRESSION

One problem with both the ICAO and Boeing regression analyses was that their authors did not report the results of the tests for autocorrelation.[6] Since all these data are time series, and thus clearly subject to autocorrelation, this omission means that the reader is unable to tell whether the reported regression coefficients are statistically reliable.

For this paper the standard logarithmic regression equation used by ICAO and Boeing was applied to data for Canada and for the U.S. for the years 1969-92. That is, the natural logarithms of Canadian scheduled RPM (the dependent variable) were regressed with the logarithms of Canadian GDP and average prices (the independent variables), measured first in current-dollars and then in constant-dollars. The same was also done with U.S. data. In each case, while high adjusted R-squares were obtained, the Durbin-Watson test indicated the existence of positive autocorrelation. If this were also true for the worldwide data used by ICAO and Boeing, their coefficients may be inefficient estimates of the income and price coefficients. Obviously, autocorrelation must be removed in order to estimate reliable coefficients.

There are several ways to remove the effects of serial correlation. One is to introduce a lagged autoregressive variable [AR(1), for example].[7] A second way is to introduce a dummy variable for some factor, whose ordinal fluctuations help define the variation in the dependent variable and, thus, work to reduce autocorrelation. Both were used in this study and both proved to be effective in eliminating autocorrelation.

CANADIAN and U.S. DATA

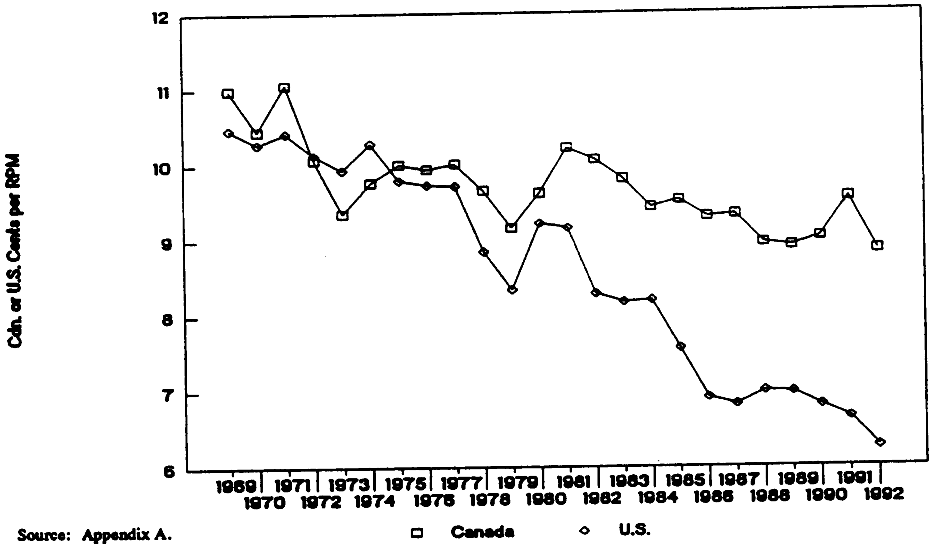
In addition to the constant-dollar GDP index numbers in Figure 2, Figure 3 shows the 1969-93 index numbers for Canadian and U.S. current-dollar GDP. Then, Figures 4 and 5 show the average prices per RPM (yields plus taxes) for 1969-92 in constant- and current-cents using each country's own currency. It is desirable to use average prices rather than yields because tax policies in the two countries differed appreciably, with Canadian taxes on air transportation becoming much higher than U.S. taxes.[8] Finally, Figure 6 shows the current-dollar turbine fuel prices in Canadian and U.S. cents per liter. The actual data underlying all these figures are given in Appendix A, and these are the data used in the regression analyses reported in this paper. Since all regression analyses were done separately for Canada or the U.S., there was no need to convert monetary measures into a common currency.

Figure 6 shows the second oil price shock of 1978-81 was much larger than the price shocks of 1974-76 and 1990-91. It also shows that increases in U.S. airline fuel prices started

Figure 4

CONSTANT $ PRICES PER RPM, CDN./U.S.

AIRLINES OPERATING JET AIRCRAFT, 69-92

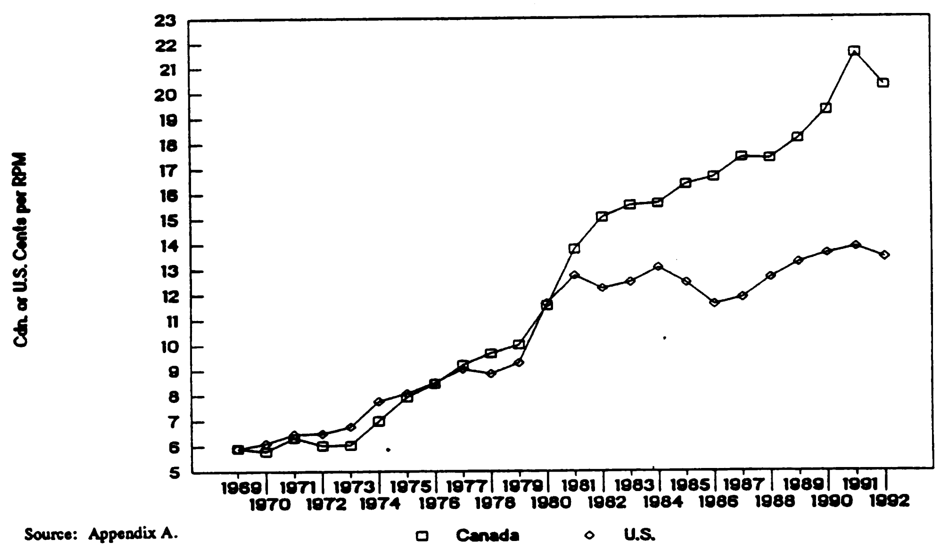


Source: Appendix A.

Figure 5

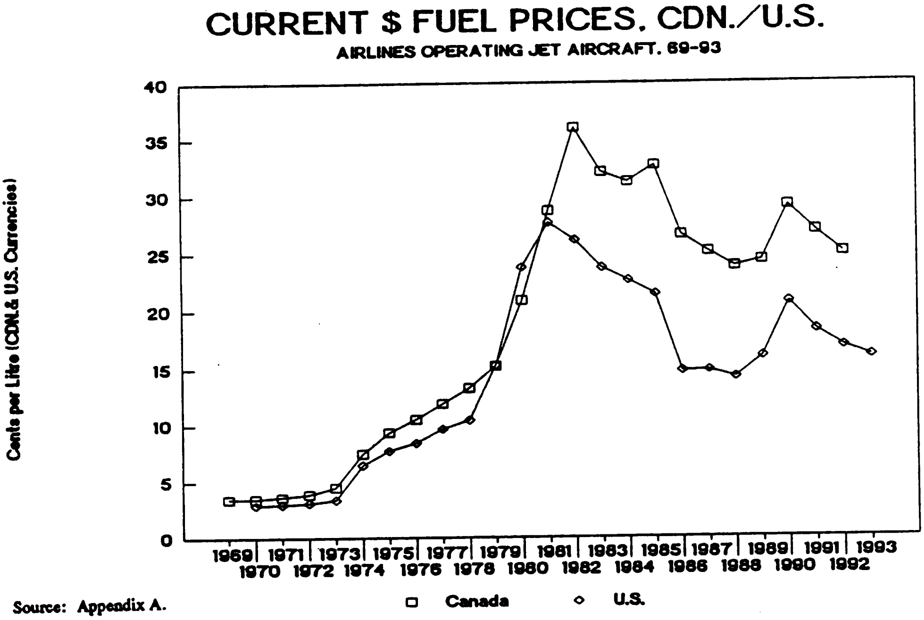
CURRENT $ PRICES PER RPM, CDN./U.S.

AIRLINES OPERATING JET AIRCRAFT, 69-92



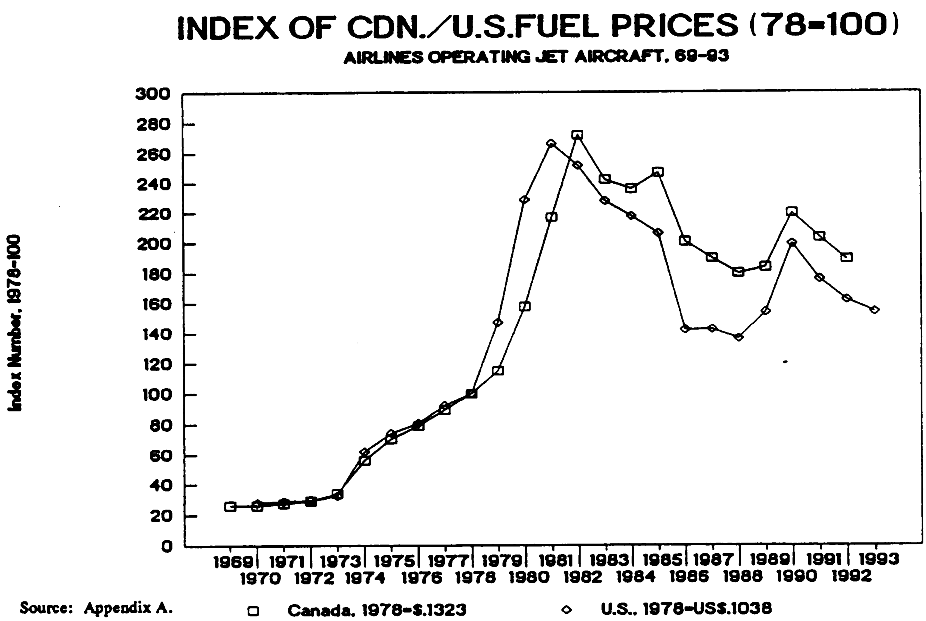
Source: Appendix A.

Figure 6



Source: Appendix A.

Figure 7



Source: Appendix A.

in 1979, peaked in 1981, and then fell, while Canadian fuel prices began to increase a year later, in 1980, peaked in 1982 at a higher level than in the U.S., and then declined but continued to be appreciably higher than U.S. prices. An earlier detailed study of Canadian and U.S. fuel prices concluded that this ongoing price difference was largely due to higher taxes and airport fuel charges in Canada.[9] The relative changes in Canadian and U.S. fuel prices are shown more clearly by the index numbers (1978=100) drawn in Figure 7.

The one-year lag in Canadian fuel prices was due to different energy policies adopted by the Canadian and U.S. governments. Domestic aviation fuel prices were decontrolled in the U.S. on February 25, 1979, four months after the Airline Deregulation Act was adopted.[10] In contrast, because of the National Energy Program, aviation fuel prices were not decontrolled within Canada until well into 1980.[11] This timing difference in fuel price increases had important secondary effects. The one-year delay in fuel-price increases in Canada (Figure 7) resulted in a one-year delay in the largest increases in average passenger fares (1981 in Canada versus 1980 in the U.S. -- Figure 5), followed by the same one-year delay in scheduled RPM declines (1981-83 in Canada versus 1980-81 in the U.S. -- Figure 1). This, of course, implies that the large increases in average passenger prices had an important impact on RPM in those years.

In order to reflect the large size and impact of the second fuel price increase, and the different timing of its occurrence in the two countries, a dummy fuel variable was created. For the variable USFUEL, the years 1979-82 were given a value of "1" with all other years having a value of "0". For Canada, the variable CNFUEL was assigned a value of "1" for the years 1980-83. It turned out that this dummy fuel variable played an important role in eliminating autocorrelation in most regression analyses.

CANADIAN and U.S. REGRESSION ANALYSES

It is easy to obtain high adjusted R-squares when using time-series data in regression analyses. For example, the arithmetic regression of scheduled RPM against years only (1969=1, and 1992=24) yields an adjusted R-square of .959 for the U.S., and .906 for Canada. At the same time, the Durbin-Watson statistic shows positive autocorrelation in both cases so that the coefficients are unreliable. There is no underlying theory that supports time per se as being a causal factor in traffic growth. It is the things that happen over time that are relevant. For example, the replacement of propeller aircraft with jet aircraft starting in 1958 had a major impact on airline traffic as a result of a fundamental improvement in service quality and reduction in aircraft operating expenses. That is one reason why this study is limited to airlines that operated jet aircraft.

Simple regressions of the natural logarithms of scheduled RPM versus logs of current-dollar GDP, constant-dollar GDP, current-dollar average prices, or constant-dollar average prices also yield high adjusted R-squares for the U.S. jet airlines (.981, .993, .847, and .948, respectively), and for the Canadian airlines (.929, .955, .834 and .713 respectively).

Unfortunately, all but the U.S. constant-dollar GDP regression (.993) suffered from autocorrelation.

The object of this paper, however, is not to obtain high adjusted R-squares. Rather, it is to determine the relative importance of income and average price on airline traffic growth in an effort to explain why U.S. traffic grew more rapidly than Canadian RPM after 1981, even though Canadian GDP increased more than U.S. GDP. Initially it was expected that average price would have a greater impact on traffic than GDP and, since Canadian current-dollar prices grew more than U.S. prices, or Canadian constant-dollar prices decreased less than U.S. prices (see Figures 5 and 4), this would account for Canadian RPM increasing less than U.S. RPM. It turns out that this reasoning is partially correct, but only partially.

Regressing the natural logarithms of scheduled RPM for each country for 1969-92 against the logs of current-dollar GDP and average prices, or the logs of constant-dollar GDP and average prices, yields results similar to those obtained with simple regressions, that is, high adjusted R-squares (.962 to .995) with low Durbin-Watson statistics indicating the presence of autocorrelation. However, adding the dummy fuel variable (described above) served to increase the Durbin-Watson statistic to the point where there was no evidence of autocorrelation in three of the four analyses.[12] The results of these regression analyses are summarized in Table 1.

Equations 1-3 have no evidence of autocorrelation, have high adjusted R-squares, and have statistically significant coefficients with the proper signs for GDP and average price (but not for the fuel coefficient). Equation 4, however, retains evidence of positive autocorrelation even with the added fuel variable. This was removed by using the AR(1) error specification in which observations were lagged by one unit. This adjusted Equation 5 will be used with Equations 1-3 in the following discussion.

Because of the logarithmic specifications, the GDP and average price coefficients provide estimates of elasticity. Thus, Equations 1 and 2 imply that the U.S. jet airlines have GDP elasticities that are higher than their average price elasticities. This is especially true for the constant-dollar relationships shown in Equation 2. In that equation, the GDP elasticity is 3.17 times larger than the absolute value of the average-price elasticity (1.881 vs. 0.594). This happens to be consistent with the ICAO results calculated from the logarithms of worldwide real GDP and real yields for 1960-90. That study found a GDP elasticity of 2.08 which is 3.15 times larger than the absolute value of their yield elasticity of 0.66.[13] Boeing reported an even larger difference, however, using constant-dollar data for 1970-89. It calculated a worldwide GDP elasticity of 1.995, which was 5.5 times larger than the absolute value of its yield elasticity of 0.363.[14]

Equation 1 has a somewhat different finding. Using current-dollar data, that equation concludes the differences in the absolute values of the U.S. elasticities differ by only 38 percent (1.087 vs. 0.787). Not only is the income elasticity very close to one, but the price elasticity is also closer to one, even though it continues to be inelastic. This implies that consumers flying on U.S. jet airlines are influenced more by a given percentage change in current-dollar prices than by the same percentage change in constant-dollar prices, but are influenced less by some percentage change in current-dollar GDP than by that percentage change in constant-dollar GDP. In contrast, consumers flying on Canadian carriers respond more to changes in both current-

TABLE 1

Regression Equations Between the Log of Scheduled RPM and the Logs of GDP and Average Price Canadian and U.S. Airlines Operating Jet Aircraft, 1969-92

U.S. Airlines

1. Current-dollar GDP and Average Prices:

LUSRPM = 1.087 LUSCUGDP - .787 LUSCUPRICE + .040 USFUEL
(25.75) (-8.94) (2.22)
Adjusted R-square = .996 Durbin-Watson Statistic = 1.865

2. Constant-dollar GDP and Average Prices:

LUSRPM = 1.881 LUSCOGDP - .594 LUSCOPRICE + .052 USFUEL
(17.14) (-5.17) (3.91)
Adjusted R-square = .997 Durbin-Watson Statistic = 1.886

Canadian Airlines

3. Current-dollar GDP and Average Prices:

LCNRPM = 1.391 LCNCUGDP - 1.385 LCNCUPRICE + .086 CNFUEL
(19.67) (-12.52) (4.11)
Adjusted R-square = .991 Durbin-Watson Statistic = 1.591

4. Constant-dollar GDP and Average Prices:

LCNRPM = 1.195 LCNCOGDP - 1.538 LCNCOPRICE + .126 CNFUEL
(12.23) (-3.83) (3.46)
Adjusted R-square = .975 Durbin-Watson Statistic = 0.879

5. Constant-dollar GDP and Average Prices adjusted by AR(1) error specification:

LCNRPM = 1.224 LCNCOGDP - 1.028 LCNCOPRICE + .070 CNFUEL
(8.55) (-3.28) (1.60)
AR(1) = .591 (2.636)
Adjusted R-square = .981 Durbin-Watson Statistic = 1.622

Source: Calculations using data from Appendix A and the MicroTSP, Version 7.0 program (see pp. 14-8 to 14-10 of the MicroTSP User's Manual).

dollar GDP and average prices than to identical percentage changes in constant-dollar GDP and prices.

WHY CANADIAN RPM INCREASED LESS THAN U.S. RPM

The elasticity coefficients in Table 1 explain why Canadian RPM generally grew at a slower rate than U.S. RPM after 1981. Looking first at Equation 5, we see that the Canadian constant-dollar GDP elasticity is only 1.224 compared with 1.881 for the U.S. in Equation 2. This implies that the 31.9 percent increase in Canadian constant-dollar GDP from 1980 to 1992 had less impact on scheduled RPM than the 32.0 percent increase in U.S. GDP.[15] At the same time, the 8.3 percent decrease in Canadian constant-dollar prices, with an elasticity of -1.028, did not increase Canadian RPM as much as the 32.2 percent reduction in U.S. prices increased U.S. RPM with its elasticity of -.594. Thus, in terms of constant dollars, the regression analyses imply that the U.S. RPM grew appreciably more than Canadian for two reasons -- its higher GDP elasticity <u>and</u> its much greater decline in average prices which more than made up for its lower price elasticity.

Equation 3 provides another interesting finding. With current-dollar data reflecting the large inflation of the late 70's and early 80's, the absolute values of the average-price elasticity and GDP elasticity were virtually the same in Canada -- 1.385 versus 1.391! This implies that the same percentage change in both current-dollar GDP and average prices effected Canadian RPM equally, but in opposite directions. Thus, while current-dollar Canadian GDP increased by 122.2 percent from 1980 to 1992, the impact on RPM of that increase in GDP was substantially offset by a 75.2 percent <u>increase</u> in current-dollar average prices in Canada.

Meanwhile, the analyses also imply that the virtually identical 123.0 percent increase in U.S. current-dollar GDP had a smaller impact on RPM than in Canada due to its lower GDP elasticity (1.087 versus 1.391 for Canada). This smaller GDP impact on RPM, however, was offset to a much lesser extent by the small 15.4 percent increase in U.S. current-dollar average prices with an elasticity of just -.787 (versus -1.385 for Canada). Again, changes in both GDP and average prices influenced traffic, but the regression analyses support the contention that it was the intercountry differences in price increases and elasticities that were largely responsible for RPM growing faster in the U.S. than in Canada. The large increases in Canadian current-dollar prices, with high elasticities, offset much of the traffic growth associated with increasing GDP.

REASONS FOR CANADA'S HIGHER PRICE ELASTICITIES

The fact that both the current- and constant-dollar price elasticities are elastic in Canada, but are inelastic in the U.S., deserves further consideration. Three reasons for these differences come to mind. First, the higher absolute values for the Canadian elasticities are consistent with the fact that Canadian travelers can, and do, cross the border and use U.S. carriers for domestic, transborder and international travel when Canadian prices are appreciably higher than those available in the U.S In 1984, Transport Canada estimated that over 200,000 Canadian passengers used U.S. carriers, while in 1992 the estimated leakage to the U.S. was well over 500,000 passengers.[16] This was more than two percent of total Canadian passengers in 1992, and just under four percent of domestic passengers. Since most of the leakage consisted of long-haul passengers, the impact on Canadian domestic RPM is doubtless greater than four percent.

Second, as scheduled passengers fares increase, more passengers are diverted to Canadian charter operations. For example, domestic charter RPM in Canada's top ten domestic city pairs fell from 552 million in 1985 to 9.7 million in 1988 and then grew to 803.6 million in 1992 (and higher in 1993).[17] Thus, in 1992, another 3.0 percent of total RPM might have used scheduled service had fares been at the lower charter levels.

Third, there is a theoretical explanation regarding why the U.S. carriers appear to operate in the inelastic portion of their demand curve while Canadian carriers operate in the elastic portion. It is common for professors, using straight line demand curves, to demonstrate that a firm's profit maximizing price should be in the elastic upper half of the demand curve where marginal revenues are positive and, thus, can be equal to marginal costs which are always positive. This reasoning, however, assumes that all consumers pay the same single price so that the demand curve is also the average revenue/price curve. In an industry practicing first, second and third degree price discrimination, with consumers paying a variety of fares, the marginal revenue curve rotates up towards the demand curve and the average revenue/price curve lies above the traditional demand curve. In this situation, marginal revenue can equal positive marginal cost in the inelastic portion of a demand curve. It happens that over 90 percent of U.S. RPM moves under discount (largely discriminatory) prices, compared to under 75 percent of Canadian RPM.[18] Thus, profit maximizing prices for U.S. carriers should exist at lower price elasticities than those of Canadian carriers, and profit maximizing (or loss minimizing) average prices could well be in the inelastic portion of the demand curve.

POLICY IMPLICATIONS

Tax Policy

The above findings have particularly important policy implications for Canada. Since average-price elasticities of Canadian jet airlines are larger than one (especially for changes in current-dollar prices), Canadian governments must recognize that increases in direct taxes (ATT, GST and the Quebec sales tax) will serve to reduce scheduled RPM by proportionally more than the resulting percentage increases in average prices, unless the airlines reduce fares by offsetting amounts. The same is true for increases in fuel taxes and other government charges that serve to increase fares because of increased costs. Similarly for the airlines, increases in current-dollar fares will serve to decrease RPM proportionally more than the increases in fares and, thus, reduce total revenues. Of course, reduced RPM also tend to reduce total costs so profits may or may not increase with increased fares.[19]

The 15.34 percent decline in Canadian scheduled RPM in 1991 is consistent with this reasoning. Between 1990 and 1991, average yields increased by 7.21 percent while average taxes increased from roughly 8.5 percent of yields to about 13.1 percent -- a tax increase of more than 50 percent which resulted in a 4.6 percentage-point increase in average prices. Thus, in total, average prices increased by about 11.8 percent in one year. Applying the 1.385 average price elasticity coefficient from Equation 3 to this price increase implies a decline in RPM of about 16.3 percent. Then, the 0.73 percent current-dollar GDP increase between 1990 and 1991, times its elasticity of 1.391, yields a 1.0 percent increase in RPM from that factor. The predicted 15.3 percent decrease in RPM from these two opposing forces is virtually identical to the 15.34 percent decrease that actually occurred between 1990 and 1991.

The same analysis applies to the U.S. airlines. However, their current-dollar price elasticity of -.787 implies that changes in average price have a smaller impact on RPM, while their 1.087 GDP elasticity also implies a smaller impact from economic growth.

Similar calculations for other years would not necessarily provide such close results due to the random impact of various factors (which, of course doubtless affected the above calculations), but the point is that Canadian governments have less latitude than U.S. governments to increase taxes without having significant adverse effects on their carriers. It would be ironic if the increase in overall passenger taxes in 1991-92 resulted in the Canadian federal government having to use large portions of increased tax revenues to purchase aircraft from, and guarantee loans to, PWA Corporation which might have had less financial trouble in the absence of the tax increases.[20]

Airport Inspection Fees

A related concern is the proliferation of the Passenger Facility Charge (PFC) in the U.S. and elsewhere. The Air Transport Association reported that 161 U.S. airports had PFC approved by the Federal Aviation Administration as of December 1, 1993, with 32 more pending.[21] In all but two cases, the PFC was set at the $3.00 maximum, with collections limited to no more than two airports on a one-way trip and four on a round trip.[22]

Similar charges are being adopted in Canada as it moves to privatize its airports. Vancouver International Airport has implemented an Airport Improvement Fee (AIF) for each enplaned passenger originating in Vancouver of C$5 for travel within British Columbia, C$10 for flights to other North American points, and C$15 for travel to points outside North America.[23] Also, Edmonton Municipal Airport has an airport user fee of C$5.20 for each enplaning or deplaning passenger.[24] Based on Equations 1 and 3, it appears that these charges will reduce RPM by .787 percent in the U.S. and by 1.385 percent in Canada for each resulting percentage-point increase in average prices.

The same general considerations apply to any increases or additions to U.S. Federal Inspection Fees (immigration, customs and animal/plant) now totaling $12.50 to $13.95 for each international passenger arriving in the U.S.[25] While it seems unlikely that the price elasticity will be the same for long-haul international trips as opposed to short-haul domestic trips, it also seems unreasonable to expect that these charges will have no impact on scheduled U.S. RPM, especially on transborder traffic from Canada where passengers must pay the \$12.50 immigration and customs fees.

The point of all this is that Canadian and U.S. airlines are experiencing significant increases in taxes and fees which serve to increase average prices to passengers. Those imposing these taxes and fees should not be surprised to find that they decrease the airlines' total RPM and will result in less-than-expected tax revenues. It is reminiscent of how governments came to consider railroads to be "cash cows" in the late 19th and early 20th centuries.[26]

Implications Regarding Profits

Since Canadian average-price elasticities are in the elastic range it follows that total revenues can be increased somewhat by lowering average prices. Whether or not this will increase profits depends on how much total costs increase as a result of the increased traffic.

In contrast, U.S. airlines operate in the inelastic range which means that further reductions in average prices in general will not increase total revenues. However, individual prices can still be lowered in ways to increase total revenues. For example, if first-class and business-class fares are lowered to the point where a proportionally larger number of economy passengers chose to use these higher-than-economy fares, price reductions can result in higher average prices and revenues. A diversity of prices provide many opportunities to modify individual prices in ways that will raise total and marginal revenues. At the same time, operating in an inelastic demand situation implies that the airlines must increase average prices or reduce costs in order to increase profits or reduce losses). Given that excess capacity now characterizes the industry, raising prices will serve to increase that excess capacity. Therefore, the U.S. airlines' focus should be on lowering costs in order to return to profitable operations.[27]

CONCLUSIONS

The regression analyses described in this paper imply that changes in GDP and average prices both have important effects on airline RPM, but the relative effects (elasticities) differ among countries. This is true regardless of whether they are measured in current-dollars or constant-dollars. Thus, while worldwide elasticity estimates are useful, individual countries and carriers should be aware that their own elasticities may differ appreciably from worldwide averages.[28]

In the case of Canada, average price elasticities are elastic, and are close to the GDP elasticities (especially when measured in current dollars). In the case of U.S., average prices elasticities are inelastic but, because of large declines in constant-dollar prices, they have still played an important role in increasing RPM.

It would be pleasant for airline managers if changes in RPM were due almost entirely to changes in GDP. Since they have no influence over changes in GDP it would be easy and comfortable for them to say that they can do little or nothing about declining traffic since it is due to declining GDP. It is clear, however, that changes in average prices also influence changes in RPM, and managers have a great deal to say about fare changes.

Government policy makers also bear responsibility for changes in airline traffic. Not only do fiscal and monetary policies change GDP, but tax policies which increase ATT, GST, inspection fees and other taxes on air travel have an adverse impact through increasing prices paid by consumers. Also, policies which allow various airport authorities to assess passenger facility charges and airport improvement fees on passengers serve to decrease total traffic.

The above analyses imply that slower growth in Canadian RPM after 1981 was due to higher fares and larger tax increases in a situation where firms were operating in an area of elastic demand. Canada's larger current-dollar price increases (or smaller constant-dollar declines) were consistent with the continuation of formal regulation through 1987. It is not a coincidence that the first year of deregulation was the first year in which both current- and constant-dollar Canadian prices declined after 1978, and that Canadian RPM had a larger percentage increase than U.S. RPM (see Figures 1, 4 and 5). The fare increases following PWA's acquisition of Wardair in 1989, plus higher taxes, resulted in large price increases with a reversion to slow growth and then declines in RPM until prices fell in 1992.

Clearly, both airline managers and government policy makers share responsibility for airline traffic performance. Recognizing the importance of both GDP and average price on airline traffic would be a significant step in their discharging this joint responsibility more effectively.

ENDNOTES

* The author is Professor Emeritus of Economics, York University.

1. See, for example, Edward H. Phillips, "Airlines' Choice: Adapt or Perish," Aviation Week & Space Technology (March 14, 1994), p. 62.

2. Index numbers are used because of the large differences in traffic carried by Canadian and U.S. jet airlines. Actual Canadian scheduled RPM ranged from 8.08 billion in 1969 to a high of 30.60 billion in 1989, compared with the U.S. range of 127.04 billion in 1969 to 488.26 billion in 1993 (see Appendix A).

3. Wayne Watkins, Donna Kaylor and David Richards, "Forecast of Scheduled Domestic Air Travel for the 50 States, 1972-1981," (Civil Aeronautics Board, November 1972), p. 7. Calculations were based on U.S. data for 1946 to 1971 using a delta-log equation which provided the following results:

Δ**log**RPM/Capita = .0736 - 1.3498 Δ**log**FPM + 1.088 Δ**log**DPI/Capita (.266) (.433)
-.0395 **log**Time
(.030)
R-squared = .559; Durbin-Watson statistics = 2.02.
FPM = CPI-adjusted average fare per passenger-mile.
DPI/Capita = real disposable personal income/capita.

4. International Civil Aviation Organization, Outlook for Air Transport to the Year 2001, Circular 237/AT96 (August 1992), p. 45. Estimated passenger model:

lnPKP = 1.60 + 2.08 **ln**GDP - 0.66 **ln**PYIELD
(24.7) (6.3)
R-squared = 0.999; No Durbin-Watson statistic specified.

5. Boeing Company, Current Market Outlook, (Feb. 1991), p. 80. Estimated high passenger formula:

log(RPMs) = -11.362 + 1.995 **log**(world GDP) - 0.363 **log**(yield)
R-squared, "t" statistics, and Durbin-Watson statistic are not reported.

6. The CAB study did calculate the Durbin-Watson statistic and found no evidence of autocorrelation.

7. R. E. Hall, J. Johnston and D. M. Lilien, MicroTSP User's Manual, (Irvine, CA: Quantitative Micro Software, 1990), pp. 14-10 to 14-13.

8. The U.S. domestic air transportation tax (ATT) was 8% from 1969 through December 1, 1990, except for about two years from around December 1, 1980 to December 1, 1982 when it was 5%. It increased to its current level of 10% on December 1, 1990. The international ATT was \$3.00 per passenger until early 1990 when it increased to \$6.00. A U.S. Federal Inspection Fee was implemented in early 1987 at \$10.00 per deplaning passenger. It has since increased to \$13.95 per passenger. In Canada, the first ATT was introduced on December 1, 1974, when a domestic tax of 5% (to a maximum of C\$5.00) was adopted together with an international tax of C\$5.00 per passenger. The domestic and international ATT increased eight times until the domestic ATT became 10% plus C\$4.00 (to a maximum of C\$50.00) on May 1, 1987, and C\$19.00 per international passenger. Effective January 1, 1991, the domestic ATT was decreased to 7% plus C\$10.00 (to a maximum of C\$40.00) when the 7% Goods and Services Tax (GST) was applied to the fare plus ATT. Combined, these two taxes totaled about 15%. In addition, effective July 1, 1992, the Province of Quebec applied a 4% services tax to the fare plus ATT for domestic travel originating in Quebec. Lack of data on domestic revenues on Quebec-originating travel prevented this tax from being included in this study. Starting January

1, 1991, the international passenger tax was $40.00 if the first enplanement was in Canada, but remained at $19.00 if the first enplanement was outside of Canada. Official Airline Guide, North American Edition (various dates, 1970-94). FAX from J.A.A. Lovink, Transport Canada, May 19, 1994, and telephone conversation June 27, 1994.

9. W. A. Jordan, Performance of Regulated Canadian Airlines in Domestic and Transborder Operations, Research Monograph No. 12 (Ottawa: Consumer and Corporate Affairs Canada, 1982), pp. 104-8.

10. PSA, Inc., Annual Report, 1979, p. 7. Also, Airline Deregulation Act of 1978, Public Law No. 95-504, 92 Stat. 1705, enacted October 24, 1978.

11. Energy, Mines and Resources Canada, press release (October 29, 1980); and Air Canada, 1981 Annual Report, p. 12. Note that the National Energy Program applied only to domestic fuel prices. Canadian carriers paid world prices for fuel used on international flights originating outside of Canada.

12. Regression analyses having 24 observations and three independent variables require the Durbin-Watson statistic be between 1.54 and 2.46 in order for there to be no evidence of autocorrelation at the five percent level of significance in a two-sided test. D.R. Anderson, D.J. Sweeney and T.A. Williams, Statistics for Business and Economics, 5th Ed. (Minneapolis/St. Paul: West Publishing Co., 1993)., pp. 636-38.

13. Supra note 5.

14. Supra note 6.

15. Note that the 1990-91 recession had a greater impact in Canada than in the U.S. Prior to 1990, GDP increased more rapidly in Canada than in the U.S. For example, between 1980 and 1989, Canadian constant-dollar GDP increased by 33.5 percent versus 28.1 percent in the U.S. (Calculated from data in Appendix A.)

16. Lloyd Axworthy, "New Canadian Air Policy," Notes for Remarks by the Minister of Transport to the House of Commons Standing Committee on Transport (May 10, 1984), p. 2. Also, Sypher:Mueller International Inc., The Impact of GST on Transborder Air Travel (Prepared for the Air Transportation Association of Canada, April 1992).

17. Statistics Canada, Catalogue 51-004, Vol. 25, No. 7 (July 1993), p. 7; and Vol. 26, No. 1 (January 1994), p. 3.

18. Air Transport Association, Air Transport 1991, p. 9. Also, Statistics Canada, Catalogue 51-206, Canadian Civil Aviation, 1991, p. 31.

19. Governments have more incentive to increase taxes than airlines have to increase fares. For example, increasing a 10% tax to 15% results in a 4.5% increase in current-dollar average prices and, thus, about a 6% decline in RPM in Canada. Despite this traffic decline, total tax receipts increase because the tax-rate increase is 50%. A five percentage-point increase in fares, however, is more than fully offset by the 6% RPM decrease. Of course, a tax increase is the worst situation for the airlines -- total RPM decline without an increase in average revenues so that total revenues decrease more than they would under the fare-increase scenario.

20. PWA Corporation, 1992 Annual Report, pp. 4 and 7. The sale of three A310-300 aircraft to the Department of National Defense was for approximately C$150 million. PWA Corporation, "Third Interim Report for Nine Months Ended September 30, 1992," p. 4.

21. Gordon G. Baldwin, "Airport Improvement Fees/Passenger Facility Charges and Canadian Airports," p. 1. Paper presented at the 29th Annual Conference of the Canadian Transportation Research Forum, Victoria, B.C., (May 17, 1994), referring to Air Transport Association of America, PFC MEMORANDUM 93-105, (December 1, 1993).

22. Baldwin, Ibid., p. 4. Also, OAG Desktop Flight Guide (June 1994), p. F143.

23. Baldwin, Ibid., p. 2.

24. Ibid., p. 1.

25. Supra. note 22, OAG, p. F142.

26. G. Kolko, Railroads and Regulation, 1877-1916 (Princeton, NJ: Princeton University Press, 1965), p. 165.

27. W. A. Jordan, "New Aircraft Orders: Still a Leading Indicator of Airline Profits," Airfinance Journal, 139 (June 1992), p. 42.

28. In addition, before using any published elasticity estimate, it would be wise to verify that the coefficients are reliable and are not influenced by autocorrelation.