



**ESTIMATION OF THE ECONOMIC
BENEFIT OF AIR JAMAICA
TO JAMAICA BETWEEN 1995 AND 2004**

John-Paul Clarke, Bruno Miller, Robin Riedel,
Owen Miller, Praveen Pamidimukkala, Michelangelo Raimondi
(with input from Peter Belobaba and Karen R. Polenske)

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MIT International Center for Air Transportation
Department of Aeronautics & Astronautics
Massachusetts Institute of Technology
Cambridge, MA 02139 USA

Executive Summary

In this study, we estimate the economic benefit of Air Jamaica to Jamaica between 1995 and 2004. Specifically, we determine the economic benefit of Air Jamaica by estimating the economic contribution of air transportation for the case where Air Jamaica does not exist and then subtracting this value from the economic contribution of air transportation for the case where Air Jamaica does exist. Thus the value we determine is the incremental contribution of Air Jamaica to the Jamaican economy, i.e. the benefit that can only be attributed to the presence of Air Jamaica.

Although there are many different ways in which airlines contribute to socioeconomic growth, only two of these mechanisms are explored in this study: 1) the portion of airline revenues that remain in Jamaica by virtue of the wages that are paid to residents of Jamaica, and the goods and services that are purchased from companies in Jamaica; 2) the expenditures of foreign visitors. Therefore, this study represents a conservative estimate of the benefit of Air Jamaica to the Jamaican economy.

The results of our analysis indicate that the economic benefit of Air Jamaica to Jamaica between 1995 and 2004 economy was US\$5.491 Billion of which US\$1.830 Billion was a direct incremental contribution to the economy and US\$3.661 Billion is the corresponding indirect incremental contribution.

1. Introduction

Air transportation is a significant factor in the socioeconomic development of nations [1]. Aviation provides access to markets and facilitates the transportation of goods and people throughout the world in relatively short time periods. Small island countries like Jamaica depend heavily on air transportation for commercial, political, and social connections to other countries. In this context, the existence of reliable, efficient, and convenient air service is essential for continued socioeconomic growth.

There are many different ways in which airlines contribute to socioeconomic growth [2], [3], [4]. For example, airports and airlines provide employment, payroll and local expenditures for goods and services. In turn, the increase in the number of employed persons at the airport or airline, and elsewhere in the economy due to the economic activities that result from the presence of the airport or airline, leads to better social welfare. The presence of convenient airline schedules makes a specific region or nation more attractive for both business and tourist travel, leading to decisions to locate business activities or take vacations in that region or nation, which all have a positive effect on the balance of trade.

In this study, two mechanisms are explored: (1) wages paid and goods and services purchased by Jamaican companies and (2) the expenditures of foreign visitors. We selected these two mechanisms because the monetary contribution of air transportation with and without the presence of a particular airline can be quantified using accepted modeling techniques, and because most of the data that are required to perform the requisite analyses are available. Therefore, this study represents a conservative estimate of the benefit of Air Jamaica to the Jamaican economy.

2. Technical approach

We determine the value of Air Jamaica to the Jamaican economy by first performing a counterfactual analysis, i.e., estimating the economic contribution of air transportation for the case where Air Jamaica does not exist, and then subtracting this value from the economic contribution of air transportation for the case where Air Jamaica does exist. Thus, the value we determine is the incremental contribution of Air Jamaica to the Jamaican economy, i.e., the benefit that a national carrier alone provides. An added strength of this approach is that we need only quantify those portions of the economic contribution that would be affected by the removal of Air Jamaica.

First, we consider the portion of airline revenues that remain in Jamaica by virtue of the wages that are paid to residents of Jamaica, and the good and services that are purchased from companies in Jamaica. Based on the results of our analysis of the Air Jamaica cost figures during the period in question, and the corresponding cost break down for US carriers in the US Department of Transportation Air Carrier Financial Reports [5], we assume that for passengers

who are destined to or originating in Jamaica: 30% of the ticket revenue stays in Jamaica if they travel on Air Jamaica, while only 10% of their ticket revenue stays in Jamaica if they travel on a foreign carrier. Further we assume that 20% of the ticket revenue from passengers who connect through Jamaica on Air Jamaica stays in Jamaica—this being the difference between 30% and 10%.

Second, we consider the expenditures of foreign visitors. According to the Caribbean Tourism Organization (CTO) [6] and The Planning Institute of Jamaica [7], each stopover visitor to Jamaica spends approximate \$1,000 dollars in Jamaica. Thus, any reduction in the number of stopover visitors due to either a reduction in the number of seats into and out of Jamaica, or a lessening of the convenience of airline schedules without the presence of Air Jamaica, will result in a reduction in the direct economic contribution due to air transportation.

2.1. Overview

A key question in any counter-factual analysis is “What would the competition do if the entity in question did not exist?” In a rational world, the decision to add a flight on a particular route would be based on the expected profitability of the new flight. There are several tools to assess the profitability of an additional flight leg. However, much of the resulting estimate depends on the interaction between the competitors. Because the interaction between competitors is game theoretic in nature, the response of other carriers is largely uncertain. Thus, we conduct the analysis for two limiting scenarios.

In Scenario A, foreign carriers do not change their schedules but add capacity to replace lost Air Jamaica seats by increasing the size of the aircraft that they fly to Jamaica to absorb some of the passengers that would have flown on Air Jamaica. This represents the upper bound of our estimate, as this results in a situation where many of the passengers who would have traveled to Jamaica on Air Jamaica—the fraction in each market depending on the details of the airline schedules in that market—do not take their trip because the remaining schedules are inconvenient or there are not as many available seats to Jamaica. It is important to note that this situation is not as far fetched as one might imagine because the decision to add additional flights on a route is based on many factors, not just whether there are passengers who want to travel. For example, an airline will only add a flight to Jamaica later in the day if there will be many connections from origins upstream of the airport where the flight departs for Jamaica and if there is corresponding demand for an early morning departure the following day—the latter is generally not the case for a tourist destination where visitors want to spend as much time as possible on their vacation. This assumption is also consistent with the experience of other islands in the region both before and after 11 September 2001 in terms of getting foreign carriers to add capacity to support their tourism industry.

In Scenario B, foreign carriers add capacity to replace lost Air Jamaica flights, but this is subject to the limitations placed on their ability to do so by their network structure. For example, we assume that carriers would add flights to and from their hubs but would not add flights from Jamaica to a market such as Boston, which is not a hub for any airline. This scenario represents the lower bound of our already conservative estimate, as this results in a situation where most of the passengers who would have traveled to Jamaica on Air Jamaica would still take their trip.

With these “bounding” schedules in hand, we estimate the monetary contribution to the Jamaican economy (due to Air Jamaica airline ticket revenues and the expenditures of stopover visitors who travel on Air Jamaica) and then compare this to the monetary contribution due to the Air Jamaica passengers who would still travel to Jamaica in both of the proposed scenarios.

The details of the analysis are described in the remainder of this section, followed in Section 3 by a description of the model used to determine how passenger choice would be different without Air Jamaica, and a presentation of the results in Section 4. A brief conclusion is provided in Section 5.

2.2. Estimating the Constant Parameters

For each “gateway,” we estimate constant values (used across all ten years) for the fraction of passengers on each route that travel between the gateway and Kingston (KIN), travel between the gateway and Montego Bay (MBJ), connect through Jamaica, and travel between markets beyond the gateway and Jamaica. The term gateway refers to a non-Jamaican airport (whether it be in the Caribbean, UK or US) that is at the other end of any route to Jamaica. These three steps were required because Air Jamaica archives data for each route as if Jamaica had only one international airport and without regard to the ultimate origin or destination of each passenger who travels on that route.

These values were derived by:

1. Estimating the fraction of Origin-Destination (OD) passengers (passengers traveling between either KIN or MBJ and the gateway) on each route using Computer Reservation System (CRS) data for the number of OD passengers on each route that traveled on Air Jamaica in 2001, and the corresponding Air Jamaica passenger data for the total number of Air Jamaica passengers on each route in 2001. We also use the CRS data to estimate the fraction of the OD passengers on a particular route in 2001 that travel to/from KIN and to/from MBJ. These estimates are used for all the years because CRS data were only available for 2001. It is important to note that the split in passengers between KIN and MBJ was the same before and after 11 September 2001.
2. Estimating the fraction of connecting passengers on each route using Air Jamaica data for the total number of passengers on each route in 2004 and the corresponding Air Jamaica data for the number of connecting passengers on each route in 2004. We use this estimate for all the years because connection data were only available for 2004.
3. Estimating the fraction of “feed passengers” on each route by subtracting the fraction of OD passengers and the fraction of connecting passengers from one. The term “feed passengers” refers to passengers who travel between Jamaica and markets beyond the gateway.

2.3. Estimating the Annual Economic Contribution Due to Air Jamaica

For each route and each year, we derive values for the economic contribution due to Air Jamaica by:

1. Using the constant parameters (the fractions) derived in Section 2.2 and the corresponding total number of Air Jamaica passengers to derive estimates for the number of connecting, OD, and feed passengers on each route.
2. Multiplying the number of passengers who travel on Air Jamaica to/from Jamaica (the sum of the number of OD passengers and the number of feed passengers who travel on Air Jamaica) by the average fare paid by each passenger and then by a factor of 0.3 (corresponding to the 30% recovery of Air Jamaica ticket revenue from passengers who travel to/from Jamaica).
3. Multiplying the number of connecting passengers by the average fare paid by each passenger and then by a factor of 0.2 (corresponding to the 20% recovery of Air Jamaica ticket revenue from connecting passengers).
4. Multiplying the number of passengers who travel on Air Jamaica to/from Jamaica by the fraction of passengers on the specified route who are visitors and then by \$1,000 (the average expenditure by visitors to Jamaica).
5. Summing the monetary values derived in steps 2 through 4.

We then derive a value for the total economic contribution due to Air Jamaica by summing all the contributions for each route and year.

2.4. Estimating the Annual Economic Contribution in Scenario A

In Scenario A, we assume that the other carriers do not change their schedules. Therefore, we need only derive values for the economic contribution due to “former Air Jamaica passengers” who would still travel to/from Jamaica on the existing schedules of other airlines.

For each route and year, we derive this value by:

1. Using an airline passenger choice model (APCM) to estimate the market share of Air Jamaica between both KIN and MBJ and the corresponding gateway (the fraction of the total number of OD passengers in the specified market who travel on Air Jamaica).
2. Dividing the number of OD passengers who travel on Air Jamaica (derived in Section 2.3) by the market share of Air Jamaica to estimate the total number of OD passengers between both KIN and MBJ and the corresponding gateway when Air Jamaica is present.

3. Using the APCM to estimate the total market coverage between both KIN and MBJ and the corresponding gateway (the fraction of the unconstrained demand that is satisfied by all airline schedules) when Air Jamaica is present.
4. Dividing the total number of OD passengers by the market coverage when Air Jamaica is present to derive estimates for the unconstrained demand between both KIN and MBJ and the corresponding gateway.
5. Using the APCM to estimate the unique Air Jamaica market coverage between both KIN and MBJ and the corresponding gateway (the fraction of the unconstrained demand that is only satisfied by the schedule of Air Jamaica).
6. Multiplying the unconstrained demand by the corresponding market coverage without Air Jamaica present—this is the total market coverage with Air Jamaica present minus the unique market coverage of Air Jamaica—to derive the total number of OD passengers between both KIN and MBJ and the corresponding gateway without Air Jamaica present.
7. Subtracting the number of OD passengers who travel on foreign carriers when Air Jamaica is present from the total number of OD passengers between both KIN and MBJ and the corresponding gateway without Air Jamaica present to determine the number of former Air Jamaica OD passengers who still travel to Jamaica.
8. Adding the feed traffic (determined in Section 2.3) to the number of former Air Jamaica OD passengers who still travel to Jamaica to determine the total number of former Air Jamaica passengers who travel to/from Jamaica when Air Jamaica is not present.
9. Multiplying the number of former Air Jamaica passengers who travel to/from Jamaica when Air Jamaica is not present by the average fare paid by each passenger and then by a factor of 0.1 (corresponding to the 10% recovery of foreign carrier ticket revenue from passengers who travel to/from Jamaica).
10. Multiplying the number of former Air Jamaica passengers who travel to/from Jamaica when Air Jamaica is not present by the fraction of passengers on the specified route who are visitors and then by \$1,000 (the average expenditure by visitors to Jamaica).
11. Summing the monetary values derived in steps 9 and 10.

2.5. Estimating the Annual Economic Contribution in Scenario B

In Scenario B, we assume that the other carriers change their schedules. Thus, some of the market of coverage that was unique to Air Jamaica is recovered and the number of former Air Jamaica passengers who still travel to Jamaica will be greater in Scenario B than Scenario A. Thus, the goal must be to estimate how the modifications to the schedules of the other airlines changes the “residual” market coverage of Air Jamaica (the portion of the unique market coverage of Air Jamaica that is not captured by changes in the schedule of other airlines) and then derive values for the economic contribution due to “former Air Jamaica passengers” who

would still travel to/from Jamaica on the modified schedules of other airlines. For this analysis the residual market coverage was estimated using the APCM and expert judgment.

For each route and year, we derive this value by:

1. Multiplying the unique Air Jamaica market coverage between both KIN and MBJ and the corresponding gateway (derived in Section 2.4) by one minus the corresponding passenger recovery factor (derived using expert judgment and listed in Appendix A) to determine the “residual” market coverage of Air Jamaica. The residual market coverage being the portion of the unique market coverage of Air Jamaica that is not captured by changes in the schedule of other airlines.
2. Multiplying the unconstrained demand by the corresponding market coverage without Air Jamaica present—this is the total market coverage with Air Jamaica present minus the residual market coverage of Air Jamaica—to derive the total number of OD passengers between both KIN and MBJ and the corresponding gateway without Air Jamaica present.
3. Subtracting the number of OD passengers who travel on foreign carriers when Air Jamaica is present from the total number of OD passengers between both KIN and MBJ and the corresponding gateway without Air Jamaica present to determine the number of former Air Jamaica OD passengers who still travel to Jamaica.
4. Adding the feed traffic (determined in Section 2.3) to the number of former Air Jamaica OD passengers who still travel to Jamaica to determine the total number of former Air Jamaica passengers who travel to/from Jamaica when Air Jamaica is not present.
5. Multiplying the number of former Air Jamaica passengers who travel to/from Jamaica when Air Jamaica is not present by the average fare paid by each passenger and then by a factor of 0.1 (corresponding to the 10% recovery of foreign carrier ticket revenue from passengers who travel to/from Jamaica).
6. Multiplying the number of former Air Jamaica passengers who travel to/from Jamaica when Air Jamaica is not present by the fraction of passengers on the specified route who are visitors and then by \$1,000 (the average expenditure by visitors to Jamaica).
7. Summing the monetary values derived in steps 5 and 6.

2.6. Deriving Lower- and Upper-Bound Estimates of the Direct Incremental Contribution

We determined the lower- and upper-bound estimates of the direct incremental contribution by subtracting the values of the economic contribution in Scenario B (derived in Section 2.5) and Scenario A (derived in Section 2.4) from the economic contribution in the actual situation (derived in Section 2.3).

3. The Airline-Passenger Choice Model

The Airline-Passenger Choice Model (APCM) utilized in this study uses the flight schedules for competing airlines in a given city-pair to determine: a) the total percentage of the customers wishing to travel who are satisfied by the current schedule offerings of all the airlines combined; b) the percentage of the customers wishing to travel who are uniquely satisfied by the schedule of each airline; and c) and the market shares of each airline. The total number of customers wishing to travel is referred to as the “unconstrained demand.” The percentage of the unconstrained demand that is satisfied is referred to as the market coverage. The portion of the unconstrained demand that is uniquely satisfied by the schedule of an airline is referred to as the “unique market coverage of that airline.”

The important schedule characteristics in the model are the time of day; the total travel time measured in local departure and arrival times; the itinerary quality, which is a function of whether a passenger must make a stop, connect between two flights on the same airline, or connect between two airlines; and the passengers’ subjective impression of an airline’s quality.

For large metropolitan areas that are served by multiple major airports, we conducted the market analysis for the metropolitan area rather than for each airport individually. In this study, the Chicago metropolitan area (CHI) includes Chicago Midway Airport (MDW/KMWD) and Chicago O’Hare International Airport (ORD/KORD), London metropolitan area (LON) includes London Gatwick Airport (LGW/EGKK) and London Heathrow Airport (LHR/EGLL), New York metropolitan area (NYC) includes New York Kennedy International Airport (JFK/KJFK) and New York La Guardia Airport (LGA/KLGA).

We verified the APCM in two ways: First, we compared the APCM market-share output market-share data computed from Computer Reservation System (CRS) booking data. The average difference in the market-share data between the two sources is 3.7% and the median difference is 4.0%. The CRS data do not include bookings that occur on the airlines’ web pages and can therefore be biased depending on efficiency of the different airlines’ web pages.

Second, we compared the total number of passengers who traveled to and from Jamaica from and to the U.S. in 2000, as extrapolated from the JM passenger data using the derived market shares to the total number of travelers in those markets as reported by the Bureau of Transportation Statistics (BTS) [8]. While the BTS reports 2,258,000 one way passengers between the two countries, the results from the APCM model suggest 1,979,213 one-way passengers in the top 10 markets between the two countries, an offset of 12.3%, which correlates well with the expected offset due to the consideration of only the top 10 markets in the later case.

4. Results

The cities served by Air Jamaica over the ten year period fall into 3 categories: major Air Jamaica markets, competitor hubs, and nonstop monopolies. The most important cities served are New York (JFK) and Miami (MIA). These two cities produce very high traffic volume. The next group of cities includes Philadelphia (PHL) and Atlanta (ATL). These cities generate significant traffic levels to Montego Bay and more modest levels to Kingston. Each has direct nonstop competition from the incumbent carriers: Delta in Atlanta and US Airways in Philadelphia. The last group of cities contains Chicago (ORD), Los Angeles, Fort Lauderdale (FLL), Orlando (MCO), Phoenix (PHX), and Baltimore (BWI). In each of these markets, Air Jamaica provides the only nonstop service and as such holds a very large share of the traffic. The remaining cities are essentially monopolies as alternative connecting itineraries typically involve interline connections with Air Jamaica via Miami.

In the case of removing Air Jamaica with no competitor replacement, the different city categories produce different results. Because of the large number of competitor flight offerings in the major NYC and MIA markets, these markets maintain relatively high market coverage despite a decline. The hub markets of Atlanta and Philadelphia are mixed. Delta had a code-share agreement with Air Jamaica and only begun flying to Jamaica in December of 2000, so that the Air Jamaica flights represented a large portion of the market prior to that time. Philadelphia was served by several US Airways flights and saw only a small decline in market coverage. Chicago, BWI, and EWR retain their connecting services and decline slightly. FFL and LAX saw extreme loss in market coverage as no nonstop flights existed after Air Jamaica's flights were eliminated from the schedule and the connecting flight options were suboptimal. The overseas market to London was still served by British Airways and connecting flights through the US and thus the market coverage declined by less than a third.

When replacement of the Air Jamaica service is included, the market coverage remains much closer to their baseline levels. When deciding how to replace Air Jamaica service, we had to consider the existing competitor services. In the market to NYC, the American Airlines and Air Jamaica direct flights were not originally at the same time. We assumed that American Airlines would respond aggressively in this market and replace all but one of Air Jamaica's frequencies. In a case where flights would overlap, three Air Jamaica Flights might be replaced by only 1 or perhaps 2 additional flights by the incumbent competitor. This can result in a decrease in market coverage, but that decrease will be less than the case with no competitor replacement. In general, the markets with existing nonstop competition demonstrated small decreases. In addition to New York, these include Miami, Fort Lauderdale, Atlanta, and Philadelphia.

4.1. Direct Incremental Contribution Due to Air Jamaica Ticket Revenue

The lower- and upper-bound estimates of the annual direct incremental contribution of Air Jamaica ticket revenue are listed in Table 1. As shown in the table, the annual contribution grows significantly during the first five years of the ten-year period as the incremental number of passengers traveling on Air Jamaica (above and beyond the number who would travel without

Air Jamaica) increases and due to the corresponding higher revenue retention (30%) on Air Jamaica revenue. The direct incremental contribution due to Air Jamaica ticket revenues over the ten-year period is between US\$637 Million and US\$709 Million.

Table 1: Estimates of the Direct Incremental Contribution Due to Air Jamaica Ticket Revenue

	Lower Bound Estimate	Upper Bound Estimate
1995	36,086,924	39,829,601
1996	37,895,436	42,814,455
1997	48,377,906	53,431,963
1998	54,695,131	60,081,109
1999	62,666,257	69,233,739
2000	74,516,981	84,298,129
2001	78,999,308	87,838,816
2002	81,159,945	90,039,753
2003	78,642,794	87,249,056
2004	84,505,796	94,164,166
Total \$	637,546,477 \$	708,980,785

4.2. Direct Incremental Contribution Due to Air Jamaica Tourist Receipts

The lower- and upper-bound estimates of the annual direct incremental contribution due to receipts from tourists who travel on Air Jamaica are listed in Table 2. As was the case with the contribution due to Air Jamaica ticket revenue, the annual contribution due to receipts from tourists who travel on Air Jamaica grows significantly during the first five years of the ten-year period. This is due to increases in the incremental number of tourists traveling on Air Jamaica. The total direct incremental contribution due to receipts from tourists who travel on Air Jamaica over the ten-year period is between US\$674 Million and US\$1.639 Billion.

Table 2: Estimates of the Direct Incremental Contribution Due to Air Jamaica Tourist Receipts

	Lower Bound Estimate	Upper Bound Estimate
1995	33,899,828	94,744,117
1996	44,203,790	124,277,401
1997	54,731,558	130,642,794
1998	57,471,404	135,091,326
1999	65,403,851	158,105,751
2000	88,217,550	217,438,503
2001	80,499,960	192,744,337
2002	84,716,077	200,140,325
2003	79,453,652	185,157,943
2004	86,334,174	201,059,913
Total \$	674,931,844 \$	1,639,402,411

4.3. Indirect Incremental Contribution of Air Jamaica

Air Jamaica also provides an indirect incremental contribution to the Jamaican economy as each dollar of direct activity leads to a second round of expenditures in the economy. For air transportation, a forthcoming study by the Airports Authority of Jamaica [9] estimates an indirect

multiplier of 2, i.e., each dollar attributed to aviation leads to a further \$2 of economic activity. This multiplier is also used for the tourism receipts.

4.4. Total Economic Benefit of Air Jamaica

Given the direct economic activity described in Section 4.1 and Section 4.2, and the indirect economic activity described in section 4.3, it is then possible to determine the annual levels of direct, indirect, and total incremental contribution of Air Jamaica to the Jamaican economy. The annual values for these parameters are listed in Table 3. As shown, Air Jamaica provided a direct incremental contribution of between US\$1.312 Billion and US\$2.348 Billion to the Jamaica economy over the ten-year period. With the corresponding indirect incremental contribution of between US\$2.625 Billion and US\$4.697 Billion, the total economic incremental contribution over the ten-year period is between US\$3.937 Billion and US\$7.045 Billion.

Table 3: Lower Bound Estimates of the Economic Benefit of Air Jamaica

	Direct	Indirect	Total
1995	69,986,752	139,973,504	209,960,256
1996	82,099,226	164,198,452	246,297,678
1997	103,109,464	206,218,929	309,328,393
1998	112,166,535	224,333,069	336,499,604
1999	128,070,108	256,140,215	384,210,323
2000	162,734,531	325,469,061	488,203,592
2001	159,499,268	318,998,536	478,497,805
2002	165,876,022	331,752,043	497,628,065
2003	158,096,446	316,192,892	474,289,337
2004	170,839,970	341,679,941	512,519,911
Total \$	1,312,478,321 \$	2,624,956,642 \$	3,937,434,964

Table 4: Upper Bound Estimates of the Economic Benefit of Air Jamaica

	Direct	Indirect	Total
1995	134,573,718	269,147,436	403,721,153
1996	167,091,856	334,183,713	501,275,569
1997	184,074,757	368,149,514	552,224,271
1998	195,172,435	390,344,870	585,517,305
1999	227,339,490	454,678,980	682,018,470
2000	301,736,631	603,473,262	905,209,894
2001	280,583,153	561,166,306	841,749,460
2002	290,180,078	580,360,156	870,540,234
2003	272,406,999	544,813,997	817,220,996
2004	295,224,079	590,448,158	885,672,238
Total \$	2,348,383,196 \$	4,696,766,393 \$	7,045,149,589

4.5. Potential Sources of Error

Because of data limitations, we could not determine the precise number of OD, connecting passengers in each route in each year; therefore, we estimated the values for each year using CRS data from 2001 and Air Jamaica passenger connection data from 2004.

This likely led to an under estimation of the OD passengers in the earlier years of the ten-year period as the hub at Montego Bay was not yet full operational and the code-sharing agreement with Delta was not in place. Thus, the connecting and feed passengers estimate would be higher than they actually were because we multiplied the number of passengers carried by Air Jamaica on each route by constant factors (derived using 2001 and 2004 data) to estimate the number of connecting and feed passengers. This would result in an underestimation of the OD traffic that, in turn, would reduce the magnitude of the change in both ticket revenue and tourism receipts due to the removal of Air Jamaica flights, and therefore the estimate of the economic incremental contribution of Air Jamaica.

This underestimation of OD passengers would, of course, be offset some by an over estimation of the number of connecting passengers and the corresponding ticket revenues that are lost when Air Jamaica flights are removed. However, the lower revenue retention rate (20% versus 30%) and no tourism receipts for connecting passengers means that this effect would be small compared to the effect due to the OD passengers.

Note that the underestimation of the OD passengers would not be offset by the overestimation of the feed passengers. In fact the equal retention rate and tourism for OD and feed passengers (30% retention rate and \$1,000 expenditure per tourist for both) means that overestimation of feed passengers exacerbates the underestimation of the economic incremental contribution of Air Jamaica.

4.6. Other Considerations

Our estimates of the economic incremental contribution of Air Jamaica do not include the effect of advertising on passenger demand. Recent research suggests that individuals who watch a well-produced advertisement about consumer products are up to three times more likely to purchase the given item that is advertised [10]. Assuming that the advertisement campaign by Air Jamaica (approximately US\$20 Million per year) during the ten-year period reached 5% of the population in the target country, then this would result in an increase of 15% in the number of passengers who traveled to Jamaica. This value is in good agreement with the reported 18% increase in sales volume of brand-name consumer goods (above and beyond any increases for all corresponding consumer goods) due to print advertising in the UK [11]. However, it is not clear how these results would extend beyond the domain of consumer products. Thus, although the effect of Air Jamaica's advertising campaign is most certainly positive, the magnitude of that effect in terms of increased sales volume is uncertain, and we can only conclude that the increase in sales volume due to advertising could be up to 18%.

5. Conclusions

We have only considered two mechanisms through which Air Jamaica contributes to the economy of Jamaica. Many argue that the additional jobs in the local aviation and tourism industries lead to an improved social situation in Jamaica with corresponding positive consequences. However, most of these effects are difficult to measure. The mechanisms that have been studied are readily quantifiable and if one believes that they are a subset of a larger pool of positive mechanisms, then the values that have been derived in this study are very conservative estimates of the economic incremental contribution of Air Jamaica.

The net effect of the potential sources of error described in Section 4.5 is an underestimation of the economic incremental contribution of Air Jamaica. Given the magnitude of these effects, the contribution of Air Jamaica could lie anywhere within the range that has been determined. Thus, assuming equal likelihood of the incremental contribution lying anywhere within the range, the likely economic benefit of Air Jamaica to Jamaica between 1995 and 2004 economy is US\$5.491 Billion of which US\$1.830 Billion is a direct incremental contribution to the economy and US\$3.661 Billion is the corresponding indirect incremental contribution.

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