Cranfield UNIVERSITY

David Warnock-Smith

The socio-economic impact of air transport in small island states: An evaluation of liberalisation gains for the Caribbean Community (Caricom)

COLLEGE OF AERONAUTICS

PhD Thesis

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ABSTRACT

As the primary output of the air transport sector, the flow of air passengers plays an important role in the economic and social welfare of nations, while the sector's regulatory framework represents the main vehicle through which government can exert a given level of influence over the provision of such services. This research modifies and applies existing macroeconomic impact theory to the Caribbean Community (Caricom), before developing an improved method by which to evaluate the supply and demand effects of further air policy liberalisation in the region.

It was found, using an original multi-method approach, that the Caricom air transport sector contributed on average 16.9% towards GDP and 14.2% of the labour force. A large variation around these regional averages were noted, however, and are said to be primarily determined by exogenous factors such as relative size of GDP, relative sector diversity and relative level of trade dependency, with the largest impacts being recorded in smaller, tourism dependent islands. A significantly different picture emerges if catalytic impacts are removed showing the strength of the multiplier, with contribution to GDP reducing to 2.8% and the percentage of the labour force declining to around 1.9%. Multipliers for Trinidad & Tobago (-0.40), the Bahamas (2.38) and Guyana (2.95) were below the global average, however, reiterating the heterogeneity of the sample and by extension the whole Caribbean community.

Using fixed-effects panel regression, the removal of bilateral or multilateral entry and tariff barriers were found to increase the average country-pair's arriving and departing passenger levels by 250,000, 22,000 and 8,000 on NA-, UK- and Intra-Caricom markets respectively, given a one unit increase in air policy liberalisation. The actual impact of liberalisation on any given market was moderated by unobserved fixed-effect dummy variables which provided each country-pair with a unique intercept value to take account of underlying network and market maturity differences. Hence, all currently restricted country-pairs in the sample would stand to gain around 183,000 passengers per annum if a gradual bilateral approach to liberalisation was adopted. A counterfactual analysis suggested that a one unit policy change in the year 2000 on all 13 currently restricted markets would have increased passengers levels to around 16.4 million. In the multilateral scenario both restricted and partially liberal markets experience simultaneous reform resulting in a predicted traffic increase of 621,000 passengers per annum. Using 'within sample' multipliers, the extra bilateral output is estimated to increase baseline expenditure by US$51 million or US$16 million per annum when catalytic spending is included and excluded respectively. With multilateral reform, an additional US$164 million or US$53 million would accrue to the regional economy. When compounded, the total time-series effect of multilateral liberalisation totals 3.7 million passengers on top of the baseline, boosting regional output by 2.6% or 0.7% and increasing employment by 1.4% or 0.2%.

Given previous evidence, extra-regional reform will not take place multilaterally in the foreseeable future. In the short to medium term, a combination of a revised Caricom MASA and gradual moves towards bilateral liberalisation would produce optimum macroeconomic results. The historical and counterfactual findings of this research challenge current restrictive practises in the region. Further assistance with respect to foreign carrier entry and regional carrier integration *could* stimulate the desired fare, capacity, frequency and connectivity improvements and generate significant increases in overall welfare.

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Finally, apologies are extended to those contributors whose names I have omitted.

GLOSSARY OF TERMS & ABBREVIATIONS

AA: American Airlines
ACI: Airports Council International
ACS: Association of Caribbean States
ANOVA: Analysis of Variance
ANU: Antigua International Airport
AOA: Airport Operators Association
ASA: Air Service Agreement
ASEAN: Association of South East Asian Nations
ASK: Available Seat Kilometres
AT: Air Transport
ATAG: Air Transport Action Group
ATI: Air Transport Intelligence
AXA: Anguilla International Airport
AW: Maya Islands Air
BA: British Airways
BDA: Bermuda International Airport
BGI: Barbados Grantley Adams International Airport
BMI: British Midland International
BoP: Balance of Payments
BW: Caribbean Airlines (formerly BWIA)
BWIA: British West Indian Airways
BZE: Belize International Airport
CAA: Civil Aviation Authority
Caricom: Caribbean Community
Cariforum: Caribbean Forum
CGE: Computable General Equilibrium
CMASA: Caricom Multilateral Air Service Agreement
C-P: Country-Pair
CR: Connectivity Ratio
CRS: Computer Reservation Systems
CS: Consumer Surplus
CSME: Caribbean Single Market & Economy
CTO: Caribbean Tourism Organisation
CWIA: Constellation West Indian Airways
CYB: Cayman Brac International Airport
DEA: Differential Estimation Approach
DEL: Helenair Caribbean
DFT: Department for Transport
DOM: Dominica International Airport
DOT: US Department of Transportation
DV: Dependent Variable
E/D: Embarkation/Disembarkation card
EIS: Tortola International Airport
EU: European Union
EVA: Economic Value Added
FAA: Federal Aviation Administration
FDI: Foreign Direct Investment
FFP: Frequent Flyer Programme
FPO: Grand Bahama International Airport
FTAA: Free Trade of the Americas
FTE: Full Time Equivalent
GAV: Gross Added Value
GCM: Grand Cayman International Airport
GDP: Gross Domestic Product
GDS: Global Distribution Systems
GEO: Guyana Georgetown International Airport
GLM: General Linear Model
GND: Grenada International Airport
GPS: Global Positioning System
HHI: Herfindahl Index
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
IMF: International Monetary Fund
I-O: Input-Output
IT: Information Technology
IV: Independent Variable
JAL: Japan Airlines
JM: Air Jamaica
KIN: Jamaica Kingston International Airport
KX: Cayman Airways
LCC: Low-Cost Carrier
LHR: London Heathrow International Airport
LIAT: Leeward Island Air Transport
LI: LIAT
LSDV: Least Squares Dummy Variable
MALIAT: Multilateral Agreement on the Liberalisation of Air Transport
MASA: Multilateral Air Services Agreement
MBJ: Jamaica Montego Bay International Airport
MHH: Abaco International Airport
MIA: Miami International Airport
MNI: Montserrat International Airport
MoU: Memorandum of Understanding
M7: Tropical Airways
NA: North America
NAS: Nassau International Airport
NYC: New York Airports
OAA: Open Aviation Area
OAG: Online Airline Guide
O-D: Origin-Destination market
OECD: Organisation for Economic Cooperation and Development
OEF: Oxford Economic Forecasting
OLS: Ordinary Least Squares
OS: Open-Skies
PAP: Port-au-Prince International Airport
Pax: Passengers
PBM: Suriname Paramaribo International Airport
PIASA: Pacific Island Air Service Agreement
PL: Southern Air Charter
PLS: Turks & Caicos International Airport
PM: Tropic Air
POS: Trinidad Piarco International Airport
PPI: Producer Price Index

PPP: Purchasing Power Parity
PTF: Propensity to Fly
PY: Suriname Airways
QSI: Quality of Service Index
RBTT: Royal Bank of Trinidad &Tobago
RoRo: Roll-on-Roll-off ferry
RP: Revealed Preference
RPK: Revenue Passenger Kilometres
RTK: Revenue Tonne Kilometres
RU: Sky King Airlines
SAS: Statistical Analysis System
SD: Standard Deviation
SIA: Singapore Airlines
SIC: Standard Industry Classification
SIDS: Small Island Developing States
SJU: San Juan International Airport
SKB: St. Kitts International Airport
SLU: St. Lucia George Charles International Airport
SP: Stated Preference
SVD: St. Vincent International Airport
TAB: Tobago International Airport
TFP: Total Factor Productivity
TIA: US Office of Travel and Tourism Industries
TSCS: Time-Series Cross-Section
T&T: Trinidad & Tobago
UK: United Kingdom
UP: Bahamasair
US: United States of America
USA: United States of America
UVF: St. Lucia Hewanorra International Airport
UW: Universal Airlines
VFR: Visiting Friend and Relatives
VIF: Variance Inflation Factor
VS: Virgin Atlantic
WTO: World Tourism Organisation
WTTC: World Travel & Tourism Council
YVR: Vancouver International Airport
8B: Caribbean Star

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1. INTRODUCTION

1.1. Prologue

The principal benefit of air transport services operating in disparate island communities can be summarised by the fact that they provide a vital social and economic link between peoples, countries and cultures. The air transport sector not only impacts an economy in terms of its direct, indirect and induced contribution to employment, but also serves as a strategic catalyst, enhancing business efficiency and productivity by providing easier access to suppliers and customers (Airports Council International 2004). By opening up new markets for international travel, the sector is also considered to be a major driver of the tourism industry.

The Caribbean region consists of a mishmash of island chains and states in relatively close geographical proximity situated between the large continental land masses of North and South America. They are generally but not exclusively separated by expanses of sea large enough to make air transport the most practical mode for the vast majority of the region's travel needs both intra and extra-regionally. This is certainly the case for the fifteen full and five associate member states which make up the Caribbean Community (Caricom), originally an Anglophile customs union established in 1973 to standardise trade negotiations between each other and with third countries (Ball et al. 2004), but later expanded to include the non-English speaking jurisdictions of Haiti (French) and Suriname (Dutch).

Caricom states are, in the main, heterogeneous in size and economic structure. Notwithstanding this diversity, the services sector is, for the majority of these economies, the linchpin for economic growth. The region's tourism industry attracted approximately 6 million visitors in 2005 (World Bank Study 2006) showing a modest 2.2% annual growth over 2004. It is estimated that only 31% of total Caribbean visitors chose Caricom destinations. This is primarily due to the fact that the increasingly popular Hispanic island destinations of Cuba, Puerto Rico and the Dominican Republic lie outside the Caricom region. Despite differences in performance, all Caricom countries participate in what has become a homogenous Caribbean tourism product. This product is well renowned in the western hemisphere but in practise it encompasses jurisdictions that have developed, due to their wide-ranging historical, political and cultural ties, strong and distinctive national identities.

As the era of colonialisation ended, however, many Caricom states had to start diversifying their external dependencies and expand their trade links. This led to an increase in interdependence, albeit from a low base, between many of the member states in sectors such as banking and finance, insurance, construction and oil and gas (Caricom Secretariat 2005). Moves towards a Caricom single market and economy have also encouraged the majority of member states to seek further integration as well as standardisation of external relations (e.g. joint negotiation with Venezuela resulted in a preferential oil deal called Petrocaribe involving 13 of the 15 full Caricom member states). Finally, as organic growth of indigenous firms in many of the island states has been limited by domestic market size, organisations such as Trinidadian bank RBTT have sought to operate on as wide a geographical basis as possible. By 2002, 30% of Barbadian firms were from Trinidad while this figure was as high as 50% in Guyana (Caricom Secretariat 2005). Although this process is still very much in its growth stage, it has an important bearing on demand for Intra-Caricom air transport services beyond the traditional market segments consisting of multi-island tourist and Diaspora traffic.

Table 1.1 introduces a number of observations. First, that as a percentage of Gross Domestic Product (Purchasing Power Parity), thirteen of the twenty Caribbean countries listed are amongst the most heavily dependent on their respective travel and tourism industries in the world, with all thirteen ranking in the top 35 most tourism dependent countries (World Travel & Tourism Council 2005). This contrasts with the seven non-tourism dependent states reflecting the fact that the region is more economically diverse than often perceived. Second, there appears to be a high variance in GDP (PPP) between the selected countries, and third is the almost uniform way in which the countries listed depend on air transport (2004) for the bringing in of long-stay visitors[1], who generally contribute more to total foreign exchange earnings than short-stay cruise passengers.

[1] The World Tourism Organisation (WTO) defines ‘long-stay visitor’ as those who stay more than one night at their destination.

Table 1.1
Some socio-economic indicators for the full and associate Caricom member states

Country	Tourism % of GDP (world ranking)	GDP (PPP) $USmn	% Visit Expen. arrive by air
Anguilla	24.6 (3)	109	84
Antigua & Barbuda	25.0 (4)	750	95
Bahamas	18.4 (8)	6,105	88
Barbados	16.1 (10)	4,815	92
Belize	7.8 (32)	1,778	85
Bermuda	6.0 (46)	4,500	86
British Virgin Islands	38.0 (1)	853	94
Cayman Islands	9.4 (22)	1,939	67
Dominica	9.6 (24)	384	88
Grenada	5.0 (58)	440	96
Guyana	2.7 (115)	4,439	99
Haiti	2.2 (132)	13,970	N/A
Jamaica	10.8 (19)	12,180	92
Montserrat	N/A	29	99
St. Kitts & Nevis	7.8 (33)	339	91
St. Lucia	15.0 (11)	866	90
St. Vincent & Grenadines	10.3 (21)	342	98
Suriname	2.0 (141)	2,893	93
Trinidad & Tobago	2.4 (123)	16,845	95
Turks & Caicos Islands	11.5 (15)	216	92
Mean Average	11.82 (43.1)	3,689.60	91
Standard Deviation	9.37	4,991.45	7.28

Source: Adapted from Index Mundi (2006), World Travel & Tourism Council (2005) and Caribbean Tourism Org. (2004)

The region's air transport sector facilitates the tourism industry primarily by acting as destinations for foreign carrier services and with respect to the North American market, through the use of foreign hubs. However, a number of regional based carriers also make a notable contribution to the tourism sector as well as to the travel needs of local residents wishing to make trips for business, education, sporting, health or VFR purposes. Table 1.2 provides a full list of airports and airlines based in the Caricom region along with airport traffic flow data for the year 2006.

Table 1.2
List of Caricom airports and home based airlines (2006)

Country	Main airport(s)	Airport volumes 000 (2006)	Home based airlines
Anguilla	Wallblake (AXA)	131	None
Antigua & Barbuda	V.C. Bird (ANU)	920	Caribbean Star (8B), LIAT (LI)
Bahamas	Nassau (NAS), Freeport (FPO), Marsh Harbour (MHH)	3,233	Bahamasair (UP), Southern Air Charter (PL)
Barbados	Grantley Adams (BGI)	2,365	None
Belize	Philip Goldson (BZE)	480	Maya Island Air (AW), Tropic Air (PM)
Bermuda	L.F. Wade (BDA)	898	None
British Virgin Islands	Tortola (EIS)	562	None
Cayman Islands	Owen Roberts (GCM), Cayman Brac (CYB)	960	Cayman Airways (KX)
Dominica	Melville Hall (DOM), Cane Field	168	None
Grenada	Point Salines (GND)	421	None
Guyana	Cheddi Jagan (GEO)	426	Universal Airways (UW)
Haiti	Port-Au-Price (PAP)	1,123	Tropical Airways (M7)
Jamaica	Sangster (MBJ), Norman Manley (KIN)	4,874	Air Jamaica (JM)
Montserrat	Blackburne (MNI)	22	None
St. Kitts & Nevis	Robert Bradshaw (SKB)	270	None
St. Lucia	Hewanorra (UVF), George F.L. Charles (SLU)	910	None
St. Vincent & Grenadines	E.T. Joshua (SVD)	580	None
Suriname	Johan Adolf Pengel (PBM)	480	Suriname Airways (PY)
Trinidad & Tobago	Piarco (POS), Crown Point (TAB)	3,172	BWIA (BW)
Turks & Caicos Islands	Providenciales (PLS)	786	Sky King Airlines (RU)

Sources: Regional airport traffic statistics, Hicks (2006) Airline Yearbook 2006

Notes: Airlines without IATA codes were not included in the above list due to their insignificant size and non-scheduled, *ad-hoc* type of operation

Total air traffic includes foreign carrier traffic but does not include marginal traffic flows into and out of minor airports not featured in the above list

Post script: Sky King Airlines has since been renamed Air Turks & Caicos (RU), BWIA was replaced by Caribbean Airlines but retained the same IATA code (BW), Caribbean Star ceased operations after being incorporated into the LIAT entity and Universal Airways was made insolvent

In the tourist dependent states such as Jamaica, the British Virgin Islands and Antigua & Barbuda (See Table 1.1), a larger percentage of the number of passengers handled (as shown in Table 1.2) consists of foreign visitors while airports in primary or secondary industry dependent economies like Trinidad & Tobago and Guyana are more geared towards the handling of local residents. In the absence of both tourism and local economic activity, passengers numbers tail off quite considerably as shown by the case of Monserrat. Its unstable natural environment (volcanic activity) combined with its limited land space has stifled local population growth and infrastructure development. Indeed the size and type of economic activity has a relationship with the amount of air transport activity. States with a relatively high number of air passengers have to be supported by more sophisticated infrastructure (airports) and, in some cases, a national or regional carrier. This is evident in the cases of Jamaica, Trinidad & Tobago, the Bahamas, Cayman Islands and Antigua & Barbuda although there are also exceptions to this general rule (e.g. Barbados – no airline and Suriname - low activity with national airline).

In spite of the implied interdependence between the tourism and air transport sectors there has rarely been enough political will or data consistency, in the majority of the region's member states, to try and attempt to assess, more systematically, the net socio-economic impact of the sector to the regional economy (or any individual member state) or the possible macroeconomic gains from bilateral and/or multilateral changes to aviation policy between any arbitrary Origin-Destination (O-D) market.

1.2. Scope and definitions

Impact studies in the past have used various definitions and measurements so it was deemed necessary to lay out the precise definitions chosen and used for this study. Valuations based upon the notion of 'socio-economic impact', according to Airports Council International (2004), provide an invaluable insight into the role played by air transport in boosting regional accessibility and social expansion, driving tourism development as well as serving as national and regional economic motors. In other words, the commonly cited social factors such the level of mobility and connectivity afforded by the sector along with its role in maintaining vital international links, and the economic contribution of the sector's infrastructure in facilitating the domestic and international flow of commerce, as well as generating significant direct and indirect employment in leisure and business travel-related industries, are not treated separately in this study with a view to obtaining a more holistic assessment of true welfare benefits (disbenefits).

This study does not explicitly account for air cargo transportation nor does it cover general aviation activities, despite the fact that these sub-sectors also have important marginal roles to play[2]. Employment, income and expenditure stemming from ancillary services and transport infrastructure projects *will*, as far as possible, be included in the analysis in so far as they are inextricably linked to the performance of the sector and the creation of additional passenger flows.

The Caribbean region has also been defined in a number of ways and sometimes includes Caribbean basin countries in Central and South America (as defined by the Association of Caribbean States). The Caribbean Tourism Organisation has thirty two member states but the countries that make up this organisation have

[2] Although, as will be seen, air cargo impact data is implicitly included in national account and balance of payment (BoP) secondary data as well as the supplier probe and business survey primary data.

such varied and diverse economic and political ties that the only realistic integrating factor is the worldwide export of the "Caribbean" tourism product. Using Caricom (comprising the fifteen full and five associate member states shown in Table 1.1 and Appendix A) was therefore the most practical solution for in-depth analysis given that political ties between member states are more developed and most of the member states share a common language (English). When looking at regional level impacts, Intra-regional services are considered as domestic services in that there is no net gain or loss from Intra-Caricom air passenger flows. When impacts are broken down into different member states, however, a traditional definition of domestic air services will be retained. Movements into and out of the region will also affect the regional economy. As domestic services are limited in the vast majority of the sample's island states, international services will clearly form the major focus of this impact and air policy evaluation.

Impact assessments generally have been used for a number of purposes. A selection of these purposes has been described by IATA (2005) and is listed below:

- To make the economic case for airport expansion plans, such as new runways, runway extensions and new terminal capacity
- To make the case for investment in off-site infrastructure, such as new access roads, railways and rapid transit systems
- To examine alternative approaches to airport development, such as whether to expand an existing facility or to develop a new site
- To influence planning policy, such as in relation to proposals for housing and commercial development in the area around the airport
- To allow an informed view to be taken of the balance between economic benefits and environmental cost associated with air transport development
- To inform discussions regarding ownership structures and aviation policy development
- To promote understanding of the economic role of air transport amongst key decision makers and how air transport's role can be harnessed

In so far as they relate either directly or indirectly to air policy, the last two purposes are of principle interest for this study although a sectoral impact assessment can clearly be utilised as an input into a cost benefit analysis or an airport master plan as shown by the range of above mentioned impact study uses.

Finally, externalities typically form a major aspect of the *social* impact of air transport and like any other growth sector, social responsibility must be at the top of the political and industrial agenda at all times. Common externalities of air transport include aircraft noise at airports, air pollution on a local and global scale, the incidental contamination of soil and water, change of land use, air accidents and congestion (Janic 1999). However, for the purposes of this study, it is assumed that a) in a region such as the Caribbean there are *few* feasible options for mode switching leaving necessary journeys with little or no alternatives but to utilise air transport services and b) the Caribbean like all other regions will act upon the recommendations of ICAO as soon as a suitable model for cost internalisation is available. Until such time it would be perilously difficult to quantify, measure or compare accurately the net social benefits (disbenefits) of the air transport sector when including externalities. Thus, a detailed analysis of externalities lies outside the scope of this study, although it would clearly form an important 'next step' in a holistic socio-economic impact assessment.

1.3. Statement of research problems

From the above prologue, it can be seen that the air transport sector plays an important facilitating role as well as being a generator of national wealth and welfare in its own right. Its impact on interdependent yet heterogeneous island groups like that of the Caricom region remains unknown, however, due to the lack of detailed research in this area. It is important for both policy makers and industry alike to be able to access reliable macroeconomic impact estimates both in terms of magnitude and dispersion among the region's member states. From a research perspective it is also important to identify the key factors influencing the macroeconomic contribution of the sector and how these factors differ from those found in previous studies undertaken in larger economies. Once a set of reliable estimates are established, two more important research problems arise when trying to evaluate the partial macroeconomic gains of further bilateral and multilateral liberalisation:

- There is no Caricom/Caribbean air policy database from which to facilitate a rigorous research analysis or any future air policy decisions
- There is a lack of research and consensus into the nature and magnitude of gains(losses) on partially reformed and fragmented air transport markets

The first gap relates to the quality of data while the second requires an original methodological approach which takes into account the complexities of Caricom air policy and air transport market development. It will be revealed in this study that these two gaps need to be plugged in order to improve the understanding of net macroeconomic gains (losses) of further air policy reform. It is also believed that other regions consisting of country-pairs at differing stages of liberalisation will be able to benefit from the air policy estimation techniques used in this research.

1.4. Aim and objectives

In accordance with the above proposed contributions to knowledge, this study has the following research aim, which is then supported by four interrelated research objectives:

Aim:

To evaluate the socio-economic impact of the air transport sector in the Caricom region and to measure the macroeconomic contribution of further air policy liberalisation using counterfactual prediction and alternative regression modeling techniques

Objectives:

1. To *assess* the current socio-economic impact of the air transport industry to the Caribbean (CARICOM) region
2. To *measure* the extent to which air traffic has been and can be stimulated to, from, and within the region in a more liberal and competitive air transport framework
3. To *explore* the possible producer and consumer gains(losses) of higher(lower) traffic volumes, airfares and productivity levels as a result of a set of further air policy reform scenarios

4. To *estimate* macroeconomic performance in terms of the affect changes to the region's air policy would have on national and regional employment, output (GDP), and investment & mobility

The key objective, linking objective 1 with 3 and 4 is objective 2. Herein lies the main research contribution as it attempts to provide a robust model which isolates the liberalisation effects from the other determinants of the primary output of the air transport sector, that of air traffic. This type of analysis requires a high level of statistical reliability given that the results from objectives 3 and 4 will rely on the robustness of the coefficients found by satisfying objective 2.

1.5. Method overview

With the objectives being the desired outputs of this study, a viable input proposal is required in order to achieve those outputs. These methodological inputs are guided by a proposed research approach and are limited by the availability and quality of the subsequent set of data sources.

1.5.1. Research approach

Given the nature of the case-study region described above, it was important to introduce an inductive, thematic approach on top of the traditional deductive approach which is designed to test a pre-defined set of generalisations against real life examples. This approach will be adopted to ensure that the nuances of the region are captured and the research objectives met. Pure utilisation of a conventional set of strategic ideas is therefore to be avoided both for the socio-economic impact assessment and the liberalisation analysis; although the literature review will demonstrate that sufficient research has been conducted so far in other parts of the world on similar themes. Thus, it would be unwise to ignore altogether such generalisations and deductions just because they do not take into account the socio-demographic and air transport market characteristics of small-island economies.

Whilst both qualitative and quantitative methods have been applied to inductive and deductive research approaches, the numerical nature of objectives 1 to 4 necessitates a primarily quantitative assessment. Elements of qualitative appraisal will also be introduced, however, in order to account for non-tangible impacts like business investment and productivity decision making (managers were interviewed to obtain the causes of investment and productivity disruptions), passenger perceptions of airline and airport quality of service, and the perceived role of the sector in maintaining social cohesion and regional integration.

The core quantitative assessment firstly gathers employment and expenditure data across a range of different categories of air transport impact. Each Caricom country will have different overall impact values both in percentage and absolute terms as well as a different breakdown of impacts with direct on-site airline and airport activities forming the simplest impact category to account for[3]. Air traffic volumes are the primary driver of all other air transport activity in the supply chain. Thus the macroeconomic and air traffic values can be combined to create a set of baseline multipliers. A multiple regression model incorporating historical socio-demographic, air transport and economic data will then be used to capture the partial effect of liberalisation on levels of employment and expenditure by applying the additional air traffic multipliers to a number of counterfactual scenarios. This core quantitative assessment is outlined by a mind map, which is presented in section 1.5.3 (Figure 1.1).

1.5.2. Data sources

A multi-method approach for data collection is proposed, firstly because currently available published data is inadequate in the Caricom region and secondly to triangulate, compare and contrast results, allowing for more accurate inferences. For instance, primary data collected through surveys and questionnaires will be compared and contrasted to secondary historical data collected on the same regional impact indicator. Both the secondary and primary data will then be checked against some of the assumptions made and results found in previous studies explored in the literature review. If data across all research methods are consistent then more weight is added to the theory, whereas any anomalies could be explained by irregularities inherent in the case-study providing evidence that a more specialised analysis is necessary.

Another common way to formulate research strategy is to categorise data sources into opinion, analytic, empirical and archival groupings (Buckley et al. 1976).

[3] This is primarily because at every stage in the expenditure cycle there are leakages in terms of savings, payments for imports and taxation which diverts money out of the region or into other sectors.

This way, the strengths and weaknesses of a full range of sources can be explored for the research question and any gaps in the published data can be more easily highlighted and consequently mitigated. A summary of the techniques and data sources used in each category is now provided:

Opinion: Two surveys (one internet based business and one face-to-face passenger survey) were carried out in support of the analytical findings on the direct, indirect and induced impacts of air transport to the region. The passenger survey also looked to capture passenger perceptions on issues relating to consumer surplus, social impact of the air transport sector in the Caricom region, airline and airport quality of service and the most relevant issues affecting their decisions to make journeys (passenger demand). A pilot survey was conducted in Barbados, the designated fieldwork base, in order to refine the questionnaire and shorten the duration of the survey by discarding duplicate questions or questions that were not totally relevant to the thesis' aim and objectives. Refined surveys were then repeated among a sample of representative member states. The passenger survey is modelled on a combination of a typical Civil Aviation Authority (CAA) passenger survey (2005) along with a Caribbean Tourism Organisation (CTO) survey (2004) which is targeted at long-stay tourists travelling by air. The business survey is adapted from an Oxford Economic Forecasting (OEF) survey of UK companies (2006). Elements of expert judgement were also required for the formulation of the Caricom air policy database. Interviews were carried out with regulation officers from the UK CAA, the US Bureau of Transportation (DOT), the Caricom Secretariat as well as individual member state Ministries of International Transport.

Analytic: To assess the direct, indirect and induced impact of air transport to an economy, access to employment and expenditure records are a must from both air transport authorities and service providers. These data are usually obtained from actual and historical balance sheet and income statements relevant to the concerned airport activities. Secondary data sources like the internet, government national statistics (including Central Bank national account data), and financial yearbooks are considered in order to disseminate the relevant sectoral contributions. Air passenger data are available to differing consistencies through the Caribbean Tourism Organisation, the UK CAA, the US DOT, Statistics Canada, Caricom airports and national tourism authority statistical services. Embarkation/Disembarkation (E/D) cards from the region's Immigration Departments were used to obtain true O/Ds and place of residence. Time-series data was collected primarily through desk-top research of published data on variables such as capacity (Online Airline Guide), airfares (ICAO) and real GDP (International Monetary Fund) and used as the primary inputs of a descriptive time-series analysis, a pilot regression model and the main General Linear Model (GLM) poly-linear regression specifications.

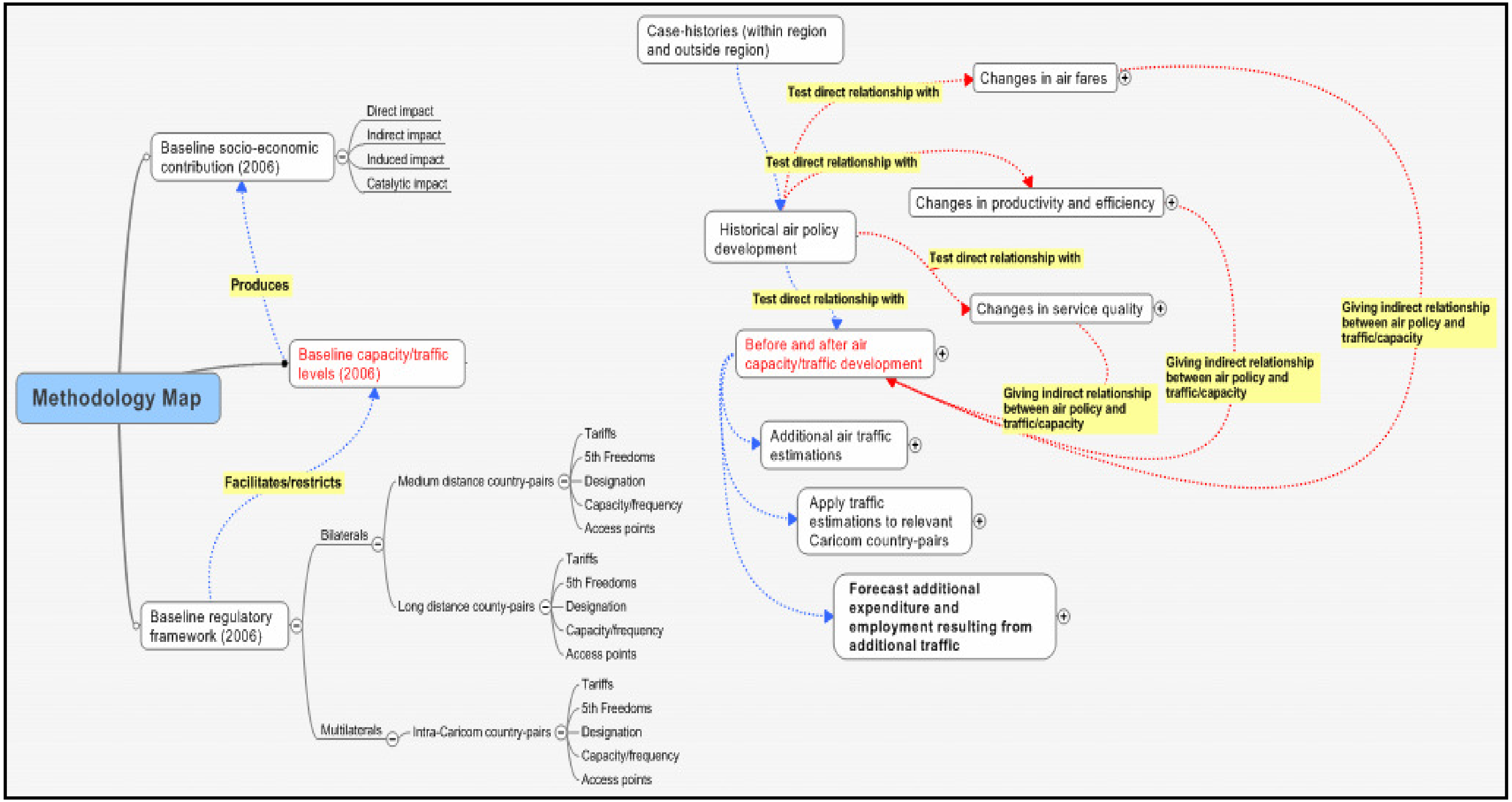
Empirical: Having a base in Barbados meant that approximately half of the total research period could be spent conducting fieldwork, considerably more than the average case-study based project. As a result, a number of air transport seminars could be attended in the Caribbean and key contacts made with industry players. A more reliable impression of the Caricom region could be obtained and the sample of representative member states for further analysis could be selected with more confidence. Moreover, a number of informal meetings with aero-political groups both representing government and the travel and tourism industries in the region assisted in gaining access to the limited number of publications and archival data on the subject of air policy, and a better understanding of the current debate, including a number of non-economic barriers to further liberalisation in the region. A range of seminars and conferences were attended as a valid and productive way to open new data streams. The passenger survey was purposefully designed as a face-to-face interview firstly to increase the response rate and secondly to conduct an observational comparison of the variation in service levels, facilities and infrastructure across the region's airports.

Archival: A myriad of historical data sources were targeted until the completion of the study. Starting with a series of lectures at Cranfield University, the relevant general theoretical considerations were gathered, ranging from the strategic direction of the global air transport sector to the international development of multilateral and bilateral air service agreements. This is supported by a number of core texts which have also been useful in assimilating the deductive aspects of the research. Search engines such as Proquest, Science Direct, Emerald *inter alia* have provided the main source material for academic journals which were generally considered to be less biased than industry based studies, providing a useful counterbalance to some of the assumptions made in studies by Airports Council International, the International Air Transport

Association, the Air Transport Action Group, Oxford Economic Forecasting and the Civil Aviation Authority. OECD and the World Bank also generally tend to be more neutral data sources. With regard to the Caribbean region there is a dearth of academic research into the sector with only two air transport related Caricom journal articles found in the main literature search. Topical data was gathered from trade journals such as Air Transport World, Airline Business and on-line portals like Air Transport Intelligence and Caribbean Net news (including the local press).

1.5.3. Mind-map

Fig. 1.1 Radial map to show the integration of the overall methodology



1.6. Thesis structure

1.6.1. Flow chart

Given the abovementioned aim, objectives and methodological outline, the following thesis structure (Figure 1.2) was devised to show the links between the different thesis chapters along with the sequential approach in which the research questions are to be answered. A reminder of the relevant time-periods and methodological techniques are also provided. A description of the contents of each chapter then follows.

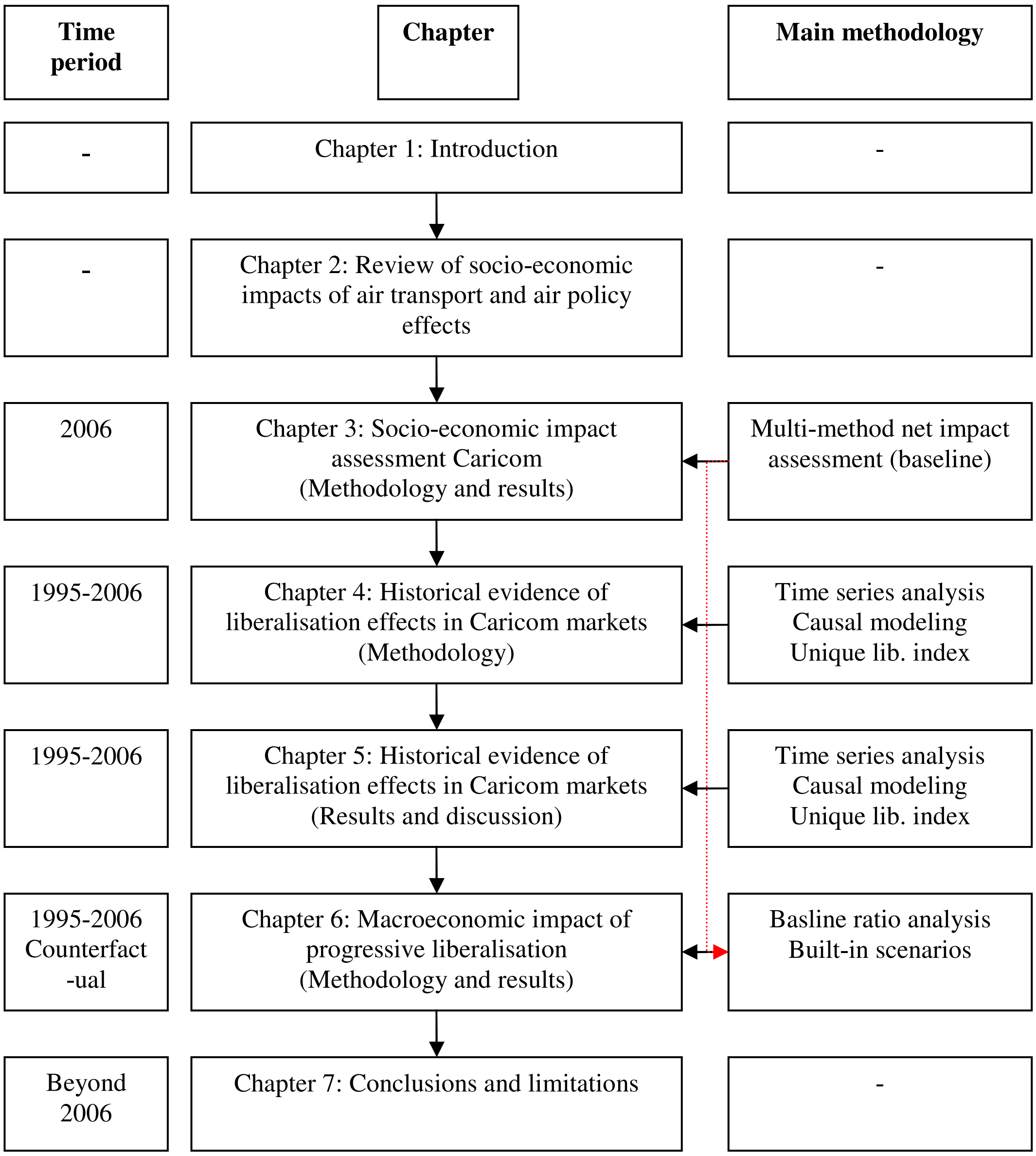


Fig. 1.2 Thesis structure

1.6.2. Chapter breakdown

The primary step in the research is to outline the aim, objectives and research approach as well as to introduce the reader to the case-study region's air transport sector and socio-demographic profile. This is contained in Chapter 1. In Chapter 2, a critical review is conducted of previous studies. General macroeconomic impact and deregulation theory is discussed as well as possible applications of this theory to the case-study sample of Caricom states and other small island groups. Any research gaps are identified.

Chapter 3 consists of a self-contained assessment of the socio-economic impact of the sector to the case-study region for the year 2006. Sampling techniques used to arrive at a representative member state sample of seven states are discussed before the net multi-method research plan is detailed. The primary and secondary findings are then examined in the results section and finally the different categories of impact are brought together and compared across the sample of member states.

The historical analysis of liberalisation effects on a sample of Caricom country-pairs is split into two chapters. Chapter 4 provides an in-depth examination of the time-series and regression methodology. The relevant socio-economic, air transport and exogenous variables for each of these sections are discussed and the calibrations used to arrive at the final annual values are presented. A number of model validation procedures termed diagnostics are then explored and any remedial action to improve the statistical reliability, interpretability and logic of the model outputs is taken. Chapter 5 then goes on to reveal the main descriptive and causal model results, with the partial performance of liberalisation in improving aggregate traffic volumes being of primary interest[4].

The model's partial coefficients become major inputs for Chapter 6, where they are used to estimate what would occur if the control group of restricted markets was to experience further reform. The estimated changes in volumes are tested for possible effects on consumer and producer welfare, national and regional GDP, employment and business investment and productivity. This is performed under a number of scenarios, namely further bilateral or multilateral reform and high and low elasticities

[4] Although, the effect of liberalisation on other aspects of supply, like airfare, productivity and service levels are also explored given the interaction between these secondary factors and air traffic volumes.

of demand. The baseline ratios discovered in Chapter 3 are applied in Chapter 6 to estimate the macroeconomic performance of output and efficiency gains facilitated by air policy reform. Conclusions and limitations are finally drawn in Chapter 7.

1.7. Background to case-study (CS) region

Following on from the brief CS introduction given in the prologue, it is useful at this point to explore the region's air transport sector in more detail as well as the external factors effecting local air passenger markets before the main research task is undertaken. The reader will firstly be familiarised with the general Intra-Caricom, EU-Caricom and North America-Caricom air policy status compared with the current stage of liberalisation in other regions of the world. The socio-economic and demographic heterogeneity of the region is then presented and its effects on the region's air transport markets are given through a comparative breakdown of the main source markets, purposes of travel, mix of local and foreign carriers and airport characteristics by member state.

1.7.1. Socio-economic setting

Although the Caribbean Community boasts a world renowned tourism product, Table 1.3 shows that individual member states are currently at different stages of tourism industry maturity with economies like those of Haiti and Guyana still depending heavily on agriculture for export into the global marketplace, while manufacturing based economies like Trinidad & Tobago are comparably large and fast growing, independent of the earning of foreign exchange in the form of visitor expenditures.

The majority of the smaller economies in the Caribbean, in terms of GDP (PPP) and population, have typically been poorly diversified and rely heavily on the export of only a few products and services. They tend to suffer from a lack of human and natural resources and this necessitates more demand, per head of population, for sea and air transport, with the latter being driven by the need to import high value, fast moving products and the need for local populations to gain vital access to regional centres for higher education and more advanced medical treatments.

The presence of a well developed tourism product, as seen in Antigua, the Bahamas, Barbados, Jamaica and St. Lucia, generally tends to increase the level of air traffic volumes per inhabitant to levels way beyond those found in larger, landlocked economies. In 2004, Guyana had 0.69 air passengers per inhabitant whereas in the Bahamas it was as high as 10.74 with the majority of air passengers being foreign visitors (Regional airport statistics 2004). In Jamaica the local population is notably higher than the regional average, and consequently the high number of foreign air passengers recorded in 2006 does not result in a high passenger per inhabitant ratio (1.68). Again, the heterogeneity evident among different member states has an analogous impact on their respective air transport markets[5].

Table 1.3
A selection of socio-demographic data for the full Caricom member states

Caricom Country	Population (000)	Main industries	Foreign tourist (stop over) arrivals (000)
Antigua & Barbuda	68	Tourism, construction	254
The Bahamas	311	Tourism, banking	1,492
Barbados	278	Tourism, banking sugar production	563
Belize	273	Garments, food production.	247
Dominica	69	Soap production, tourism	84
Grenada	89	Food & Bevs, textiles	118
Guyana	706	Bauxite, sugar production	113
Haiti	7,656	Sugar production, flour	60
Jamaica	2,713	Tourism, bauxite	1,679
Montserrat	9	Tourism, rum production.	8
St. Kitts & Nevis	39	Tourism, sugar, banking	118
St. Lucia	164	Tourism, bananas	305
St. Vincent & Grenadines	117	Food production, cement	97
Suriname	437	Bauxite, gold mining	35
Trinidad & Tobago	1,097	Natural gas, petrochemicals	233

Source: IMF data (2006), CTO annual visitor data (2004)

5 A map of the region showing the locations of the states presented in Table 1.2 is provided in Appendix A.

1.7.2. Air transport market setting

Extra-regional air transport markets in the Caricom region are currently guided by a set of traditional bilateral air service agreements (Figure 1.3). Making up the main source markets, the US, UK and Canada have all made moves to officially amend their traditional air service agreements with Caricom states to varying degrees of success. In the absence of official amendments, a number of *ad-hoc* agreements have also been made in an attempt to stimulate further air services. The Dominican Republic, Jamaica and Aruba have all drafted open skies agreements with the US as an indication that these Caribbean states were willing to accept a wider range of foreign carrier services, even in direct competition with local carriers. However up to the time of writing, only the US-Aruba open-skies agreement has come into force (in 1997).

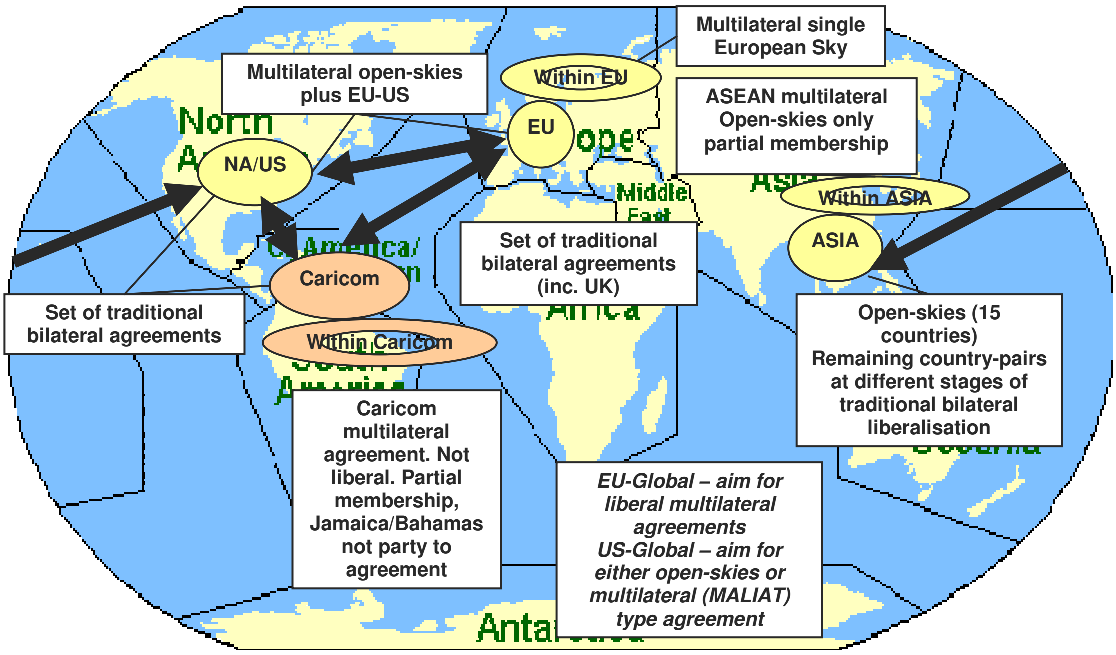


Fig. 1.3 International air policy status: Global comparison

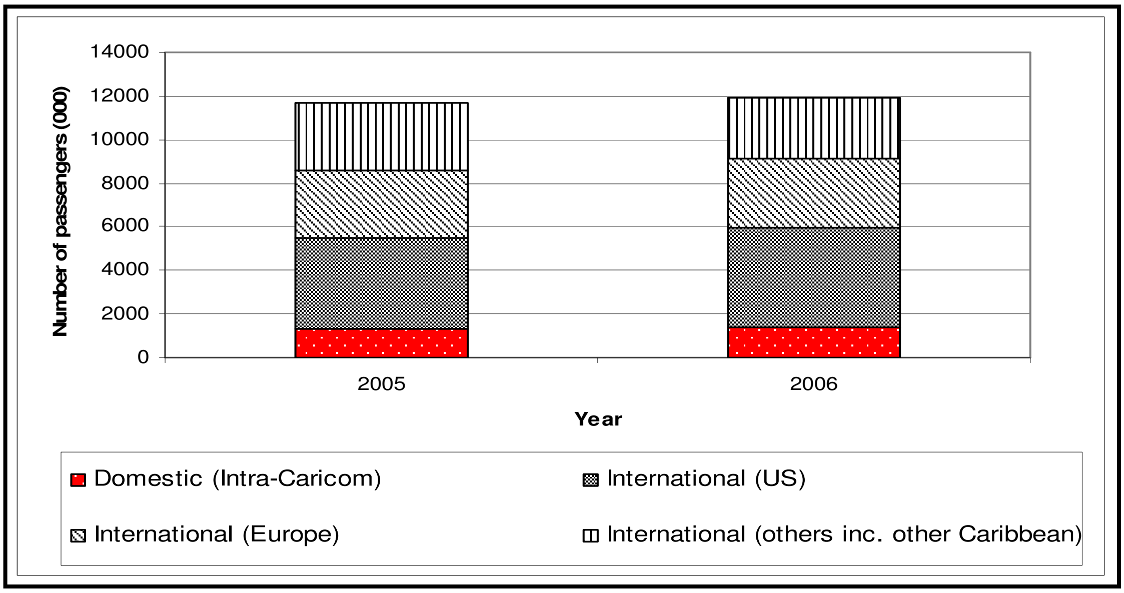
The US and Canadian approach to multilateral negotiation has been less forthcoming while the EU has declared that its aim is to negotiate liberal multilateral agreements with 3rd countries or even 3rd country groups such as the Caricom region; but no tangible progress has been made to date on this front. The US has also expressed a desire to negotiate multilaterally with Pacific nations, becoming a full member of the MALIAT agreement (Multilateral Agreement on the Liberalisation of Air Transport) and an interested party in the PIASA agreement (Pacific Island Air

Service Agreement). Leading the way in terms of progress towards market relaxation is the EU-US agreement. As negotiations are currently in progress as to how liberal it can become, regulatory bodies from other regions of the world keep a close eye on any developments and how similar developments could affect their air transport markets.

In terms of regional air service agreements the Caricom Multilateral Air Service Agreement signed and ratified in 1998 by nine of the fifteen full member states only resulted in limited reform measures taking place, with the notable absence of key members Jamaica and the Bahamas and the precedence of earlier bilateral agreements making adherence optional among the signatory states. Again, it is the EU which leads the way in terms of membership, adherence and degree of relaxation. The ASEAN multilateral agreement is in a later stage of development than the Caricom equivalent but again suffers from a lack of full participation among some key states in the region, notably China and Korea.

The stage of development towards air transport liberalisation can affect the structure, organisation and development of air transport networks. Airlines are still generally not permitted to operate freely or to make unchecked capital investments into foreign air transport markets. The generally restrictive 'status quo' of intra and extra-regional air policy in the Caricom region compared with other world regions would also have clear supply and network affects that may or may not hinder the growth and development of demand for air services.

Foreign visitors to the Caricom region generally come from very few source markets and as a percentage of extra-regional traffic, Intra-regional flows formed a relatively minor share of the c.12 million passengers arriving into the region's airports in the years 2005 and 2006 (Figure 1.4). The dependence of Caricom countries on Europe and the US as the major source markets actually intensified between 2005 and 2006 with the percentage of passengers arriving from other international destinations decreasing by 5.4%. By comparison, both EU and US markets have sizeable domestic markets, especially in the case of the US as well as a wider range of international source markets.



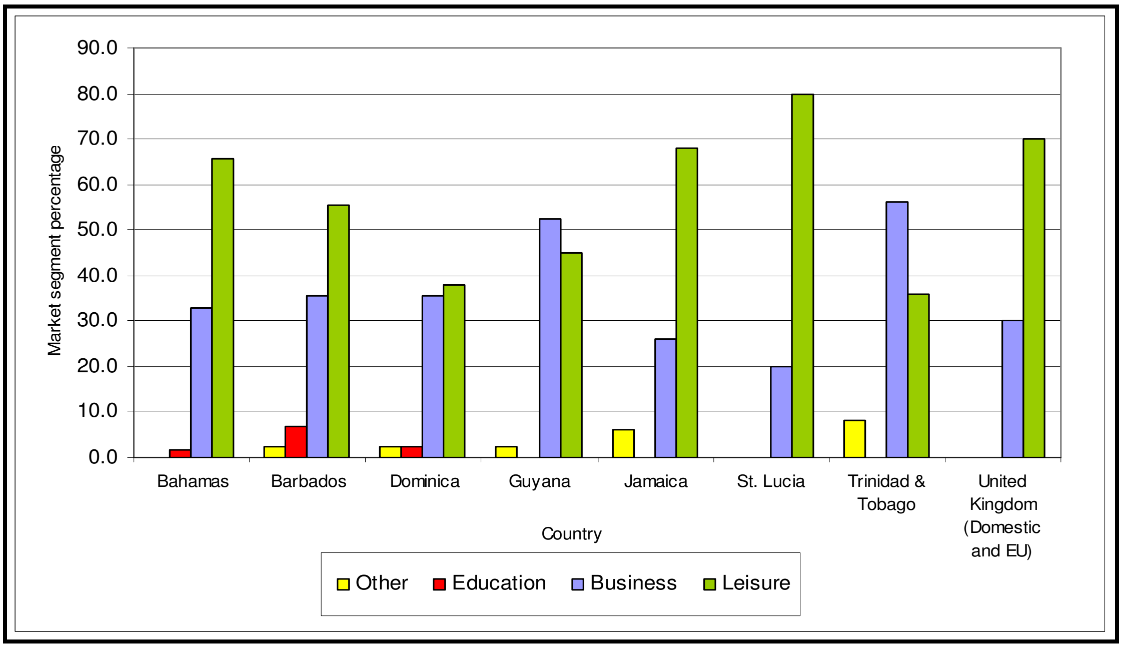
Source: World Bank Study (2006)

Fig. 1.4 Caricom traffic – Source markets (2005-2006)

This last observation is supported by traffic data provided by regional airports (including E/D immigration cards), the UK Civil Aviation Authority and the US Department of Transportation which reported an average US-Caricom traffic growth of 10.2% between 2005 and 2006 and 3% for UK-Caricom markets, whereas growth on Intra-Caricom markets was at a modest 1.6% over the same period. E/D cards provide evidence that the ratio of foreign to local passengers on these markets can be as high as 95% (US-Dominica market) and averaged at 74.1% with a moderately high level of variation around the mean, suggesting heavy directional imbalances on these markets. These two factors combined make it difficult for Caricom countries to exercise a great level of control over the development of these traditional source markets with socio-economic change in the US or in European countries having a pronounced effect on air traffic volumes into the case-study region.

Linked to this is the breakdown of Caricom air traffic markets by purpose of visit. Levels of leisure traffic appear to be similar when Caricom and UK air traffic markets are compared (Figure 1.5), but the main difference is, of course, that the majority of UK leisure travel is outgoing whereas in Caricom markets the opposite generally applies. As will be demonstrated, this difference can have a significant effect on the catalytic impact of the air transport sector as visitor expenditure spills over into other areas of an economy. Within the region itself, Jamaica, Bahamas, Barbados and St.

Lucia were more heavily dependent on the leisure market whereas in Guyana and Trinidad & Tobago a higher percentage of respondents cited business as their major purpose for travel. A nearly even spread of respondents between business and leisure were travelling to and from Dominica reflecting the fact that its tourism market is its infancy stage. Also, its eco-tourism product can only be sustained by its limited carrying capacity and infrastructure development, which in turn has a moderating effect on incoming tourism demand.



Source: Caricom passenger survey (author), UK CAA airport survey statistics (2006)
Note: Caricom country figures were extracted from the Caricom passenger survey and UK figures from the 2006 CAA airport passenger survey

Fig. 1.5 Market segmentation by purpose of visit (2006)

The Caricom region's local air carriers have generally had a history of poor financial performance as well as being the recipients of several rounds of blanket subsidies by the region's stakeholder governments. Carriers such as LIAT, Air Jamaica, Bahamasair and Caribbean Airlines have rarely been exposed to truly liberal air transport markets and have typically suffered from inefficiencies stemming from a lack of access to scale economies, proper capitalisation, preferential lease and fuel rates and relaxed labour markets. Continued governmental control has also led to frequent interference in strategic, network and operational decision making. Although the global industry has suffered from periods of heavy losses, a 2005-2006 comparison between a sample of similarly sized Pacific island and Caricom carriers showed that Pacific island carriers managed to stem losses more effectively in absolute terms while, despite the sampled airlines producing a similar level of output, labour productivity was found to be notably higher for the Pacific island carriers (Table 1.4). With the exception of Air Tahiti Nui, pre-tax financial performance among the sample of Pacific carriers was incremental. A loss of US$39 million by Air Tahiti Nui in 2006 explains the high average increase in losses between 2005 and 2006 in percentage terms.

Table 1.4
Pre-tax profit and labour productivity of a sample of Pacific island and Caricom airlines

Carrier group	Average pre-tax profit 2006 (US$mn)	Average pre-tax profit 2005 (US$mn)	% change	Average RPK mn. (2006)	RPK per employee (2006)
Caricom carriers (n=4)	-66.0	-19.3	-241.9	1,788	665,715
Pacific island carriers (n=4)	-18.9	-1.44	-1,212.5	2,171	3,008,943

Source: IATA, airline annual reports (calendar year), ATI traffic statistics
Note: Caricom airlines include LIAT, Air Jamaica, Caribbean Airlines and Bahamasair. Pacific carriers include Air Pacific, Air Tahiti Nui, Air Vanuatu and Air Niugini

Possibly related to the poor financial performance of local carriers is the region's failure to create a competitive hub. In the absence of deep alliances or strategic cooperation between the region's carriers (or between regional and long/medium haul foreign carriers), the two main hubs of Caricom and wider Caribbean currently lie outside the region (San Juan, Puerto Rico (SJU) and Miami (MIA)). High frequencies and the lion's share of capacity on US- and UK-Caricom routes are provided by foreign carriers (Table 1.5), whereas the opposite is the case for Intra-Caricom markets. As local carriers provide the majority of Intra-Caricom services[6], a poor financial and service record may be cited as a contributory factor to the modest growth levels in Caricom source markets as recorded by the region's yearly airport traffic statistics.

Table 1.5
Local and foreign carrier shares of capacity on three country-pair groupings

Country-pair group	Caricom carrier share (%)	Foreign carrier share (%)
Intra-Caricom	95.6	4.4
NA-Caricom	40.4	59.6
Europe-Caricom	33.6	66.4

Source: OAG airline guide

[6] Foreign carriers often do not possess the necessary traffic rights to operate Intra-Caricom routes under the existing traditional bilateral agreements.

A review of the sample's main airports in Table 1.6 confirms the finding that a low level of hubbing activity takes place within the case-study region. While there is a certain amount of hubbing activity taking place in the Bahamas (in terms of air transport movements not passenger numbers) due to the presence of a domestic network linking Nassau with the outer islands, none of the airports recorded over 5 million enplanements and disenplanements in the year 2006 (which according to ACI (2004) is the threshold over which an airport becomes a medium density airport with some hubbing activity). Kingston, Montego Bay, Nassau and Trinidad airports all benefit from local carrier bases but arrivals and departures have not been concentrated or coordinated to provide a sufficient number of on-line and interline opportunities. In fact, despite the presence of Air Jamaica and BWIA bases in Montego Bay and Port-of Spain, transfer traffic was restricted to 4.7% and 6.6% of total traffic in 2006 respectively (Airports Council International 2006). Moreover, the majority of these passengers had an onward connection to Kingston in the case of the former and Tobago in the case of the latter pushing down the amount of international transfer traffic yet further. By contrast, Panama City, a similar size airport with a home based carrier (COPA) created 35% of total traffic in the form of transfer passengers. The region's airports are thus unable to compete with the American Airlines offering of an array of connecting flights through its Miami and San Juan hubs. In fact, Caricom airports have yet to appeal to connecting passengers from South, Central or North America as well as Europe even if it makes intuitive sense to make connections in the region.

Consequently, airport employment densities are generally low in the region. An ACI survey of 23 world airports suggested that low density airports can facilitate only modest direct employment in the range of 350-750 jobs per million passengers. If this assumption holds, POS and DOM represent anomalies (they are therefore highlighted in bold in Table 1.6). Trinidad is a sub-regional aircraft maintenance hub as well as base of home carrier Caribbean Airlines (BW) while DOM and GEO employ a disproportionate number of employees given a minimum number of airport operations are required no matter how small the yearly throughput is. These fixed operations require a minimum level of employment. The variability in airport infrastructure and employment densities in the region may lead to contrasting socio-economic impacts of the sector on their respective economies.

Table 1.6
Selected airport data – Caricom regional airports

Regional airport	Passenger numbers 2006 (000)	On-site (Direct) employees	Jobs per million passengers	ACI airport classification
Montego Bay (MBJ) – Jamaica	3,159	1,669	528	Low (<5mn)
Grantley Adams (BGI) – Barbados	2,365	951	402	Low (<5mn)
Piarco (POS) - Trinidad	2,364	2,011	**851**	Low (<5mn)
Linden Pindling (NAS) - Bahamas	2,313	1,096	474	Low (<5mn)
Norman Manley (KIN) - Jamaica	1,715	899	524	Low (<5mn)
Crown Point (TAB) - Tobago	808	358	443	Low (<5mn)
Freeport (FPO) - Bahamas	570	254	446	Low (<5mn)
George Charles (SLU) – St. Lucia	472	211	447	Low (<5mn)
Hewanorra (UVF) – St. Lucia	437	154	352	Low (<5mn)
Cheddi Jagan (GEO) - Guyana	426	312	732	Low (<5mn)
Melville Hall (DOM) - Dominica	143	135	**944**	Low (<5mn)

Source: ICAO (2006), ACI (2004), Caricom regional airport traffic statistics (2006)

2.1. SOCIO-ECONOMIC IMPACT OF THE AIR TRANSPORT SECTOR

2.1.1. Introduction

"Air transportation, by moving goods to where they are required and people to where they wish to go, is a vital component of all products and services produced in an economy. By expanding the markets for goods and labour, air transportation promotes regional specialisation, large scale production, interregional and international trade, personal mobility and social interactions". (Dempsey and Gesell 1997).

The significance of transport and more specifically, for the purposes of this study, air transport to macro-economies, can be appreciated when one looks at the interconnected roles between air transport and economic development, production, distribution and the price of goods and services. Indeed, in order to gain a more accurate picture of relative impact, one must also take into account the important relationship that exists between the development of other transport modes and economic development, production, distribution and the price of goods and services, as well as other vital network systems such as the telecommunications industry and sources of energy and power (Button and Stough 2000). To work out net value one must then subtract any costs and externalities associated with the provision of such a network of services and be left with net benefit also referred to as net value (IATA 2005).

The natural progression of an air transport socio-economic value assessment is to find ways of increasing that value by predicting or forecasting the positive and/or negative effects of improvements to infrastructure, of bilateral or multilateral liberalisation or of regional airline privatisation *inter alia*. Gillen, Harris and Oum (2002) measured the economic effects (i.e. changes in market share, airline profits and consumer welfare) of liberalising the fare, entry and service levels of a bilateral Air Service Agreement (ASA) between Japan and Canada. The Civil Aviation Authority (CAA) in the United Kingdom (UK) has, on more than one occasion, looked at the macroeconomic impact of introducing new routes to and from the UK (1994), while Kasarda and Green (2005) have looked into the possible economic effects of improved air service liberalisation, customs efficiency and reduced corruption in the air cargo sector.

This chapter firstly looks to critically evaluate the generalised socio-economic impact studies undertaken to date, comparing the results of those which have been conducted for large, developed and mature markets to those that have been conducted for small, developing markets. Secondly, it highlights the fact that there has been a dearth of similar studies carried out for the Caribbean region, often only briefly explored within literature that has lumped it together with the larger land masses of South or North America. The few Caribbean studies that *are* currently available focus almost completely on visitor demand whilst neglecting the social utility and economic value of the industry to local communities. Thirdly, it seeks to point out the most appropriate evaluation method that can be applied and adapted to suit the socio-economic peculiarities of the Caribbean region and other small, developing, tourism driven areas of the world.

The same process of critical literature dissemination will then be repeated in the area of air policy, highlighting any gaps and weaknesses in published literature to date before selecting the most appropriate approach for estimating change in passenger output along with industry and national welfare as a result of further liberalisation in the region. This consists of an assessment of what is relevant to macro-economies generally and then more specifically to island and peripheral states that constitute the Caricom region. Research that measures the possible socio-economic effects of traffic growth using macro-economic indicators like GDP growth and change in trade and foreign investment will provide a basis from which to develop an appropriate analytical framework for the Caricom region given its atypical socio-demographic profile.

2.1.2. The socio-economic impact of air transport: alternative methods

2.1.2.1. General indicators

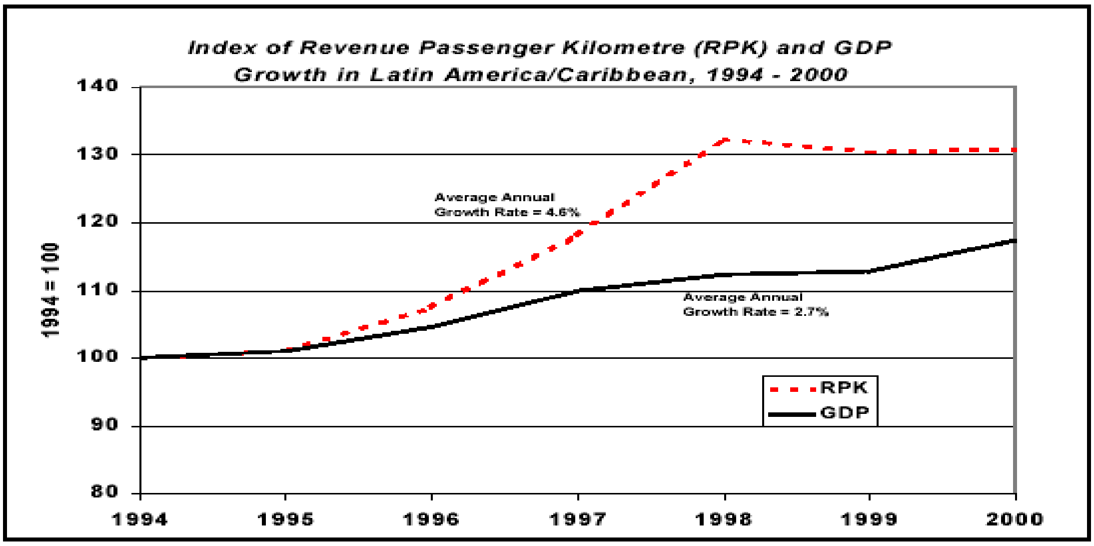
Before the more comprehensive socio-economic impact literature is detailed, it is worth mentioning that there are a number of indicative measures that can be used in order to introduce the researcher or industry stakeholder to some key macroeconomic relationships. The advantages of such measures include the ease of access to data and the low levels of complexity, making synopsis results accessible to a wider group of readers. They are also useful for informing a more detailed impact analysis. For service driven economies, the amount of services traded (exported or imported) by air can be compared to the amount traded by other modes.

Similarly, in tourism led economies, the wider economic benefits of the air transport industry in supporting tourism can be measured by calculating the amount of incoming tourism by air as opposed to other modes (Air Transport Action Group 2002). Other indicators include the amount of domestic/international air trips per capita or the number of inhabitants in a country or region per aircraft movement (Whelan 1998).

These indicators provide a summation or snapshot of how active the air transport sector is within a country, as well as a breakdown of its network characteristics. The most common indicator used, however, gives the reader an instant overview of growth in the sector by comparing change in one of the sector's output measures to real GDP growth. For the Latin America/Caribbean region, the annual growth rate of Revenue Passenger Kilometres (RPK's) was compared to the annual growth rate of real GDP with a common index starting in the year 1994 (see Figure 2.1). It clearly demonstrates that in the 6 year period 1994 to 2000 the annual growth rate of RPK, on average, superseded that of GDP growth by 2.9% (4.6%-2.7%). It also shows that at the start of the year 1998 the regions RPK growth rate peaked, decoupling itself completely from the GDP growth curve. Thus, if the GDP curve is thought of as the average annual growth rate in output of all sectors in an economy, then it provides evidence that the air transport sector's output is above average and consequently has been adding more value to aggregate GDP than the average sector.

Of course, this indicator like many others is clearly limited given that a proportion of the recorded RPK represents local passengers making expenditure abroad. It could therefore be argued that the not all above average growth in air transport will contribute to national output growth. A more detailed assessment has to take these factors into account along with the spillover effects of air transport infrastructure[7] on productivity, investment and competitiveness.

[7] The term infrastructure here includes physical infrastructure as well as the network of services provided by air transport (Dempsey and Gesell 1997).



Source: Air Transport Action Group (2002)

Fig. 2.1 Regional economic growth vs. trends in air traffic

2.1.2.2. Common effects on national economies

Moving on to a more in depth look at the socio-economic contribution of air transport, the Air Transport Action Group (2000) suggests that airlines and airports make vital contributions to any nation's economy; first as a key component of a country's transport infrastructure which facilitates the domestic and international flow of commerce and second as an industry that generates significant direct and indirect employment in leisure and business travel-related industries. This economic assertion agrees with Oxford Economic Forecasting (1999), as it states that the most important contribution aviation makes to the UK economy is through its impact on the performance of other industries and as a facilitator of growth. According to the International Civil Aviation Organisation (2002), air transport facilitates growth elsewhere in an economy by, on average, 3.5 times as much as its direct impact on output and by a staggering 6.1 times as much as its direct impact on jobs. This results in an estimated total output attributable to the global aviation[8] sector in the order of US$1,360 billion (4.5% of world output in terms of real GDP) with 27.7 million jobs created as a result of that extra output (1998). The direct impact of the industry, according to ICAO, is but a fraction of the aggregate figures, with a contribution of only US$360 billion to output and 3.9 million jobs created worldwide but still

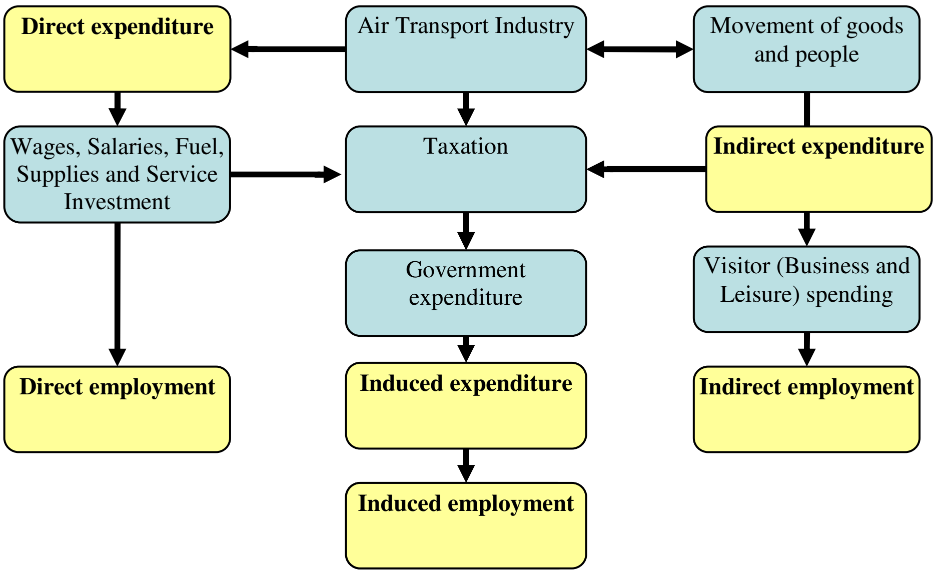
[8] It ought to be clarified that ICAO's definition of "civil aviation" is much broader than the definition of "air transport" as used for the purposes of this study. It includes commercial air transport, non-commercial air transport, commercial non-transport, infrastructure and manufacturing whereas only commercial air transport and infrastructure are included in this study.

comparable in its direct impact to other large industrial sectors like car manufacturing, hotels and telecommunications (Oxford Economic Forecasting 1999).

Understandably, direct impacts are generally easier to quantify than indirect or induced impacts which are subject to leakages[9]. Examples of leakages include imports which are purchased by visitors/businesses as opposed to local products and services, when savings are made instead of spending, when taxation revenues are used to increase the current account deficit or when impacts have already been claimed by other sectors in the same economy (Caribbean Tourism Organisation 2005). But according to ICAO (2005), the contribution described above of US$360 billion, has been calculated using methods which compensate for the double counting of output.

Figure 2.2 (below) shows, in diagrammatic form, the various components of total economic impact which ultimately fall into one of six categories; direct, indirect and induced expenditure and direct, indirect and induced employment. One of the weaknesses of the economic model shown below is that it does not encapsulate wider economic cost or wider economic benefit as defined by Brian Pearce, the International Air Transport Association's (IATA's) chief economist (2005). Pearce argues that economic impact studies need to be more comprehensive by including wider benefits and costs in order to create net value in excess of cost as being a more accurate estimation of the sector's contribution to national economies.

[9] Although airfares and freight rates accrued to foreign carriers can be said to be a direct impact leakage.



Source: Air Transport Action Group (2000)

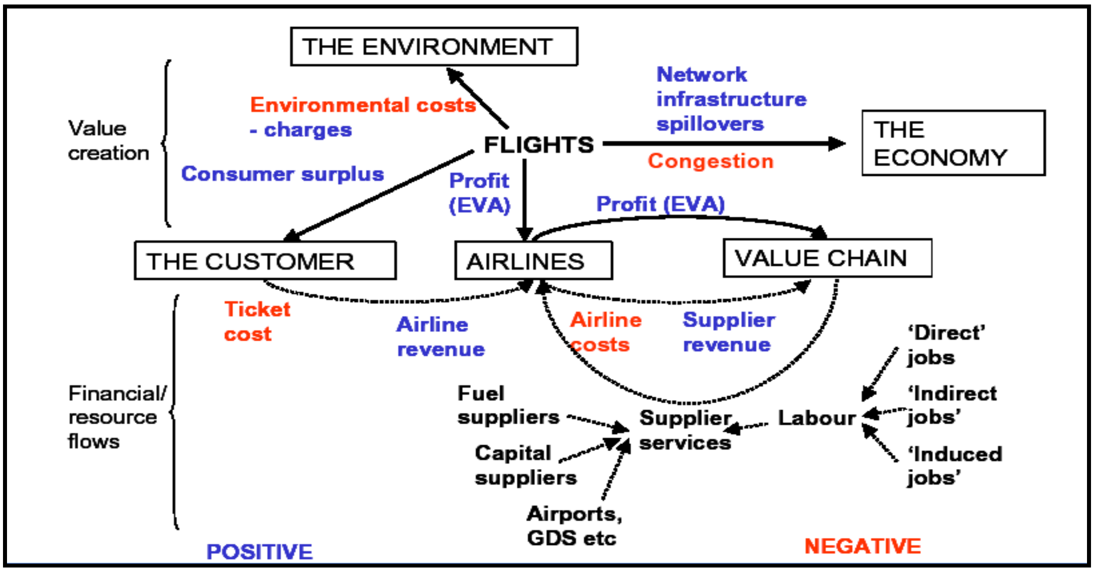
Fig. 2.2 Components of total economic impact of the air transport industry

Pearce's wider economic impact argument is centred on a number of assumptions. First and foremost it is assumed that consumer surplus should be maximised for the customer. In other words the net welfare gain in better service, cheaper tickets and higher frequencies, for example, widens the gap between what the customer is willing to pay for a ticket and what he actually pays. Second, airlines wish to maximise revenue in excess of operating and capital costs[10], as do suppliers. It can also be assumed that a proportion of this excess revenue would be invested in human resource development and therefore job creation. Third, workforce value is assumed to be created by comparing current wages to the next best opportunity. Fourth, externalities to the environment must be weighted against environmental charges and levies which are accrued to local and central government through commercial aviation activity. Finally, it is assumed that on a macroeconomic level congestion costs must be subtracted from the positive impact on GDP as a result of improved productivity and business investment stemming from a well developed infrastructure system.

The supporting role air transport plays in tourism and the value placed on connectivity (frequent, efficient access to new markets or essential education/medical

[10] This can also be called Economic Value Added (EVA).

facilities) are also included in his amplified model of economic impact. Pearce's inclusion of consumer welfare and externalities as a real and growing benefit/cost clearly shows that there is a degree of overlap between social and economic impacts. There is a close relationship, for instance, between quality of life and perceived or actual consumer value derived from the existence of healthy levels of growth in the air transport sector. The terminology used for these wider benefits are interchangeable and can often be called both social and economic benefits in the same report. It is interesting to note that Pearce refers to air transport's role in supporting tourism as a wider economic contribution, whereas a recent ATAG report suggests that this is more of a social role, as it can assist in reducing levels of poverty (IATA 2005). To emphasise this relationship the term socio-economic impact should be used for the purposes of this study. Pearce's holistic model of the economic contribution of air transport is summarised in Figure 2.3.



Source: Pearce (2005)

Fig. 2.3 Components of air transport value creation

Now the range of components of socio-economic impact have been discussed, it is important to understand that there are, according to previous studies, a number of different ways to measure (quantify) and qualify these contributions. Invariably the set of parameters which are chosen will affect the outcomes themselves along with the accuracy of those outcomes.

The Federal Aviation Administration (1986) was responsible for classifying the economic impact of the existence of airports into the three categories that the majority of later studies subsequently copied. That is, the concept of direct, indirect and induced expenditure, income and employment. To measure direct impacts one has to quantify the economic activity of the aviation industry itself, such as its effect on GDP, employment, investment, profits and turnover generated, along with taxes and revenues paid to the treasury as a result of demand for airline and airport services. Oxford Economic Forecasting (1999) suggest that this part of the overall impact measurement is essentially an accounting exercise but for the avoidance of double counting. For example, the double counting of a domestic passenger is avoided by counting a journey only once. Similarly on an EU regional level, a passenger travelling between Paris and London will only be counted once in an EU25 analysis even though it will have been counted as a departure in France and an arrival in London (Eurostat 2006).

2.1.2.3. Differential Estimation Approach (DEA)

The Federal Aviation Administration (FAA) also argued that, strictly speaking, any study that is purporting to measure true economic impact should look only to measure those activities that would not have taken place if an airport did not exist (Montalvo 1998). This method was named the Differential Estimation Approach (DEA) by the FAA and it matches the basic economic concept of opportunity cost very closely. However, the FAA themselves state that it will rarely be cost effective to develop a basecase scenario that depicts the economy of a region without an airport. The time and resources required for such an exercise will seldom warrant the resulting improvement in the estimates of employment, payroll and expenditure impacts. To circumvent this issue an alternative approach was proposed by Karyd and Brobeck (1992), which only considers direct impacts and a small proportion of the indirect impacts of an airport to an economy. The approach was based on the concept of derived demand. In other words, demand for transport is seen by the consumer as a medium by which to move a visitor or a business person to a place where he or she can start to consume the real product or service. In addition, it is argued that the use of air transport is complementary to the use of other infrastructures like communications, highways, railways and so on.

This methodology is rejected, however, on two accounts. Firstly, although perceived as a derived demand, air transport, especially efficient air transport, actually adds value given that a person or a piece of cargo in a sub-optimal location is in a state of limbo, always remaining as an intermediate product; or in the case of the traveller, always remaining in an intermediate location. Second, just because it is deemed complicated to account for the full range of socio-economic contributions, this should not be an excuse to avoid such a calculation even if some simplified assumptions have to be made (Montalvo 1998).

2.1.2.4. Input-Output analysis and Computable General Equilibrium modelling

Thus, a more established holistic measure which has proven to be feasible, in many cases, is the Input-Output (I-O) methodology, developed by the economist Wassily Leontief. The major advantage of this type of analysis is that economic impacts are estimated as they are produced reducing to zero the amount of sensitivity assumptions that need to be made in order to work out a basecase scenario. Furthermore, they are measured along with the demand effects of other sectors in an economy (ICAO 2005) enabling the investigator to compare and contrast the demand effects of say the agricultural sector against those of the transport sector.

The clearest and most comprehensive application of I-O analysis to the air transport sector can be found in ICAO's Economic Contribution report (2005). Assuming that any given industry in an economy makes use of labour and products offered by other industries we can trace the demand effects of the air transport sector on interrelated industries dependent on the existence of air transport facilities and services for a proportion of their own demand effects. The impact types (direct, indirect, induced and catalytic) and measures (value added, employment, expenditure) of an industry can be estimated by its relative contribution to total output and final demand (consumption). A summary of the necessary I-O steps and calculations is now offered using the example of the regional and national impact of Frankfurt airport in 1998.

- For direct impact a survey of 127 firms located on-site gathered empirical data on airport salaries, wage and employment levels.

- Total expenditure on intermediate products, investment and employee wages by these firms were then calculated along with the number of employees.
- Affiliated firms located off-site were not included in the sample. Had they been included estimated impacts would have increased.
- The proportion of intermediate inputs supplied by domestic firms was then extracted (i.e. by means of a question pertaining to the location of airport suppliers).
- The largest providers of air transport inputs were identified based on a Standard Industry Classification (SIC).
- 1993 national input-output tables of 58 industries were reduced to the 17 most relevant ones to the regional economy of Hessen with an additional industry 'Rest of Germany' added to approximate the import-export effects of inter-regional trade between Hessen and the rest of Germany.
- Employees residing outside Hessen were subtracted from the direct total. Total wage effects were calculated based on an average wage levels.
- Transactional cross-industry tables were then produced detailing national and regional inputs and investment by sector based on the information provided by the survey data. In the case of Frankfurt airport, manufacturing and transport and communication suppliers provided the lion's share of indirect activity.
- Similarly, using average wage levels, total Frankfurt airport related wages were assigned to the 17 industries and it was noted that manufacturing income was largely leaked into households in other region's/countries.
- Using the direct, indirect and induced transactional data as a baseline, multiplier values and technology coefficients could be derived. In the case of the former by dividing the combined indirect and induced effect by the core direct effect and in the case of the latter by dividing a given industry's input level by the air transport sector's gross output.
- Using the inverse *(I-A)* matrix, a change in successive rounds in industry inputs for a given change in air transport output could be derived for any or all classifications of impact. If $100 million additional total output was produced by Frankfurt airport then this would incur a first round of input changes of $a(X)$ where a is an air transport suppliers technology coefficient and X is the given change in gross air transport output.

- As supplier output increases, these suppliers input factors also have to be adjusted representing a second round of demand effects. This process continues until final equilibrium is reached.
- Finally, income effects can be approximated using income coefficients (derived by dividing a given industry's income level by the air transport sector's gross income level multiplied by the new output coefficients required to produce $100 million of extra air transport output). Supplier income adjustments are then aggregated to arrive at a total change in income assuming an open I-O model.

As shown in the example, one of the main prerequisites for an I-O analysis is an I-O sector table which is normally produced periodically by national or regional government. Because it is a costly procedure, however, most national governments collect and process data and conduct nation-wide surveys on a very infrequent basis[11]. According to Oxford Economic Forecasting (1999), another prerequisite for I-O analysis is to have access to airport operators and their affiliates' annual expenditures broken down into a) purchases by product category and b) the location of every supplier, none of which are available on the average airport balance sheet or income statement.

The practise of quantifying induced and catalytic impacts, according to Airports Council International (2004), is an indefinite science as there are always assumptions to be made on the extent of air transport's sphere of economic and geographical influence and whether, for example, all on-site activity is related directly to the airport and whether all off-site activity is related only indirectly to airport activities. In support of this point, a number of airport studies were gathered by Wirtschafts Faktor Flughafen (1990) using a variety of methodologies on similar size airports, and whilst the results showed similarities in the collected values for direct effects, the total impact effect showed a large variability (Montalvo 1998). Employing established techniques like I-O does not guarantee the reliability of such impact estimates either given the fact that it assumes that there is always a free supply of resources (capital, labour, land) into a region or nation to support extra economic activity (output) and that these required resources are never drawn from any other economic activities

[11] With regard to the Caricom region, the Secretariat based in Guyana has, to date, failed to produce a statement for its member states.

inside the region. If they are then the I-O calculations would not pick up decreases in output in these other industries as a result of the resource transfer (Forsyth 2006). Overestimations of the industry's indirect impact on national and regional economies can result, although this exaggeration would be less significant in import/export dependent economies. Further, the interaction of resource transfer between economies is not covered by I-O estimations. That is, the negative effects of a reduction in resources in one country/region for the benefit of an increase in activity in another region must also be taken into account in order to calculate the net welfare gain (loss) to an economy overall. In regions involving a number of different currencies, an increase in the exportation of services like tourism for example can have damaging effects on the export capability of other sectors in the same region as their products become more expensive for foreign importers to buy. This makes it harder to estimate with any accuracy inter-industry effects of a given level of air transport output using an I-O analysis. Forsyth (2006) and Dixon and Parmenter (1996) offer computed general equilibrium modelling of industry interactions as a more appropriate alternative to I-O analysis especially when considering multiple regions or jurisdictions.

ICAO (2005) states that airports in the United States typically expand their impact assessments to include catalytic effects or the spin off effects created by the consumers of air transport services, namely passengers and air cargo customers. This boosts the multiplier effects[12] on impacted industries and on the affected economy. It is important to include catalytic impacts if there is a close relationship between the air transport industry and other non-transport related industries like tourism, for example. A high number of tourist arrivals by air, for instance, will lead to higher indirect and induced output in tourism related supply industries and in the spending of supplier disposable income respectively.

[12] One of the multiplier effect calculations offered by ICAO can be defined as:

$$m^o = \frac{\text{indirect and induced (+ catalytic) output}}{\text{direct output}}$$

2.1.2.5. Alternative approaches to estimating induced and catalytic impacts

Input-Output tables published periodically by national and regional statistical bodies and airport survey data detailing employment, income and expenditure items do not encompass important information about resource transfers between regions and traveller behaviour. In fact the production function in I-O analysis assumes a fixed input requirement in order to meet a static amount of final demand or consumption. CGE models do build in wage and price elasticities on top of the transactional data required for an I-O analysis but again final demand is fixed as individual industry contributions are solved against this static final level of output (Organisation for Economics Co-operation and Development 2007).

One alternative according to Montalvo (1998) and ICAO (2005) is to focus more intensively on the demand side by analysing the expenditures and attitudes of transport users in more detail. Armed with direct employment and income as well as catalytic expenditure data for a given level of air transport user output, basic multipliers can be used to estimate indirect and induced income as well as employment effects. This approach compromises the industry by industry breakdown of demand effects but on the other hand allows for a much deeper understanding of the drivers of these demand effects and in turn what internal (e.g. level of service) and external (e.g. policy) measures could possibly increase air transport output in the future. If I-O assumptions are relaxed, factor inputs are no longer fixed having possibly been transferred from other regions or nations. This would then put into question the accuracy of the inter-industry transactional and technology coefficients given the costs of using external inputs would not have been accounted for. Perhaps this has been the root cause of the variability in multiplier values in I-O airport assessments undertaken to date. Table 2.1 shows this heterogeneity among an ICAO sample of previous study multiplier values quite clearly (ICAO 2005).

Table 2.1
Multiplier results from a sample of studies using Input-Output methodology

Scope of assessment	Airport	I-O employment multiplier
National economy	Frankfurt	1.77
	Heathrow	2.26
	Hamburg	1.69
	Munich	1.98
Standard deviation		*0.254623906*
Regional economy	Birmingham	0.48
	Frankfurt	1.29
	Gatwick	0.71
	Hamburg	1.10
	Manchester	0.61
Standard deviation		*0.342593053*
Local economy	Cardiff	0.31
	Dusseldorf	1.25
	Exeter	0.73
Standard deviation		*0.47088569*

Source: ICAO (2005) based on an ACI (1998) survey of airport impact studies
Notes: Studies based only on I-O analyses were extracted from the ICAO report (2005)
Multiplier = Indirect and induced employment/direct employment

It can be observed in Table 2.1 that the consistency of I-O results reduce for regional and local assessments as the level of resource transfer and input leakages increase. Secondly, the employment multiplier of Dusseldorf airport on the municipality of Dusseldorf is claimed to be almost the same as the impact of Frankfurt airport to the whole region of Hessen. This seems unlikely given there would be less households and local suppliers in Dusseldorf to take advantage of any increased air transport activity than in the whole region of Hessen. The same can be said for Exeter's multiplier effect on Exeter which is claimed to be higher than Birmingham's multiplier on the whole of the West Midlands.

Focusing then on the factors influencing air transport user behaviour, passenger or air crew surveys are typically conducted in order to estimate the travel behaviour of a population, and if the sample is large and varied enough it can produce some accurate inferences. Questions regarding length of stay, type of accommodation, number of people travelling, principle purpose of air travel and travel expenditures are commonly found in these types of survey. Embarkation/Disembarkation (E/D) cards collected by Immigration Departments also provide some useful insights into similar subjects, but the principle downside of E/D cards is that they only capture detailed information about non-residents and they frequently fail to portray key data on Diaspora expenditure and travel behaviour, an activity which occurs frequently in the

Caribbean region with such large numbers of ex-patriots returning from North America and Europe for holidays and to visit friends and relatives.

Interestingly, Airports Council International (2004) have incorporated catalytic effects into their own study framework although they claim that these effects are usually difficult to quantify in terms of employment and income as air service accessibility, frequency, price etc. is only one factor among several which will attract businesses and tourists to an area or improve business productivity. However, in a case like the Balearic Islands, for example, it has been argued that it is possible to quantify tourism impacts where it is clear that tourists would not have visited the destination by any mode other than air. Social and economic impact can also be evaluated by route using trip '*additionality*' and '*displacement*' indicators to measure the importance of certain routes and services to a regional economy (Civil Aviation Authority 1994). This is useful when policy makers and air transport operators are considering the potential benefits and setbacks of opening or closing routes to the macro-economy. At this point, however, it is important to highlight the fact that airline revenue accumulated by carriers based outside the region cannot be included in the regional accounts as incoming expenditure. In this case, repatriated airline revenues must be separated from all other expenditure categories, whether an impact analysis is being done on a micro level route basis or not (Highlands and Islands Enterprise 2005).

If a foreign carrier opens a route which directly or indirectly competes with a home based incumbent, then the revenue that is displaced must be counted as a negative direct impact to the air carrier (although positive indirect, induced and catalytic impacts may actually outweigh the increased burden to the national or regional air carrier)[13]. Displacement of revenue occurs when national carriers' share of traffic decreases and a larger share of total revenue earned is diverted out of the local economy and repatriated back to a foreign carrier's country of origin. This disbenefit might be offset, however, if foreign carriers are able to create additional demand for *incoming* traffic which would facilitate extra expenditure and output at local airports and in the wider economy. If demand for *outgoing* traffic is stimulated,

[13] Refer to Civil Aviation Authority (CAA) document entitled "The economic impact of new long-haul air services" CAP 638 (1994) for effects of new routes on incumbent carriers (p30).

however, then it would be equally important to capture any additional outgoing expenditure as a result of a new service or as part of any ‘as it is produced’ alternative assessment.

Herein lies the advantage of a hybrid, multi-method assessment. Multipliers are based on easy to follow traceable in and outflows of expenditure into an economy, wider catalytic output can be captured by examining passenger behaviour in more depth, the initial data requirement is not quite so onerous and the unique characteristics of a particular sample of countries can be incorporated into the assessment to take into account, for example, slack labour markets, movement of labour and resources and close substitute effects of an increase in output in one region at the possible expense of activity in another. In a US survey conducted by the Transportation Research Board (2008) of US airport economic impact methodologies, 81% of all respondents regarded the use of a passenger survey as either a useful, very useful or extremely useful exercise as compared to 92% of respondents for I-O models. Moreover 10% of respondents stated that the airport user survey was not applicable to them where as there were only 2% not-applicable responses for I-O analyses. This suggests that, although I-O analyses are both popular and considered to be useful methodologies, the use of basic multipliers and passenger surveys are considered not only to be a common alternative, but a useful alternative.

2.1.3. The socio-economic impact of air transport to SIDS

Although the UK cannot be classified as small when compared to other island economies it retains some characteristics that are specific to island nations. Namely, it relies heavily on air transport (and to lesser extent sea/rail transport) to maintain its vital trade links with neighbouring countries. Efforts have been made in recent years to transfer some of this burden to road and rail resulting from the introduction of the Channel Tunnel and the expansion of routes and frequencies of roll on roll off (RoRo) ferries. However, even given the recent increase in modal alternatives, Oxford Economic Forecasting (1999) suggests that relative to other non-island countries air transport carries a disproportionate amount of responsibility for attracting foreign investment from neighbouring countries. For example, in 1998 there were a total of 76.6 million visits to and from the UK. Of those 76.6 million journeys 51.8 million were by air (68%) while only 15.6 million travelled by sea (20%) and 9.3 million by train through the channel tunnel (12%) (UK National Statistics 2007). If one contrasts this with the example of Canada, that has a common border to the South and to the North-west with the United States, then air transport's contribution reduces to only 23% (in 2004) of total incoming and outgoing journeys while land transport (road and rail combined) contributed as much as 76% (2004) of all international journeys (North America Transport Statistics 2004). Of course, since 1998 Channel Tunnel traffic has grown quite considerably, but most island communities in the world today clearly cannot benefit from such an alternative, thus making the average island state yet more dependent on air transport as an important facilitator for growth.

Being 'small' adds further complications which will now be discussed. Crowards and Coulter (1998) explored the socio-economic vulnerability of small island states. They contend that they are vulnerable to external shocks due to their dependence on exports and imports and their limited possibilities for sector diversification. Although it was a generalised study, they highlighted the importance of air and sea transport in enabling small island economies to participate in world trade and that the increase in their domestic capacity to supply (at home and abroad) depends a great deal on the development of core services like transport, finance and communications. They then go on to explain that in these service areas small island economies are at a comparative disadvantage due in part to their high per unit transport costs. These costs are typically high due to poor modal choice, small fragmented passenger/freight demand (thin markets) and low scale production.

According to the World Tourism Organisation (2001), small vulnerable and tourism dependent economies need some form of special attention in the way of mutual assistance from both the air transport and tourism sectors[14]. They claim that air carriers re-fuelling in small or remote regions experience unfavourable disparities in fuel prices, having to pay rates that are often 40-50% higher that those carriers obtaining fuel at airports in other regions. Many small nations also do not have any income tax or other popular fiscal tax policies in place and so they tend to compensate for this by increasing airport departure taxes for passengers as well as landing fees for air carriers. Having to import expertise and material from abroad for any major

[14] One way to quantify, in monetary terms, the balance of assistance might be to compute the difference between the air transport catalytic multiplier and the tourism catalytic multiplier in any given region.

infrastructure projects also increases airport tax to a level where it becomes an impediment to international tourism growth. This, in turn would constrain the potential demand effects of the air transport sector to the economy. Finally, the World Tourism Organisation states that there needs to be more promotion towards the creation of sub-regional hubs where geographical position permits it, otherwise small countries will continue to lack that critical mass needed to make costs more manageable and to ultimately lower average airfares.

Aubeeluck (1984) alluded to some more common issues that small countries face. It is important to understand, for example, that Mauritius (his thesis' case-study) is so small that it cannot influence the decisions of other countries. As a result it is very difficult to enforce reciprocity. That is, if Mauritius has to waive or reduce aeronautical charges for foreign air carriers from country A in order to attract more services, and therefore more investment, then it is not guaranteed that Mauritius will have enough negotiating power to ensure reciprocity of aeronautical charges for their national flag carrier which may also want to operate services to and from country A. Aubeeluck (1984) then goes on to say that the problems facing Mauritius are no different from those faced in other island communities and that reliance on tourism in many cases should, from time to time, necessitate an examination of air transport policy along with the demand benefits that can be derived from alternative policy choices. However, as previously discussed, most impact studies completed to date have been confined to developed, highly diversified regions of the world such as Europe and the United States; regions that have large domestic markets and therefore a higher resilience to external shocks, regions with lower trade to GDP ratios thereby reducing the relative importance of external links as the main economic engine of an economy.

Many small islands are locked in a state of inertia with natural monopolies and highly inefficient industries being the unfortunate side effect of the understandable desire to protect locally produced goods and services from the onslaught of fickle global market forces. The air transport sector in the majority of cases is no different, especially in cases where an island's national flag carrier has no operational or strategic alliance with other external carriers, thereby preventing it from attaining the illusive critical mass required to compete on the global stage. These carriers often receive some form of subvention in order to support their inefficient but vital network of routes and services. Public subvention may discourage private investment, however, often leading to a high firm concentration ratio. This can have a negative effect on inward tourism, given that it reduces consumer choice and the number of travel alternatives available, something many substitute destinations in today's globally competitive industry *can* offer.

A Barbadian tourism impact study (CTO 2005) claims that passenger airfares paid to indigenous air carriers are a direct tourism impact. This is supported by the World Travel & Tourism Council (2005) which attempts, periodically, to estimate the global, regional and national economic contribution of the sector. They claim that personal and business air travel expenses clearly form a major part of total tourism demand, and thus regard this expenditure as a direct impact of tourism to an economy. Although it is not the wish of the author to question this claim, it is important to note the potential for double counting of aggregate expenditure in an economy if net airfare revenue is both a direct demand effect for tourism and a direct economic impact of the air transport sector (Civil Aviation Authority 1994)[15].

Aside from issues relating to definitions, a case which typifies some of the remaining impediments to impact enhancement within a small island economy can now be summarised. In Malta, it is widely understood that the airport and the airline are crucial elements of the Maltese tourism industry, which accounts for around 25-30% of GDP. Being an island in the Mediterranean Sea means air transport is the major contributor to this output. According to Aviation Strategy (2003) this knowledge prevents the Maltese government from releasing their state-ownership of flag carrier Air Malta.

Alterra Partners, half owned by Singapore's Changi Airport, lost out to a company called MML in the sale of a 40% stake of Malta's national airport, because the Maltese government insisted that the successful bidder could not also be a part owner of other Mediterranean airports at the same time (Alterra also made a bid for Larnaca and Paphos airports in Cyprus which is seen as a major competitor to the

[15] It can be considered a 'direct' impact of the air transport sector as variations in levels of airline revenue directly affect levels of air carrier output and employment.

Maltese tourism sector). If any bid was made for a stake in the national airline, similar restrictions would be placed on any would-be bidders thereby preventing natural market forces from taking place and potentially stifling the prospective economic development of the industry as a competitive hub in the region. The disproportionately high value placed on airport and airlines given their status as important national assets for island states, therefore leads to protectionist issues which do not exist in larger economies. The irony, however, is that these same national assets which are often prevented from becoming more efficient and competitive may forego the opportunity of attracting further demand, so critical for further stimulating the national economy.

2.1.4. The socio-economic impact of air transport to the Caribbean region

There is currently a lack of air transport specific impact assessments emanating from the Caribbean region itself. It is necessary, however, to mention one recent study which looked at the impact of Air Jamaica to the economy of Jamaica (Clarke et al. 2005). In any net impact assessment it is important to account for the importation of airline services and the repatriation of profits. As most international air services are provided on a third and fourth freedom basis (Doganis 2003), capacity increases available for foreign tourists would inevitably translate into equal capacity increases for local populations wishing to take expenditure out of an economy[16]. This omission constituted one of the main criticisms of the scope of the study. Madjd-Sadjadi (2005) claims that, in the paper, there is no accounting for the fact that passengers travelling on Air Jamaica are often originating from Jamaica. This leads to unrealistic assumptions of the true facilitating role of an airline to a nation's GDP.

The social benefit derived from increased travel opportunities for local populations is not considered either by the study itself or by Madjd-Sadjadi's criticism. In a global study, the International Air Transport Association (2005) state that this perceived increase in quality of life can in fact encourage locals to remain in their home countries and improve their labour productivity as a result of the greater work/life balance afforded by access to international travel. The Madjd-Sadjadi

[16] Since the introduction of seat only sales, charter carriers operating into the region have also had the ability to tap into local markets.

(2005) commentary does allude to the fact that local employment will often rise as a result of increased usership no matter if passengers originate in the host country or not. Although it is difficult to qualitatively account for the first consideration, both are important issues which need to be assessed more thoroughly in a more extensive socio-economic impact assessment.

The previous President of the World Bank, Mr. James Wolfensohn (2005), stated that there is a direct link between air transport and economic growth. He was speaking in relation to a new tourism development route scheme that was commissioned in conjunction with ICAO (2003) and the World Tourism Organisation (2003). The underlying assumption was that efficient air transport infrastructure would assist tourism and encourage foreign investment in trade and exports, an assumption that if true would make the air transport sector a high priority industry for the Caribbean region. The World Tourism Organisation (WTO), in the context of poorly diversified, potentially tourism reliant economies, then proposed seven (7) ways to measure the link between air transport and economic growth:

1. The contribution of the air transport sector/sub-sector to GDP (General indicator)

2. Air transportation's share of average production costs (General indicator)

3. The link between air transport infrastructure investment and economic growth (Economic impact model)

4. Creation of air transport related jobs and the generation of fiscal revenues (Economic impact model)

5. Correlation between efficient access to air transport services and private sector investment decisions to locate or relocate (Business market research)

6. Correlation of the level of air transport activity (number of flights per year per capita) with GDP/per capita (General indicator)

7. Sharpest linkage: The exclusion from the international air transport network, either because of inadequate infrastructure, services or air safety regulation,

resulting in the crippling of tourism, foreign investments, trade and exports (Differential estimation approach).

Source: WTO & ICAO: *Report to the Worldwide Air Transport Conference*, Doc. 9819 (2003).

The seven factors above were seen as a valuable adaptation of the more generic impact assessment models used for larger economies. It takes into account the endogenous factors specific to a region like the Caribbean which is characterised by high transport costs compared to other regions of the world (An Association of Caribbean States report on transport suggested that total cost of imports for the countries of the Greater Caribbean are two to three times the world average[17]).

Girvan (2001) considers air transport in the region to be grossly cost ineffective and inconvenient for the average traveller or freight forwarder. There is no country in the greater Caribbean region[18] that boasts scheduled direct flights to every other country in the same region. In fact there is no example which comes close to that ideal. Barbados, the closest example to that ideal in 2002 had direct links with only 28% of other ACS member countries with Panama coming second at 25%. As *de facto* hubs, there should really be direct services connecting these hubs but as of May 2008 there was only one direct scheduled service between any point in the Eastern Caribbean and Central American sub-regions (A daily COPA flight between Panama City and Port of Spain). Not having an Air Services Agreement (ASA)[19] that promotes economical and convenient intra-regional travel provides another characteristically small island constraint. As sovereign states in the region were bombarded by their large North American neighbour to sign open-skies agreements based, in theory, on the concept of reciprocity, in reality Chapter 11 support of American carriers proved in part that this concept was not deliverable as there was no level playing field for carriers to conduct fair competition.

Reverting back to the sustainable tourism study, point number seven (7) of the World Bank's list of impact measures reflects, quite precisely, the foregone

[17] Within the greater Caribbean region transport costs for imports in Caricom were the highest at 12% whereas in Latin America this figure was 7% with the world average being only 5% (Hoffman 1998).

[18] The greater Caribbean region, in this context, refers to 29 full and associate member states of ACS (The Association of Caribbean States) and includes some Latin American and Dutch Antilles states as well as the standard Caricom states.

[19] ACS has since commissioned, on behalf of its member states, an ASA (2004) which goes hand in hand with the Caricom multilateral ASA which came into effect in 1998. Neither of these, however, takes precedence over any bilateral agreements that precede or succeed the multilaterals.

opportunities in tourism and foreign investment caused by the shortfall of the inadequate infrastructure, the number of services and lack of a truly liberalised air policy framework.

Having the two main hubs of the region lying outside the region, namely Miami (serving 64% of ACS countries in 2002), and San Juan, Puerto Rico (covering 47% of ACS countries in 2002) leads to an increased concentration of wealth, income, education and job opportunities at one geographical pole while the Caribbean hinterlands are left behind in persistent poverty (Girvan 2001). Those who advocate the age of globalisation might question Girvan's statement but the fact of the matter is that we are not there yet. Nobody born in the Caribbean has the automatic right to live, work, vote or study in Puerto Rico or Florida (USA), so national and regional development will remain vital for the provision of home grown opportunities to a given population.

There are within the Caricom region a number of countries which have areas that are by definition 'remote'. Route sensitivity studies conducted by the Scottish Highlands and Islands Commission (2005) as well as air transport as a catalyst for economic development papers carried out by the University of Ulster[20] (2003), are not sufficiently relevant to the Caricom region given the abovementioned variation in socio-economic and spatial development. More specifically, it is important to note that 'remote' in Caribbean terms is defined as a region which participates in very little economic activity. Very often air transport acts as a lifeline for rapid access to basic facilities given the lack of road or rail infrastructure away from coastal regions. Large parts of the interior of Guyana, Suriname and Belize actually consists of Amazonian-type tropical rainforest, for example, that has little potential for short/medium term economic development. Thus, the findings of the above studies need to be considered in a Caricom context given the existence of some thin (but not negligible), non-commercial Origin-Destination (O-D) markets in the region.

According to Aubeeluck (1984), the Caribbean region's air transport sector is even more vulnerable to external shocks than the average small island economy. This

[20] A peripheral region in the UK, for example, according to Graham (2003) can be defined as one sufficiently distant from the South-east to make domestic air travel preferable in journey time and cost to rail or road substitution.

is due to the fact that inward investment in the form of tourism and business is highly dependent on a few source markets; that is the North American market and to a lesser extent the European market. Recent trends provide support for Aubeeluck's theory (Refer to Caribbean Tourism Organisation and Airport E/D card directional flow data in Appendix B).

After the events of September 11, 2001 and Hurricane Katrina in 2005, there were noticeable dips in demand from the elastic segment of the North American market (Air Transport World 2003). These unforeseen fluctuations affecting the air transport sector sent ripples down the demand chain in those islands that were heavily dependent on the North American leisure market. This indicates to any policy maker or private organisation involved in the tourism or air transport sector, that diversification is a necessary measure, not only to enable an economy to better manage unforeseen events, but also to level out some of the seasonal troughs and peaks in Caribbean travel markets. Evidence of this weakness and how it impacts the region's air carriers was observed after the events of September 11th 2001. According to Air Transport World (2003), British West Indian Airways (BWIA), based in Trinidad & Tobago, had just broken into profits when the tragedy in New York occurred. Unexpectedly, by mid-2002, the airline was contemplating losses of US$13 million for the full year. The then CEO, Conrad Aleong, suddenly made the shock announcement that the airline would go into bankruptcy within a month if it could not cut its cost base by US$1 million per month. Latin American carriers also suffered from the sudden downturn in demand from their major markets, but the effects were not nearly as dramatic as those felt by BWIA. This vulnerability can clearly have a volatile effect on the contribution of the industry to direct expenditure and employment.

Another issue specific to the Caribbean region is that of data consistency and availability. For instance, most international air transport organisations and associations which publish yearly statistics on the industry by region lump the Caribbean together with Latin America. A good illustration of this occurred in the year 1998. According to Air Transport Action Group and World Bank indicators, traffic growth for the Latin America/Caribbean region from the US market (the major market for both Latin America and the Caribbean) was very buoyant for 1998 compared to 1997. The aggregated figures show that traffic grew by a healthy 6% over aggregated annual traffic for 1997. However, when the figures are disaggregated an entirely different picture emerges. According to the Office of Travel and Tourism Industries (TIA) based in the US, traffic only grew in the Caribbean market by 1.5% in 1998 over 1997 whereas demand to Central America and South America grew by 19.9% and 8.5% respectively.

This was by no means an isolated occurrence, although it has not always been the case that the Caribbean negatively skews the aggregated traffic growth figures. What it does show, however, is that there is a case for disaggregating statistical analysis for two regions that quite clearly have distinct supply and demand characteristics. Some trade magazines like Airline Business and Aviation Strategy, for example, do not even recognise the Caribbean as part of another region, leaving one to guess whether statistics relating to air transport in the Caribbean have been coupled with those of Latin America or North America. In their recent social and economic impact assessment, the Air Transport Action Group (2008) also categorised Latin America and the Caribbean together giving the reader access only to aggregate employment and output effects.

Montalvo (1998) proposes that, in one's final choice of impact methodology, one must consider two important factors. The first is that of *additionality (new economic activity as a result of the existence of air transport)* which can be partially resolved for the region through passenger surveys which include questions such as, "Would you have still come to this region without having air connections?" It is proposed that a passenger survey will be conducted for the Caricom region containing questions pertaining to a similar theme. The second issue is that of *transferability (displacement to other substitutes in an economy if air transport did not exist)* which will be easier to address for the Caribbean[21] if one aggregates economic activity for the whole region (i.e. value creation through the exportation of products and services; mainly tourism and financial services, to consumers outside the region). However, if

[21] Generally speaking, straightforward displacement of employment, expenditure and output if the air transport sector did not exist would be negligible in the Caricom region, as in the vast majority of cases air transport acts as the main facilitator for ensuring connectivity with the global community. Workers employed would generally find other work but those that are involved in the provision of tourism, including workers in the air transport sector, are normally enjoy above average wage levels and it would be difficult for such workers to find higher wages in other sectors not connected to tourism.

one wants to disaggregate economic activity trends then this would prove to be more difficult as products and services for exports are generally homogenous.

This leads to increased competition between states for foreign demand. Thus, growth of economic activity in one island could have effectively been transferred from another competing location. Established CGE and I-O models, in reporting industry outputs on an absolute macro scale (Gross Domestic Product and employment) also fail to take the cost of a possible transfer of factor inputs into account. Forsyth (2006) suggests that one way around this would be to add a simple net benefit or welfare module to a CGE model which accounts for the value of net output less the cost of additional or transferred resources used in producing that output.

Using an alternative synthetic approach, *transferability* estimates for aggregate growth or decline in air transport related output would be easier to estimate than disaggregated data as Caricom is an example of an integrated community which is introducing (slowly) freedom of labour and movement. That is, the disagregation problem could be mitigated by gathering data using a sample of incoming visitors on vacation, visiting friends and relatives or on business, on whether they would consider substituting destinations within the same region or if they would take their investment to other regions if there was no suitable way of getting to a particular member state by air. Resource transfer costs (i.e. labour) to an individual member state and to the region as a whole can then be estimated based on survey outputs which would consequently be scaled against the actual number of aggregate and disaggregate employees per million passengers (all travellers) in each member state. Montalvo (1998) states, however, that to estimate *additionality* would logically provide more reliable results than an estimation of *transferability*, even if sophisticated forecasting and predictive tools are used to model what is, in reality, a completely hypothetical scenario. This view is found to be consistent with that of the FAA (1986), which also questioned the viability of the Differential Estimation Approach (DEA).

According to ICAO (2005), in 1998 approximately 30% of all air transport related jobs and up to 38.1% of all output was attributable to aerospace and other manufacturing industries along with their affiliates. It is important to note therefore that, given there is no notable presence of such industries in the Caricom region, it is impossible for the value chain effects of the supply of air transport services to be as extensive as it would be in some other regions. Also, given the largest airport in the region has a yearly passenger throughput of little more than three million passengers (Montego Bay in 2006), and land space is limited for many island states, it is often impractical for any notable business and retail investment to take place in and around immediate airport hinterland areas.

2.2. EFFECT OF THE REGULATORY FRAMEWORK ON IMPACT LEVELS

2.2.1. Introduction

Once aggregated socio-economic impact has been estimated, it is in the interest of any user of an impact study to find ways of strengthening that impact in a sustainable way. If it is found that air transport plays a significant role in a regional economy, then it can be considered beneficial to find ways of potentially increasing incoming traffic transported by air, in order to enhance the net direct, indirect, induced and catalytic effects talked about in the previous section.

Air policy, like any other form of trade policy, can have an important influence on a nation's level of consumer welfare, producer profit and factor employment/payments. That is, the 'status quo' of an air service agreement facilitates the current number of passengers travelling by carrier and route between the country-pair in question, which in itself is related to current fare levels, service quality, productivity, and the number of frequencies/seats supplied (capacity). Thus, these endogenous factors are said to have macro-scale implications on consumer welfare, producer profit, employment and expenditure. When an air policy reform takes place, the associated micro and macro level benefits and costs to a nation can be measured and their distributions identified (Hickling Lewis Brod 1997). An identical procedure can be undertaken on a regional level by pooling a sample of bilateral agreements that would provide enough indication of the current 'rules of the game'. The policy implication of change in this context would be that the intra-regional trade of air transport services can be seen as internal or domestic and therefore would neither be considered a net gain nor a net loss to the regional economy.

An impact assessment can, of course, be used for a number of other important purposes. It typically forms the basis of high level infrastructure investment decisions which invariably need a more precise method by which to measure benefits and costs to a national or regional economy. A more extensive version of the Caricom impact assessment might well provide the basis for a region wide investment appraisal involving the air transport sector. A detailed discussion of existing air policy evaluation literature now follows.

2.2.2. Air transport liberalisation – general theory

2.2.2.1. The case for government intervention

Fear of market failure can be considered to be the main cause of the application of economic regulation in the air transport industry (Goodovich 1998). For example, if a market is showing every sign of being a natural monopoly, most governments would prefer to exercise some control over that monopoly either by involving itself in the running of the airline or by enforcing some pricing control so that there can be no abuse of market power.

If markets were perfectly contestable (i.e. no entry or exit barriers), the case for government intervention, even on monopolistic markets, weakens somewhat as the threat of entry would always ensure that the sole operator on a route would earn normal profits. However, factors such as poor slot availability, high terminal lease costs and predatory pricing behaviour by incumbent carriers often preclude any real world examples of perfect contestability, thereby supporting the case for intervention.

More specifically, the main economic reasons cited for intervention on international markets for air transport have been summarised as follows (Brenner et al. 1985):

- The protectionist measures in other sovereign states prohibit the desired unilateral relaxation of the home country's international regulatory framework.
- Concentration of service on high yield, dense traffic routes, with the consequent deterioration of service on others.
- Destructive and predatory pricing competition, resulting in a reduction in earnings and ultimately, increased industry concentration.

- Reduction in airline employment as a result of the predicted drive for increased productivity and cost efficiency.
- Foreign airline profits at the expense of national carrier profits and increased foreign involvement in the national air transport industry.
- Airlines would be ill-equipped to finance new, expensive technological advances that make international air transport more economical, environmentally friendly and safe.

These factors represent some of the underlying principles upon which the majority of unilateral international air transport policies are based; the terms of most traditional and Bermuda type bilateral air service agreements (ASAs) still reflect this unwillingness, on the part of the negotiating states concerned, to let the market determine who flies, where to fly, with what capacity, with what frequency and at what cost. It should be noted, however, that the apparent bureaucracy attached to the provision of international air services in the period 1944 to 1978 can be viewed, in hindsight, as a marginal but controllable hindrance to traffic levels that simply paled into insignificance when compared to more notable effect that GDP growth and technological advances had during the same period (Morrison et al. 1995).

As the novelty and the infancy of the industry wore off and air transport became more accessible to wider sections of society, the effect of economic regulation became more pronounced. Passengers became more discerning and cost and convenience were to become the new priorities as technology related traffic growth inevitably levelled off. Supply and price controls of international air transport as enforced by bilateral agreements, and their effect on demand and resultant traffic levels, thus became a subject of rigorous debate.

2.2.2.2. United States moves towards deregulation

Bhagwati (1987) argued that governments often lack the information needed for intelligent intervention. An in depth understanding of airline costs/revenues and the dynamics of the industry were clearly necessary in order for controlled and/or protected state airlines to avoid the pitfalls associated with inefficient production.

Practically speaking, there was a growing argument in the United States during the 1960s that greater pricing freedom and product differentiation along with the removal of restrictions on capacity and subsequent entry of new carriers would lead to a more competitive environment. This freer environment would provide considerable benefits for the consumer with lower fares, price discrimination and product differentiation. Moreover, it was argued that lower fares would push airlines into re-examining their costs and would force them to improve their efficiency and increase their productivity (Doganis 2003). Low airfares were deemed to be sustainable even if a market consolidated due to the fact that many believed the contestability of the market would keep airlines fearful enough to seek only normal profits. Any cross-subsidy or monopolistic behaviour would attract carriers until normal profits were resumed. Incumbent carriers would no longer need to be protected as other carriers could enter and ensure continuity of service in a deregulated environment.

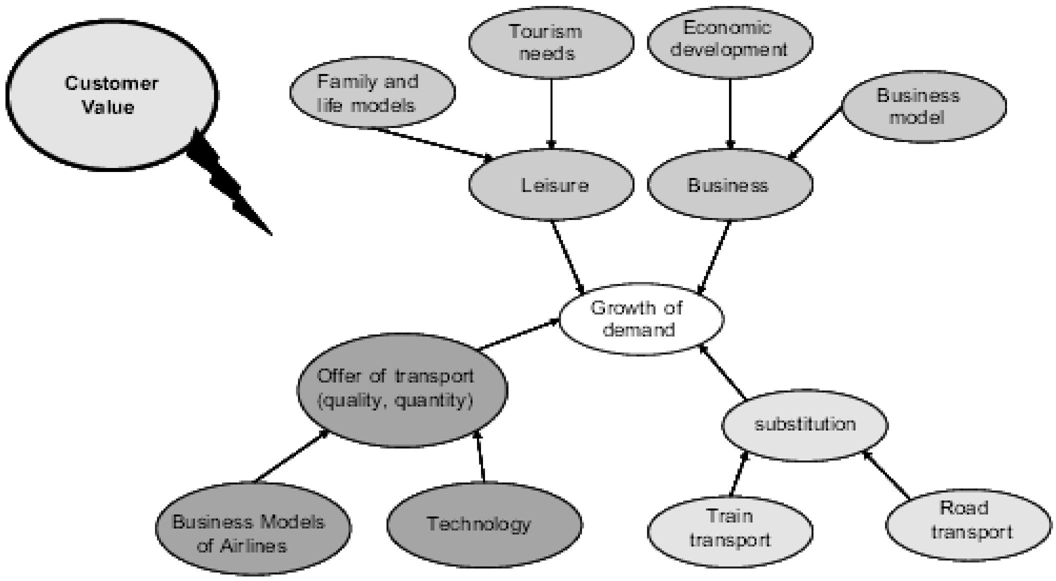
Although there were many assumptions underlying the main arguments in support of liberalisation, evidence since US domestic deregulation, which set off a spate of policy restructuring in other areas of the world, has been mostly positive (Hooper 1998 with reference to Button 1989, Kaplan 1995 and Morrison et al. 1995). Even in thin markets, communities seemed to be better off when airlines were free to compete (Duldig and Findlay 1990), even if this did not result in actual route competition.

2.2.3. The relationship between air policy liberalisation and traffic levels

2.2.3.1. The role of exogenous factors

Doganis (2003) proposes the following: “provided, of course, there are no other barriers to market entry, if there is a maximum exchange of traffic rights, which means open market access combined with little or no control over tariffs or frequencies offered, then a market can be considered to be very competitive”. By ‘other barriers’ he was clearly referring to non-liberalisation barriers that exist both internally and externally to the industry.

It is well known that (see Bieger et al. 2007), *inter alia*, demand for air travel is a function of economic development, social development (family and life models), business models, quality/quantity of air transport service, airline business models, changes in technology, availability of substitutes, external shocks and subsequently, customer value and preferences. Although not all of the above variables are mutually exclusive there is a clear distinction between demand and supply side variables as shown by Figure 2.4 below. Customer value and perceptions are used more often to explain demand on a micro-level which when combined relate to the macro forces guiding variations in aggregate demand.



Source: Bieger et al. (2007)

Fig. 2.4 Customer value and passenger air transport demand

It is therefore important to set out at an early stage that air policy often does not have a directly traceably relationship with the demand for air transport but instead acts as a facilitator or a distorter of the core relationships present in a demand function like the one described above. Goodovich (1998) states that it is very difficult to isolate just one out of the many variables that could effect traffic growth, such as income, political stability and lower fares. Of these three important independent variables only fares can possibly be directly explained away by a move towards liberalisation, in this case the removal of imposed entry barriers or pricing controls.

2.2.3.2. Supporting claims for high influence of air policy levers

Several inferences have been made, however, about the impact of a change in air policy on levels of market concentration, airfares, service quality, airline profits, costs and efficiency, and consumer welfare, which in turn have a net effect on traffic levels. Some of the previous efforts to try and evaluate these effects are now summarised below.

Gillen et al. (2002) cite four types of market setting relating to pricing: 1. Where all carriers have to use IATA set fares; 2. When one carrier from each country forms a duopoly route, the bilateral agreement may require that the two carriers agree on a uniform price; 3. A single disapproval policy that allows for one of the two governments to disapprove a carrier's fare proposal; and 4. A double disapproval regime, where the governments have to agree to disapprove a fare. Under the final regime carriers effectively have the right to freely compete on price.

Bilateral air treaties normally limit the number of carriers that can operate between two participating countries. This is often limited to the national carrier of each country and is frequently accompanied by rules about which points can be served. The carriage of beyond and intermediate 5th freedom traffic is also forbidden unless the reciprocal 'status quo' can be sustained in the provision of such rights. Gillen et al. (2002) states, "Clearly, the removal or relaxation of the carrier/route designation clause is likely to induce competitive entry by new carriers as well as encourage entry onto new routes and/or airports by the existing carriers". Thus the potential competitive implications of retaining such exit/entry controls can be damaging to potential traffic levels on a country-pair, particularly if airlines have the ability to freely control airfares.

Morrison et al. (1995) contend that, when measuring the effect of air policy liberalisation on market concentration levels, it is misleading just to do a simple count of competitors operating under the new, deregulated framework. A simple count assigns equal importance to a small carrier and a giant. To circumvent this problem, the inverse of the Herfindahl index can be used. When the index is not inverted a result of zero would indicate that a large number of small firms compete with each other and a result of one would indicate a monopoly. This calculation is then inverted to arrive at the number of effective competitors at the national or route level. Like the Herfindahl index itself, the absolute number of competitors is moderated to take account relative market share leading to the term 'effective competitors' with the only difference being that as the level of competition increases the index value also increases whereas the opposite is the case for the Herfindahl index.

Morrison et al. (1995) also note that, as airlines compete head to head only at the route level, having fewer effective competitors at the national level does not necessarily mean that an industry is less competitive. This hypothesis was proven to be true in their analysis of the effect of US deregulation from 1978-1993. The number of effective competitors at the national level actually fell from 9 to 8 in that time period whereas, after averaging for all routes it was shown that the number of effective competitors at the route level rose from 1.8 to 2.6.

Assuming that there are minimal slot restrictions or congestion problems at major airports, deregulation can bring about an increased freedom and flexibility for carriers to reorganise their networks and increase frequencies to and from hub and regional airports. The ability to online with the same airline through a well organised hub onto international destinations can be very attractive to passengers given a high enough frequency and convenient connection times. Evidence suggests that passengers prefer online to interline connections (Carlton et al. 1980) and the simultaneous relaxation of international and domestic/regional ASAs can lead to service coordination and subsequently an improvement in service quality. Conversely, the pricing freedom that can be afforded by a liberal bilateral has led to the practise of discounted pricing, and for those passengers who purchase discounted tickets, there is usually a set of travel restrictions placed on the ticket which can be seen as a service inconvenience. These restrictions include cancellation and change of date penalties, maximum and minimum stays and advanced purchase requirements. Also, in an airline's quest for efficiency, there has been more pressure to increase load factors, which may help to reduce price levels, but again can be considered a service inconvenience for travellers in terms of on-board passenger comfort levels (Morrison et al. 1995).

The findings of Fare et al. (2007) confirmed anecdotal accounts that there has been a decline in the US airline service quality since deregulation. The measures used for service quality included on-time performance and number of indirect routeings. This evidence may well hold for dense and congested air transport markets like those found in the US, but in markets where such negative externalities resulting from a higher level of competition are yet to surface, there is clearly going to be less validity to these findings.

It has been claimed that, indirectly, the competitive air transport environment which can be triggered by a liberalised framework, may induce carriers to consider forming alliances with other carriers as a fast track to gaining greater economies of scale and scope (European Commission 1997). By aligning with other airlines, a group of smaller carriers may then be able to compete more sustainably with the larger more established carriers leading to a higher number of effective competitors at the route level (even if it comes at the expense of fewer competitors at the national level). However, it could also lead to collusion on capacity and/or price with the other incumbent carriers on a route, producing a reduction in levels of competition and consumer welfare.

Morrison et al. (1999) consider that airline profits have been cyclical both in regulated and non-regulated air transport environments, and that aggregate normal profits have rarely been exceeded in the post-deregulation period in the US. The experiences in other parts of the world have shown similar cyclical tendencies often independent of air policy. Franke (2007) summarises why air policy has not been more of an influence on airline profitability: “Despite ongoing liberalisation, the regulatory framework still does not enforce far-reaching consolidation, leaving the industry in a fragmented status with massive overcapacities”. In fact, according to Chang (2002), bilateral ownership and control clauses actually have the opposite effect as often, when consolidation would seem the natural step, it is not permitted by the lion’s share of international ASAs. Perhaps if the deregulated air transport environment reflected that of other globalised industries (Doganis 2003), air reform could facilitate further producer welfare as has been witnessed for the consumer (see Figure 2.5).

The consistently poor air carrier performance shown in both the regulated and now the deregulated airline environment inspired Alder (2001) to create a theoretical game theory which concluded that network equilibrium can be found for competing airlines involved in Hub and spoke networks, and profitability can be maximised for all parties. These findings hold for natural monopolies when the demand function produces thin markets and for duopoly routes on denser markets. The model assumes that an airline is entirely free to choose its most preferred network and purchase the rights to land and take-off as required.

Marin (1998), in a study about the productivity of European flag carriers, discovered that those operating under more liberal frameworks during the 1980's were more productive than their European counterparts operating in a short-term protection environment, before the introduction of the EU common market for air transport. The resultant competition on US-Netherlands, -UK, -Belgium, -Ireland and -Germany routes triggered a spate of adjustment processes to improve long term competitiveness, often at the expense of short term efficiency. This sacrifice, however, ensured greater efficiency and economic performance for the fully-liberalised EU single market, whereas those flag carriers which continued to operate under protected frameworks consequently had to drastically improve efficiency in a more hostile air transport environment. Total Factor Productivity (TFP) along with Input-Output analysis was tested within a stochastic production function. Given that domestic and international regulatory agreements limit the freedom of companies to decide the set of routes that they want to supply, his findings on the effects of liberalisation can be regarded as exogenous while the productivity inputs endogenous. This enabled the author to compare the productivity effect of these policy factors for both open-skies and non-open skies country-pairs involving 10 European and 9 US carriers during the 1980's.

Gillen et al. (2002) contend that multiple policy levers need to be liberalised to produce the greatest net welfare; that is, pricing and capacity controls should be relaxed simultaneously. If pricing is restricted but frequency relaxed, carriers benefit in terms of excess profits. In contrast to the observed profit trends outlined in Morrison et al. (1995), it is also found that removing restrictions on entry actually increases industry profit, although there will be some winners and losers. This is especially the case where entry does not stop a market from remaining oligopolistic. However, this paper is limited in that it only tests the effects of one bilateral agreement in isolation. In actual fact air carriers operate a network of services that are subject to multiple bilateral and multilateral agreements.

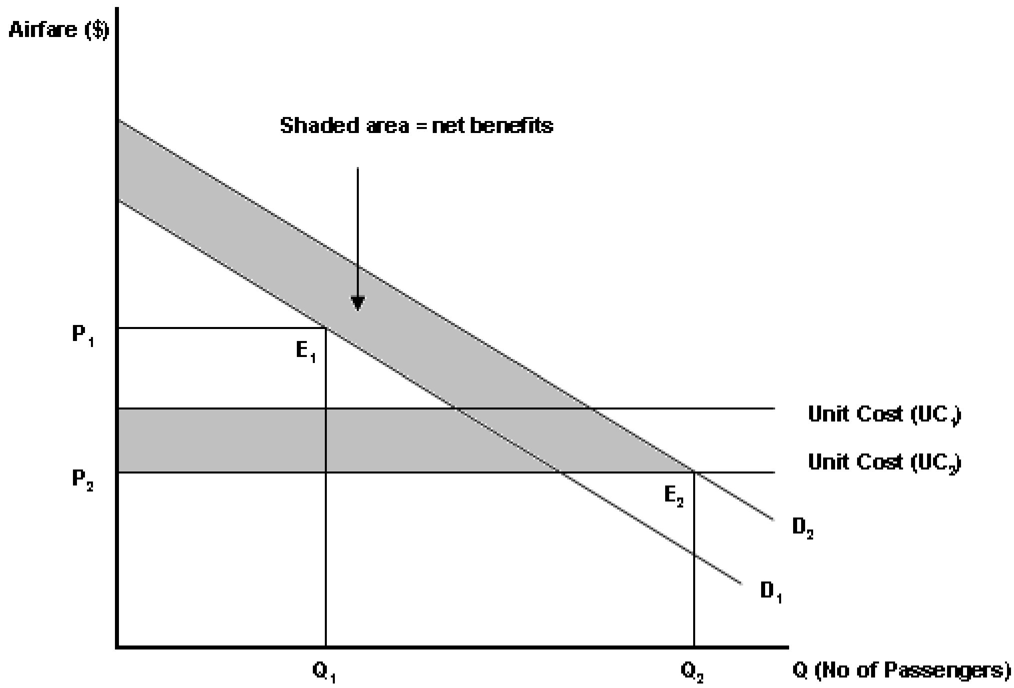
Finally, the effect of changes to air policy levers on traffic levels can be estimated either implicitly or directly; implicitly through the assumption that a relaxation of capacity or pricing controls can have an impact on airfares, productivity, and competition which in themselves are used as independent variables in the creation of a demand function (see Alder and Hashai 2005), or directly through the assumption that in a more regulated environment traffic levels would purely be dependent upon other economic drivers (which are summarised into one indicator, GDP) and thus would have yielded more modest results had deregulation not taken place (InterVistas 2006). When there is evidence of similar impacts taking place in regulated environments it is more difficult to be certain of the effects of deregulation (Forsyth 1998, p85). Perhaps it is reasonable to suggest that those assessments based purely on historical trends would generally produce more convincing inferences than those which use historical evidence from other markets as a basis by which to make traffic flow predictions in non-liberalised markets. However, just as there is a degree of uncertainty attached to making traffic predictions under hypothetical liberalisation scenarios, there is also a degree of ambiguity involved in markets which have already deregulated and wish to regress historical traffic flow data under hypothetical regulation conditions. The latter method was employed in the InterVistas report (2006).

Nevertheless, in the short-term at least, the relationship between ASA changes and traffic conditions can be very unambiguous. In Zhang and Chen (2003), as a direct result of the April 1999 signing of the open-skies agreement between China and the USA, it is said that the number of scheduled flights doubled, growing from 27 to 54 per week for each country's carriers with 8 being introduced immediately, 9 in April 2000 and a further 10 in April 2001. Open designation of carriers, access points and permission to conduct extensive codesharing, clearly allowed for palpable gains in total air traffic between the two countries during the corresponding scheduled periods. The dynamic, longer term effects of these changes may be convoluted, however, thereby increasing the need for a more rigorous assessment.

2.2.4. Selected impact methodology offered by the literature

A comprehensive assessment of the benefits and costs of bilateral reform and their distribution between producers and consumers are identified by Hickling Lewis Brod (1997). This is principally undertaken using a combination of traditional neo-classical welfare and trade theory analysis in relation to changes to bilateral frameworks between Canada and Japan, Germany, and Australia. This unique combination means that gains (losses) stemming from changes to demand can be disaggregated by nationality as well as by traveller type, carrier and route.

The other advantage of the demand model is that it factors in price and non-price variables (service quality, number of carriers) as well as direct and indirect cost variables as and when liberalisation takes place. In effect, the grey area as shown in Figure 2.5, resulting from a relaxation of pricing and/or capacity controls, is both quantified and disaggregated by simulating it for a number of real world examples involving Canadian bilaterals. This welfare model can undoubtedly be applied to any arbitrary country-pair.



Source: Hickling Lewis Brod (1997)

Fig. 2.5 Welfare analysis for a change in basecase air policy

The operationalisation of the model depends on access to quite extensive data for constructing a basecase. The required current market condition data includes information pertaining to the number of airlines serving the market, size of aircraft, passenger volumes by carrier, fares by carrier, frequency by carrier, travel time by carrier and a carrier preference factor, as well as block time costs, aircraft purchase prices and demand elasticities. The reform impacts are then entered into the model by directly adjusting the basecase according to changes in fares, changes in frequency and entry of new airlines (Hickling Lewis Brod 1997, p28).

Looking more specifically at the consequences of reform on passenger traffic (or freight traffic) levels, InterVistas (2006) offers two distinct estimation techniques which can be used either independently or concurrently. It is important to note that gains to the producer are not quantified by either method and the macroeconomic consequences of liberalisation scenarios are estimated externally to the model, with the predicted or actual change in total traffic providing the basis by which to estimate macroeconomic changes to employment levels and GDP. This research strategy reflects the assumption that benefits to the consumer and the increased tourism and business activity resulting from higher aggregate traffic outweighs any possible short term losses to the producer and that in the long term producers will benefit from denser markets and higher load factors.

2.2.4.1. Before/after deregulation trend analysis (time-series)

The principle benefit of the case-analysis method relates to the depth of insight that can be acquired on the relationship between trends in air traffic and the implementation of liberalisation measures. Moreover, any convoluting non-liberalisation factors can be more easily determined in such an analysis yielding more realistic but homogenous estimates. The case-history methodology has been used more frequently as a useful preliminary analysis tool with the proviso that there is access to detailed traffic data over time and socioeconomic data for the country-pair(s) in question. For example, Drenser and Oum (1998) were interested in comparing the degree to which Canadian and US bilaterals were liberalised with respect to the number of visitors to Canada choosing direct as opposed to indirect flights via the US. This more detailed model was preceded by a more general presentation of traffic trends coupled with dates when the respective bilateral ASAs became more liberal. *Inter-alia* this method has also been used to varying degrees of detail in studies by Goodovich (1998), Hooper (1998), and Zhang et al. (2003). Any unexpected traffic variations not relating to artificial restrictions are usually clarified descriptively using this particular methodology.

InterVistas (2006) put forward a number of possible limitations for this estimation technique: 1. Traffic will grow despite artificial restrictions due to economic growth; 2. Airline industry traffic trends are notoriously volatile; 3. Traffic levels for one country-pair may actually be affected by adjustments to the regulatory framework of another. Unless multiple county-pairs are considered simultaneously, traffic diversion effects that could have nothing to do with the sampled bilateral will not be accounted for; 4. It is difficult to identify a before and after period for liberalisation as impacts sometimes need years to "work themselves out"[22]; 5. Once a country has liberalised it is difficult to predict market outcomes if regulation would have continued.

2.2.4.2. A cross-sectional statistical model

This approach can be said to be generic in that it should include an analysis of many country-pair markets at any one point in time. The model expresses air traffic between any particular country-pair as being dependent on a vector of geographic, socioeconomic and regulatory variables, and proposes that if bilateral/air traffic correlations produce negative coefficients along with T-statistics that reject the null hypothesis at the 95% confidence level, then artificial constraints imposed by a country-pair bilateral agreement can restrict traffic for any large, medium or small markets[23].

The InterVistas (2006) study initially considered a wide range of exogenous variables and every one proved to be significant for some data points given the large sample size (1,400). However, the final list of extraneous variables was reduced to five as many did not justify the additional complexity or multicollinearity concerns. Interestingly, a tourism demand variable was rejected even though for some tourism dependent destination markets traffic was quite significantly skewed from what would be commensurate with that country's GDP. This variable would clearly produce more statistically significant relationships with traffic levels within a more limited sample of tourist destination countries, all of which heavily dependent upon the economic conditions of the host country.

[22] In Gillen et al (1999) it is suggested that a move from a restrictive to a moderate ASA is more palpable in terms of traffic effects than a move from a moderate to a facilitating agreement (which is described as "incremental gains").

[23] As long as the country-pair market has proven that it can sustain at least a trice weekly service with a load factor of 70% or above.

Quality of service variables were rejected on the basis that they are so interrelated to traffic levels that they would overwhelm the influence of other extraneous factors. Price was precluded due to the lack of data availability covering all data points.

Limitations of this type of model include: 1. the many clauses of a bilateral ASA which cannot be expressed numerically, 2. ASA variables are likely to be similar in their reliance on economic variables. This can lead to multicollinearity, as a decoupling of traffic away from GDP could have been caused by a relaxation to price controls, capacity controls or a combination[24].

2.2.4.3. Causal and multiple regression models

Neither of the previous methodologies can quantify the impact of a removal of entry and/or tariff barriers over a given historical time period whilst holding changes to other possible influences on air traffic constant. As it is the major focus of this research to forecast the macroeconomic performance of air reform on Caricom markets that are still restrictive, it is important to firstly consider any previous time-series models with air traffic as the dependent variable that have been proven statistically significant, with low residual values and a reliable set of explanatory variables.

Generally, if liberalisation has already taken place, a dummy variable is not required, as a selection of supply and demand variables said to explain traffic levels before air reform occurs can be regressed and used to forecast counterfactual volumes in the no reform scenario. These forecasts are then compared with actual traffic levels recorded during the liberalised period to calculate additional traffic which can be related to air reform. The Brattle group (2002) used this particular methodology to estimate additional traffic on US-EU markets that had already partially liberalised between the years 1995 and 2002. This prediction method is normally referred to by economists as an "out of sample" technique. The weakness of this technique, however, lies in the notion that residual values can only be partially explained by changes in air policy.

[24] The model in this case would be trying to obtain more information than the sample can provide. The interrelationships that exist between the partial bilateral variables make it difficult to allocate the incremental impact of each change to air traffic volumes.

In 2007, the Booz Allen Hamilton report did introduce an open-skies dummy variable that took the value 0 before US-EU air reform took place and the value 1 in the 5 years following liberalisation. This allowed for the testing of its impact on traffic growth as well as its statistical significance. The dummy variable growth coefficient, computed for EU countries signing open-skies agreements with the US in 1995, were added on top of Airbus' and Boeing's traffic predictions, which used other exogenous factors to arrive at a revised growth estimation explicitly capturing liberalisation induced variation.

Although additional traffic attributable to liberalisation was substantial in the findings of the Brattle Report (2002), the potential for similar output gains on restricted markets was not quantified as it was in the subsequent report undertaken in 2007. This explains why, in the second report, it was necessary to include air policy change as an independent variable in the model; so as to specify a feasible value that could be used as an input into the calibrated forecasts.

$$\Delta \text{ Traffic} = \alpha + \beta_1 \Delta \text{ US\_GDP} + \beta_2 \Delta \text{ Home\_GDP} + \beta_3 \text{ Open\_Skies} + u, \tag{2.1}$$

where Δ Traffic is the percentage change in transatlantic traffic, Δ US_GDP is the percentage change in US GDP, Δ Home_GDP is the percentage change of the combined GDP's of the countries in the relevant group, Open_Skies is the dummy variable and 'u' is the error term. This can be compared to:

$$\begin{aligned} \log(volume) = \alpha &+ \beta_1 routeFE + \beta_2 qtrFE + \beta_3 Age(a) * NewRoute \\ &+ \beta_4 Age(b) * NewRoute + \beta_5 Age(c) * NewRoute + \beta_4 log(Yd) + \\ &\beta_5 log(cstindex) + \beta_6 log(GDP_{foreign}) + \beta_7 log(RXR_{foreign}) + \varepsilon, \end{aligned} \tag{2.2}$$

where log(*volume*) is the natural log of the quarterly passenger volume on a given EU-US city-pair route, *routeFE* are dummy variables for each route, *qtrFE* are dummy variables for each quarter (except the fourth quarter), *Age(a)* is the age of the route if the route is less than three quarters old; otherwise it equals two, *Age (b)* is zero if the route is less than three quarters old; minus two if the route is less than five quarters old; otherwise, it equals two, *Age(c)* is zero if the route is less that five quarters old; otherwise, it equals the age of the route minus four, *NewRoute* is a dummy variable set equal to one if the route was not in existence during the first quarter of available data, *log(Yd)* is the natural log of real US disposable income, *log(cstindex)* is the natural log of the fuel and labour portions of the real airline constructed cost index (US dollars), $log(GDP_{foreign})$ is the log of real GDP for the EU country relevant to the city-pair converted to US dollars using the exchange rate, $log(RXR_{foreign})$ is the "real exchange rate" using relevant US and EU PPIs, and ε is the random error term.

As can be observed by comparing the two regression forms, the original Brattle Report (2002) specified a more comprehensive set of explanatory variables. It is worth mentioning here that the Brattle report model also returned a higher R^2 coefficient than the simplified model used in the Booz Allen study (0.96 as against 0.84 and 0.79 respectively). The stated priority for the 2007 model was to explain as much of the traffic variation with the least amount of explanatory variables. Given airfare was excluded from the model, the remaining variables of GDP and open-skies still achieved reasonably positive R^2 values providing evidence that air travel demand and GDP generally tend to move in similar directions in response to external shocks, and that both are indicators of the general wellbeing of an economy.

As macroeconomic performance of air reform was the major objective of both studies, together the equations have avoided the explicit use of city-pair data and intentionally based estimations purely on aggregate country-pair data. However, the Brattle Report did cover route effects (not actual data) using a set of coded dummy variables which allowed the model to account for route age effects on city-pair demand without actually having to create any separate specifications. The removal of entry and/or tariff barriers can also be coded in a similar way. According to Gillen et al. (1999) there are three possible liberalisation classifications; restrictive, moderate and facilitating. Previous studies have almost unanimously applied liberalisation as a dummy variable with only two possible outcomes, but this may under or overestimate the level of change resulting from an air reform. Thus, it may be useful to introduce a second independent dummy variable in order to account for the more sophisticated classifications. For example, if designation was completely relaxed in a market, according to Gillen's classification this sudden step change could result in air policy moving from a restrictive agreement straight to a facilitating one. Based on case-history knowledge of air carrier response to the policy change, this scenario could see the independent variable liberalisation take the more intuitive value of ‘2’. Endo (2007) also found it difficult to forecast the impact of open-skies liberalisation using dichotomous values due to competing interpretations of the degree of Japanese market ‘openness’ under the preceding traditional ASA.

Further, a couple of assumptions were made in the Booz Allen report that may have increased the inherent uncertainty of their forecasts. First, the statistically tested liberalisation coefficient for countries that agreed open-skies deals with the US in 1995, was assumed to be the same for markets that continue to be restricted like the US-UK or the US-Greece agreement, for instance. This assumption fails to recognise that there may have been incremental liberalisation measures which took place on the officially “restricted” markets, or that perhaps the restricted market group experienced other pressures on demand that may not have been captured by the model used for the 1995 open-skies group. As no coefficients were determined for the restricted group of country-pairs, forecasted traffic estimates for the period until 2010 were borrowed from Airbus and Boeing, and the 1995 group estimate was simply added on top to arrive at the final 5 year forecasts if restricted markets were to introduce open-skies. This leads to added uncertainly as Airbus’ and Boeing’s models, which were used to produce their long term forecasts may have already encompassed changes in air policy. If a parallel regression model was produced for the restricted group, however, the resulting coefficients could be used to produce an all encompassing forecast along with more clarity inherent in the methodology used to arrive at those estimates.

Marin (1995) also constructed a regression model with the dependent variable as the natural logarithm of air passengers, but on this occasion it was used within a more complex set of equations that also looked to test the relationship between air reform and firm behaviour with respect to airfares and market shares. The influence of multilateral air reform was tested by regressing a set of identical supply and demand variables for country-pairs that had ratified the first EU liberalisation package in 1993 as against those who had not. For the two data sets, variations between independent variable coefficients and passenger numbers, airfares and market structure were interpreted descriptively and it was concluded that while liberalisation tended to lead to growth in entry and competition, first mover and cost advantages for incumbent carriers typically had a moderating effect on the competitive impact of the first liberalisation package. Marin's traffic volume model took the following logarithmic form:

$$\text{Log}(Pax)_{kt} = \alpha_0 + \alpha 1 log(Averg.LF/KM)_{kt} + \alpha_2 log(Averg.AG)_{kt} + \alpha_3 log(Pop)_{kt} + \alpha_4 (Den)_{kt} + \alpha_5 log(Dist)_{kt} + V1_{ikt}, \quad (2.3)$$

where for city-pair traffic volume *k* and time *t*; *Averg.LF/KM* equals the average fare per kilometre, *Averg.AG* equals advertising goodwill (as a proxy for perceived quality), *Pop* equals population (catchment area), *Den* equals traffic density measured by total O-D movements at both end points of a route, *Dist* equals the flight path distance between airports and *V1* is the random error.

Doganis (2003) contends that models on routes where holiday traffic is dominant may include hotel prices, currency exchange rates or some other variable that is especially relevant to tourism flows, which may be used as independent variables. Also, in order to take into account directional influences on demand, it is often recommended that two separate model specifications are computed based on point of origin. In that way adjustments for inflation do not have to be weighted. The Civil Aviation Authority (1989)[25] also segmented total demand by purpose of visit, type of route and place of residence, devising a separate causal model for each group in order to reflect the intricate influences on demand more realistically. For instance, leisure traffic growth by UK residents on north Atlantic routes (*UK-NA LS*) was explained using the following model:

$$\Delta \log UK\text{-}NA\ LS = \mathrm{K} + \Delta \log CE + \Delta \log TC + \Delta \log AF, \quad (2.4)$$

where the independent variables were change in UK consumer expenditure ($\Delta \log CE$), change in tourist ground costs ($\Delta \log TC$) and change in airfares ($\Delta \log AF$) when K is a constant. A separate set of values was then inputted into a similar model for US leisure travellers. The results from both models can then be combined in order to forecast total leisure demand.

In agreement with Marin (1995), Manuela (2007) used an econometric model using a system of equations to better reflect the notion that the supply and demand of

[25] As cited in Doganis (2003).

air transport simultaneously determines the value of airfare, passenger numbers and frequency regardless of whether a market is liberalised or regulated. Although the relationship between air reform and airfare in the Philippines domestic market provided the focus for this study, it was purported that other endogenous air transport variables would have high correlations with airfare and thus were deserving of the inclusion of their own independent variables to achieve a higher overall coefficient of determination (R^2) and f-statistic for the supply and demand of air transport. The passenger model took the following form:

$$\begin{aligned} \text{InPSGR}(xy) &= \beta_0 + \beta_1\text{InFARE}(xy) + \beta_2\text{InFREQ}(xy) + \beta_3\text{InPOPN}(xy) \\ &\quad + \beta_4\text{InCPCY}(xy) + \beta_5\text{InDIST}(xy) + \beta_6\text{ALTM}(xy) + \beta_7\text{LIBR} + \varepsilon(1.xy), \end{aligned} \tag{2.5}$$

where for each route x and each year y; PSGR is the number of enplaned passengers, FARE is the average fare per kilometre in pesos, FREQ is the number of two way flights, POPN is the mean provincial populations of the end-point airports, CPCY is the average number of passenger seats per two way flight, ALTM is the average fare per kilometre of land or sea transport, LIBR is a dummy variable taking the value of ‘0’ between 1981 and 1994 and ‘1’ between 1995 and 2003 and ε is the error term.

The other point to note about the work of Manuela (2007) is that liberalisation was included as a dummy variable as were the topical external shocks of Asian recession (1998) and the September 11th terrorist attacks (2001). Analysis of independent variable coefficients show that the external events could have had had a mitigating effect on the downward pressure on airfares induced by liberalisation.

As far as a proposed sample of Caricom states is concerned, a number of unique independent variables, namely tourism ground costs and trade in services along with directional traffic flow weightings, should be tested on Caricom-North America/UK markets in line with the generalised characteristics of Small Island Developing States (SIDS). The more traditional explanatory variables should then be applied on Intra-Caricom markets that are not so dependent on incoming tourists and service sector contributions to national GDP.

A summary of this study’s extensive literature search (Table 2.2) contains a dissemination of previous air policy studies in order to obtain a convenient snapshot of methodologies used, markets and time-periods covered as well as their major findings/contributions. The literature search focused primarily on studies where traffic volumes were the variable of interest. As discussed above, a secondary interest, however, was also taken in studies that looked at the effects of deregulation on airfares, alliances and quality of service due to the fact that there are important theoretical interrelationships between these secondary factors and air traffic levels.

Table 2.2
A selection of key studies estimating a number of liberalisation effects

Author(s) (Year of publication	**Data period**	**Case-study markets**	**Main methodology**	**Variable(s) of interest**	**Main finding(s)**
Clougherty, Dresner & Oum (2001)	1982-1994	33 Canada bilaterals	Single and joint equation LSDV with dual desig. and liberalisation inputted as separate dummy variables	Traffic volumes	Dual desig. and liberalised markets produced greater total and Canadian carrier traffic volumes.
Gillen, Harris & Oum (1999)	1993	North Pacific (Canada-Japan bilateral + effect on third countries e.g. USA and South Korea)	Net welfare (trade theory and economic cost-benefit) of Canada-Japan bilateral reform	Consumer, Producer and 3rd party effect on inter-carrier and inter-routes scenarios	Aggregate gains greater with price competition and entry. Main gain to consumer plus entry gains to most efficient carriers only.
Morrison & Winston (1995)	1978/9-1994	US Domestic	Descriptive time-series indicators	Competition, fares, service quality, profits, safety	Fare reduction due to dereg. Greater price discrim. Freq. and no. of connect increased. Profits low.
Brattle Report (2002)	1990-2000	US-EU	Out of sample regression analysis and fixed individual route effects	Traffic volumes (without open-skies OS)	Of sample of 7 OS county-pairs traffic would have been 8 million pax. lower without lib.
Booz Allen Hamilton (2007)	1995-2005	US-EU (split into three groups; 1995, new OS entrants and non OS)	Log-log regression with open-skies as a dummy variable	Traffic volumes (and its macro effect)	An extra 26 million pax. possible for non-open-skies group between 2006 and 2011.
Endo (2007)	1990-1999	US-Japan	Gravity export	Traffic	High Japan import

			import model adjusted to natural log-linear regression with OS as dummy variable	volumes (carrier export penetration)	ratio under traditional bilateral agreement does not support intro of US-Japan OS.
Melville (1998)	1980-1992	US- UK-Trinidad & Tobago (with emphasis on local carrier BWIA)	Air policy reform effect captured as dummy variable combined with HHI index in log-linear regression model with route level and time fixed effects	Average yield	Pricing power and actual/potential competition varied across routes depending on regulatory regime. Restrict = collusion, Open = pricing/capacity comp & pot. entry
Marin (1995)	1982-1989	Intra EU markets (two groups, price collusion/regulate markets, price comp/dereg. markets)	Theoretical firm behaviour combined with gravity model components into log-log regression	Demand, market shares and price	Moderate price reductions and increases in comp. on deregulated markets subject to incidence of other airport/carrier pref. barriers.
Anderson, Gong & Lakshmanan (2005)	1995, 2000	US domestic	Linear and linear-in-logarithm OLS. Competition and concentration as proxy for liberalisation.	Airfare	Concentration was not outcome of US dereg. But could be on other markets.
Button, Costa & Cruz (2007)	1970-2005	Global discussion	Theoretical: Value chain and empty core problems means liberalisation has not led to stable carriers and AT markets	Airline profitability	Lack of fully competitive markets (anti-trust), high fixed costs, unbalanced AT value-chain has led to losses.
InterVistas (2006)	2005	Global (1400 data points)	Cross-sectional regression model (OLS double-log)	Traffic volumes	Air policy obstacles constrain traffic growth in both large and small markets.

2.2.5. Deregulation for whom?

More generally, the effects of deregulation can be scrutinised from the perspective of the airlines, the public and the nation at large (Morrison et al. 1995). Studies looking into airline costs and efficiency are generally more prudent in their support for liberalisation than those purely looking at effects from the consumer's perspective.

This is supported by Forsyth (2001) when he says that the balance between the needs of different stakeholders is changing in a number of countries, with the move towards open-skies bilateral agreements reflecting a greater weight being placed on consumer interests.

Hickling Lewis Brod (1997) suggest in their analysis that “the central objective of air policy and any modifications to it should be to add to net national welfare, which is composed of the aggregate of gains (losses) to both consumers and producers”. In a regional study conducted by Mandel and Schnell (2001) there are said to be four (4) potential winners (losers) of an open-sky bilateral policy for Germany. They are the airlines, the airports, the region and the customer. Interestingly, potential gains and losses were found for all four players but they concluded that the big winners would be hub airports (except Frankfurt), with a catchment area laden with demand that previously had to be diverted as a result of restrictions to named access points in accordance with the terms of the previously more restrictive bilateral agreements.

One of the more striking results of the Hickling Lewis Brod study (1997) was that, regardless of the resultant market setting of a restrictive or a moderate air service agreement, carrier entry plays a key role in the generation of net aggregate benefits. This benefit was split into two parts; first, greater consumer choice with the marginal value of a seat on a new entrant being greater than the same seat on an incumbent carrier from either country. Second, assuming low returns to scale, entrant carriers are to be as efficient if not more efficient than incumbent carriers, providing a form of competitive discipline in the market. Incumbent carriers would then be forced to improve cost efficiency in order to survive.

The other major finding suggested that aggregate welfare gains were more pronounced when the following two conditions held: first, when an ASA moved from a restrictive to a moderate agreement as opposed to a move from a moderate to a liberal one and second, when price controls were relaxed and frequency regulation held constant as opposed to the scenario of price regulation and frequency competition. This finding would hold if it is assumed that the majority of travellers are price sensitive leisure travellers, who would not react to a change in frequency unless discounted fares could be introduced to fill the extra seats. The extra capacity would have a large impact on airline costs implying a 'lose-lose' situation for both consumer and producer.

The most productive scenario according to the study's results was when an ASA was moved from a restrictive to a moderate market setting; that is, when carriers are allowed to set prices freely, entry is permitted but frequency continues to be regulated. The downside to the largest 'total' welfare gain was that consumers were found to benefit greatly but only the lower cost producers were likely to make net profits meaning that some high cost carriers were at risk of bankruptcy in this scenario (Hickling Lewis Brod 1997).

Focussing further on airfares, when transport users are disaggregated into sub-markets, it becomes apparent that deregulation has not only led to an increase in discounted fares, but has also led to an increase in business fares, showing that in a competitive environment the need to keep fares down whilst keeping yield above marginal cost has led to a heavy use of price discrimination along with yield management techniques to try and claw back a segment of consumer surplus (Button and Nijkamp 2003 with reference to Morrison et al. 1995).

Button et al. (2007) claims, however, that deregulation has been the cause of unstable air transport markets with evidence of producer gains not being as apparent as those seen for the consumer. Unbalanced air transport value chains and the high fixed costs associated with providing scheduled services has forced air carriers in liberalised markets to extract as much revenue as possible by accepting passengers down to the level of short-run marginal costs, although they concede that part of this problem can be mitigated by a more sustainable airline structure made up of merged or aligned carriers operating in air transport markets with more flexible approaches to ownership, control and alliances.

2.2.6. Liberalisation and the competitive environment

Clearly there is evidence of a strong relationship between the competitiveness of markets and the extent to which those markets have been liberalised. According to Inglada et al. (2006), moves in Asia towards the liberalisation of air transport markets led to a more competitive network of services between the year 1996 and 2000, which in turn brought about large efficiency gains for Asian carriers. Although air policy in the far-east continued to be fragmented, they were specifically interested in measuring the possible gains that arose from the authorisation of 'second level carrier' entry.

This was a reform feature that put almost immediate pressure on incumbents like Cathay Pacific (Hong Kong), SIA (Singapore), Korean Air (Korean Republic) and JAL (Japan), to improve efficiency. The paper also appears to agree with the work of Hickling Lewis Brod (1997) who suggested that a move from a restrictive to a moderate air policy framework would reap greater benefits than smaller incremental moves from a moderately liberal framework to a liberal one. Given that major deregulation efforts took place in the late 1970's in the US and in the early 1990s in Europe, the more recent moves towards liberalisation in Asia are offered as an explanation as to why Asian carriers proved to be more efficient than carriers in Europe and the US between 1999 and 2000.

Manuela (2007), in a study of the impact of liberalisation on airfares in the Philippine airline industry, contends that the introduction of discounted and promotional fares was due to increased levels of competition, which in turn was a result of a 1995 domestic relaxation of price and capacity restrictions. The findings of a Newey-West covariance model, using data consisting of 10 routes with varying market characteristics between the years 1981-2003, indicate that airfare per kilometre was 10% lower, on average, on routes with at least two airlines after liberalisation. Twenty-three routes, representing more than 90% of domestic airline passengers, had at least two airlines by 2003, indicating that most passengers benefited from lower fares since the introduction of domestic liberalisation in 1995. It is interesting to note that, as liberalisation efforts frequently deliver competitive results on a micro-economic level, the distinction between policy reform and its economic consequences is sometimes unclear in the literature. This can perhaps leads to an overestimation of the impact of policy reform on aggregate levels of competition.

Subsequently, it is important to consider those possible restrictions to air transport competition which are not directly related to air policy. First, Morrison et al. (1999) offer three important impediments clearly not related to a market's regulatory framework; 1. The existing dominant route networks and route frequencies of airlines operating out of hub airports; 2. Frequent flier programmes rewarding passengers for past patronage; and 3. Computer Reservation Systems (CRS's) whose airline owners have the distinct advantage of ensuring that travel agents etc. offer travellers their products first. Second, the findings of Inglada et al. (2006) allude to the presence of flexible labour markets and superior CRS's as possible exogenous variables that could have influenced net economic and technical efficiency differentials between Asian and US/European carriers over the period 1996-2000, as opposed to the new levels of competition noted on those markets.

Valdes and Avalos (2007) identified a positive relationship between entry relaxation and levels of competition after deregulation in the Mexican domestic market although this effect was observed to be dampened by a lack of an authoritative and coherent competition policy.

Lijesen et al. (2002) found a high incidence of competition variability dependent upon the measurement indicator used. A correlation matrix for a sample of 31 arbitrary market events showed that the only indicators which yielded similar results were those that included not only number of carriers and their respective market shares, but also an evaluation of imperfect substitutes in the markets (i.e. competing indirect or connecting flights provided by carriers through their own hubs). The weighted and total HHI indices produced the most consistent correlations and intuitive results. If the HHI index is then inversed, however, the results become even more intuitive, giving way to the expected positive correlations with traffic levels (Morrison et al. 1995).

Mergers also obscure the true competitive effects related to air policy liberalisation. On markets where two airlines compete indirectly, for example, a merger between the same two carriers would have a negative impact on levels of aggregate city-pair competition; a more flexible approach to airline ownership and a more relaxed approach to market entry could thus have had the effect of reducing direct and indirect competition. Further, if the measure used only accounts for direct traffic, this reduction in levels of total competition would not be reflected in the results leading to an overestimation of the positive competitive response to a change in air policy (Lijesen et al. 2002). On the other hand, mergers can also lead to underestimations of air policy impact. They can permit entry into markets that were previously dominated by a large incumbent carrier. Cost synergies and economies of scale operation may permit entry in an open market and create healthy competition between secure and established carriers. The reverse would hold in a closed network precluding the demand side benefits of direct/indirect competition (Gillen and Morrison 2005).

Imperfect competition can therefore moderate the impact of a policy move towards free entry, frequency, capacity and pricing. Yet it can also produce time-lags where the competitive effects of liberalisation take time to catch up with capacity effects or when both capacity and competition is suppressed by the uncontained actions of incumbent carriers, which can take advantage of their dominant positions to prevent entry from occurring in the absence of any competitive policing. Despite the possibility of time-lags, previous studies have failed to point out or approximate the role of air policy in provoking often significant carrier reactions in the market. If an incumbent carrier increased capacity and reduced airfares as a result of entry relaxation, then the air policy change clearly has to be credited with this despite the benefit not being reflected by the competition indicators. Moreover, in a free market, an incumbent can typically only prevent entry for a limited period after which new carrier entry causes competition levels to catch up with the new market 'status quo'. The resulting capacity increases, technical and efficiency gains and airfare reductions again have to be related back to the air policy change that triggered it.

2.2.7. The globalisation of air policy: evidence of benefits

Willams, F (2000) reports, "The situation today is that even though some relaxation has taken place in a few countries, international air transport, particularly scheduled passenger services, remain heavily regulated and subject to some 3500 bilateral agreements". This is supported by Yergin et al. (2000) in Hubner and Suave (2001) who adds, "such a system of bilaterals did little to impede the growth of international air transport in the early years, but as technology has evolved, and global markets have developed, the limitations of bilateral air service agreements have become apparent". It is true that technology has evolved, but it is also evident that this rate of change has slowed in recent years and any major traffic gains as a result of this change could not be repeated. Consequently the spotlight changed and as Yergin et al.

(2000) contend, the artificial weaknesses of a dated global regulatory framework became prominent.

Basic neo-classical trade theory supporting this claim is used as a basic assumption in the work of Hickling Lewis Brod (1997), Dresner et al. (1998), Gillen et al. (1999), and more recently, Hubner et al. (2001) who state; “by focusing on the reciprocity of opportunity, bilateral agreements have held back the potential gains available from comparative advantages present within the aviation industry”.

During the 1960’s and 70’s and then again in the 1990’s many bilaterals were partially liberalised in an effort to try and improve the so called ‘soft rights’ on many international markets. These efforts can be summarised in Table 2.3 below:

Table 2.3
Development of international bilateral agreements

Features	Restrictive	Bermuda 1	Liberal	Open-skies
3rd & 4th Freedoms	Limited rights	Limited rights	Open route access	Open route access
5th Freedom	Few rights	Several rights	Some rights	Open route access
Carrier designation	Single	Single/Double	Multiple	Multiple
Capacity	50:50 split Revenue pool	Post-facto review	No limits	No limits
Pricing	Based on cost + profit Double approval IATA tariffs	Based on cost + profit Double approval IATA tariffs	Double disapproval	No restrictions
Access Points	To be named	To be named	Improved access	All points
7th & 8th Freedoms	No provision	No provision	No provision	No provision
Foreign ownership/control	No provision	No provision	No provision	No provision

Source: Adapted from Williams, G (2005)

Following Table 2.3 from left to right it is apparent how some of the more important features of bilateral agreements have generally been progressively relaxed with open-skies and liberal type agreements slowly replacing older more restrictive Bermuda I and traditional type accords. If the general picture is disaggregated, however, it becomes clear that industry air policy, at the global level, is still very fragmented with many country-pair ASAs being at various stages of development.

Table 2.3 also shows that all country-pairs have been consistent in their restrictive approach towards 7th and 8th freedom rights, as well as foreign ownership and effective control rights, showing visibly that the bilateral regime has fallen short of the full liberalisation which has characterised other globalised industries.

One approach to air policy standardisation has been to expand the open-skies concept to include more members within the same agreement (multilateral agreements). This could and has (in Europe, for instance) resulted in more competition within specific blocs. Yet barriers could rise for competitors from outside the agreement and could thus run the risk of excluding them from competing with carriers from inside the bloc (Hubner et al. 2001). So long as membership of an agreement expands, however, to include an increasing number of important air transport markets and given the terms of the new agreement take precedence over any old bilateral agreements, the closer an air transport market would be, in theory, to the suggested neo-classical trade equilibrium. Moreover, as common interests are pooled further, co-operation could result in new ASA features which were not provided for within the preceding bilateral ASAs. In the EU, the community air carrier principle and the granting of cabotage rights has clearly gone a step further than any other 'liberal' bilateral to date (see Table 2.3). Therefore, it is important to bear in mind the global evolution of air transport deregulation as the context in which the evaluation of specific markets and time-periods should take place.

2.2.8. ASA reform and small density air transport markets

It is important to mention the early work of Stephenson and Beier (1980) at this point. Although it is based on US domestic routes serving small towns and communities the methodology they used to try and isolate the effect of deregulation from other confounding factors[26] that can lead to a change in service levels to small communities is worthy of further analysis. First, they mention that it is important to define properly what is meant by small, and classify accordingly the effects of deregulation not only by population size but also by profiling each community. This is

[26] For example, they mention fuel costs as a supply side cost variable that would likely affect the continuity of an air service to a small community.

performed to explain away any unexpected results through the inclusion of extenuating socio-economic factors specific to each community. Second, it is interesting to see which air transport variables they included for before/after testing. They focused their efforts on the relationships between deregulation and entry and exit of carriers, capacity (number of seats on city-pair markets), the ratio of direct to indirect services, market concentration (number of carriers[27]) and rate of increase to fares.

A key finding of the study was that on an international scale, it may well be the case that two country-pair partners are either too small and/or too unconnected to warrant any profitable air service even under the most liberal air policy frameworks.

2.2.9. A discussion of current Caribbean constraints and their traffic effects

The constraints and issues common to small island economies in general and in particular to the majority of the member states in the Caricom region can be condensed into the following three factors; 1. Unstable and lob sided balance of payments; 2. Dependence upon one or two sectors for exporting; 3. Vulnerability to external economic forces (Aubeeluck 1984).

In so far as these constraints are inextricably linked to modest GDP growth and income levels, with foreign visitors to the region held constant, future traffic growth would be linear at best. The opportunity for exponential growth would therefore be dependent upon the macroeconomic performance of the dominant source markets and the availability of suitable substitutes for the few services and products that are exported from the region's member states. Changes in traffic levels to and from the region could therefore take place independently of air policy reform.

However, given the Caribbean's main exporting product is and will continue to be tourism for the foreseeable future, the presence of many substitutes for the region's main source markets only serves to make it even more imperative to remove any artificial impediments to the free movement of passengers arriving into and departing from the region. Any marginal changes to discounted airfares, service quality and connectivity as a result of a change in air policy can therefore have an elastic effect on

[27] Please note that the HHI was not considered in this study.

demand into the region. As one of the only remaining controllable stimuli on trafficlevels, ensuring that the regulatory framework for the industry acts as a tourism facilitator should remain a priority for Caricom governments.

A World Bank study (2006) offers three factors which are commonly cited in the region in order to constrain further liberalisation measures; 1. Airlines do not generally make a profit, even in the developed world; 2. Many inter-island services are unviable and would not be served in an open, competitive market situation, and; 3. The national social and economic benefits outweigh continued financial airline losses. These three arguments are also used to support the governments' role in using taxpayers' money to continually underwrite the region's air carrier losses. It is logical to assume that, in the context of blanket subsidies, it would be difficult for governments to take a more liberal stance towards the importing of air services. The two issues, therefore, clearly go hand in hand for those regional governments that have a stake in the region's carriers (e.g. ownership and financial support of LIAT is still in the hands of the Barbadian, Antiguan and St. Vincentian governments even after LIAT merged with private competitor Caribbean Star in May 2007).

The World Bank refutes the three concerns shown above, however, arguing that services should be provided on a competitive basis, and on those routes that do not attract services, a competitive and well structured tendering process should be issued with a view to maintaining a predetermined level of service. This hypothesis, which concedes that a certain level of subsidy would be required, may need to be tested for the region given evidence that even in very thin markets commercial operators have provided some level of basic service using the examples of Air Caraibes serving the Martinique–Dominica route and Winair operating a commercial service from St. Maarten to Martinique (World Bank study 2006).

Air Jamaica recently announced that it was finally pulling out of Heathrow (LHR) and in doing so managed to secure a thrice weekly codeshare service with Virgin Atlantic (VS) from Gatwick (Kirby 2007a). This may show that a flexible air policy with regard to the exchange of codesharing rights with foreign carriers can rule out a loss of service, which is frequently cited as the primary reason to continue supporting loss making services by regional carriers. Furthermore, in a recent study of the benefit of Air Jamaica to the Jamaican economy, the methodology employed failed to allow for the possibility that without a local airline another airline may well provide the same level of service but without the same financial burden on the taxpayer. This especially would hold if new competitive services are factored in as a result of a more liberal policy towards entry, capacity, pricing, and intermediate and beyond rights (World Bank study 2006 with reference to Clarke 2005). Regrettably, a more academic approach to these issues is lacking and further evidence to either support or refute further liberalisation and/or to put an end to blanket subsidies is overdue.

2.2.10. Caribbean liberalisation

It follows, in accordance with the three arguments presented above by the region's political bodies, that national carriers should single-handedly provide the continuity of service necessary to maintain a proper scheduled network along with all available capacity between the islands, and that the entry of foreign carriers could result in a fatal loss of traffic for these local airlines. Guided purely by yields and profit margins, foreign carriers would cherry-pick the profitable routes, depriving regional carriers of the revenues that make their networks viable. They would then leave a market without a second thought for the social implications on the region's local communities so heavily reliant on the provision of air transport services for their business, health, education, vacation and freight needs. The weakness of this argument, however, is that the region's member states are more likely to overlook the region's potentially profitable routes which attracted foreign carrier services in the first place and forms part of the reason why these states have tended to take a reactive approach in the development of the most appropriate, all-embracing policy framework for the facilitation of intra and extra-regional mobility (Girvan 2002).

Another issue is that small nations invariably have little negotiating power during bilateral talks with their larger trading partners. Many Caribbean states in their negotiations, for example, cannot offer reciprocity in terms of access to many gateways or large home markets. A reciprocal relaxation of the named points clause would tend to be more a more attractive proposition, practically speaking, for a Caribbean island than it would be for large Country A. Given this principle any local or regional carriers may not be granted such reciprocity by the government of Country A. Aubeeluck (1984), however, provides the following case: Singapore did give Air

Mauritius traffic rights but it was unable to combine a Singapore service with other far east destinations in order to attain the required traffic density to make a service viable. Singapore Airlines already had traffic rights to South Africa and wanted to gain further 5th freedom rights to Mauritius with a view to commencing a service. Yet the Mauritian government denied access, presumably because it believed that there was no way the Mauritian flag carrier could gain reciprocity. Even so, this decision, according to Aubeeluck (1984) was misinformed, given the fact that even if a route cannot be operated by the flag carrier, a foreign carrier would still bring in extra traffic from a new market, in addition to obtaining revenue in the form of landing fees, commercial fees and the sale of fuel/catering. The concept of reciprocity should perhaps be considered in the wider context of overall welfare to an economy, which in itself can clearly be better evaluated within the framework of an autogenous, holistic socio-economic impact assessment.

It is also useful to discuss the effects of air transport on Small Island Developing States (SIDS) and tourism. With emergent trends reflecting multilateral liberalisation in the air transport industry, it is becoming more market-driven, and therefore it would not be unrealistic to expect that the air carriers of the future would operate air services to tourism-based countries on the dictates of unpredictable and rapidly changing market forces, rather than on sustained public service considerations. Given the advent of mass tourism in the 1960s and 1970s, this trend portends for SIDS a situation whereby their governments would have to weigh the desirability of allowing unlimited access by foreign carriers against the need to protect their own national carriers. Inextricably linked to this consideration would be the need for SIDS to determine the economic benefits that they would derive by opening their airports to a liberalised air transport policy.

Abeyratne (1999) states that it should be tempting to conclude that SIDS would benefit from an open-skies or a vastly liberalised air transport policy in order to attract as many tourists as they could. Some SIDS in the Caribbean, however, that cater for tourists with a high spending power would be mindful of the fact that a higher ‘quantity’ of visitors resulting from cheaper fares and more competitive markets may in fact reduce overall spending power as the effective ‘quality’ of visitor decreases. Limiting entry of Low Cost Carriers (LCC’s), for example, and ensuring a price cap on airfares, could assist a small island in maintaining its competitive advantage in the exclusive market (Bieger and Wittmer 2006). It is suggested that, as governments are able to influence air traffic and tourism through the use of external regulatory levers, a clear airline and air access strategy is set out with the aim of maximising total visitor spending through an optimal mix of high and low end visitors (Bieger et al. 2006).

One of the most compelling needs for Caribbean SIDS to develop the tourism sector through air transport is the need to streamline air services to the main tourist generating markets in North America. This could be done by enhancing *non-stop* air services between the two which should then be supplemented through “island-hops” by commuter aircraft feeding the region’s ‘hub’ airports. This could also be an attractive proposition for the region’s ailing airlines that may experience significant density and network economies if onlining and interlining capability was further developed to and from the region’s larger airports (e.g. BGI, POS, MBJ, and ANU). Hubbing is also a major way to increase the number of effective competitors, as stronger carriers taking advantage of lower unit costs actually attracts further entry, increasing the associated consumer benefits. As a result, demand increases to levels where entry can be sustained (Gillen et al. 2005). This theory could be harnessed further through the relaxation of regulation in the region. On a larger scale, Gillen et al. (2005) support this theory by finding that, “under regulation it was not easy to achieve the demand side benefits associated with networks because of regulatory barriers to entry”, when referring to the reluctance of US carriers to choose hub and spoke systems before deregulation took place in 1978.

Gillen’s assessment, along with the majority of others, however, is both situation-specific and retrospective. A clear step change in US air policy in 1978 provided a perfect opportunity not only to take stock of changes in market conditions, as clear before/after linkages could be made, but also the necessary data and information quality to back this research up was available. Small island regions, and more specifically the Caribbean region, have not been able to benefit from these two important requirements for a conclusive case-history analysis. The fragmented policy environment, the inconsistencies in data availability and the muddiness of socio-demographic development between the member states has hitherto resulted in a dearth of situation-specific research into small markets with such constraints. It is possible, however, to fill in this research cavity by constructing a statistically significant air traffic model for those country-pair markets within the region that have experienced partial liberalisation, with a view to rendering more reliable and applicable traffic predictions for country-pairs in the region currently subject to a more restrictive air policy. This calls for a review of how liberalisation has previously been calibrated in previous modelling and forecasting efforts, and how the use of discrete dummy variables or out of sample error term methodology is not relevant enough for application into fragmented and diverse small island markets.

Button et al. (2007) state that low-cost carriers (LCCs) are now emerging throughout the world as institutional barriers on market entry and pricing have been relaxed. In some cases, however, the link between the relaxation of market entry/pricing controls and the emergence of LCCs has been blurred by the fact that some bilateral ASA's are not up to date and thus do not provide a true reflection of the actual regulatory framework in operation. Two LCCs, for example, have entered into the US-Bahamas market under the official Bermuda I type air service agreement (ASA). This bilateral ASA stipulates that a single disapproval pricing regime is still in effect, as are limitations to permitted access points for foreign carriers wishing to commence services to the Bahamas or vice versa. If these terms were still practised today on the US–Bahamas market, it is unlikely that both Spirit Airlines and jetBlue would have entered into competition on the South Florida-Nassau and New York-Nassau markets. It is critical therefore to obtain both official ASA and extra-bilateral data in order to give a true impression of an air policy's effective 'status quo'.

The problem of measuring the degree of liberalisation of a traditional bilateral agreement is also supported by Endo (2007), who suggested that despite Japan having, officially, a more traditional regulatory framework, it had showed relative market openness during its air traffic right negotiations with the US. It is this type of policy fuzziness which needs to be evaluated in more depth.

In 1998 the Caricom Multilateral Air Services Agreement (CMASA) was ratified by nine of the fourteen Caricom member states. Although it is still in its early stages of development towards being a truly liberal alternative (which would need to include some of the more important member states, notably Jamaica and the Bahamas), it is worthy of further assessment for those country-pairs where it *has* entered into force. Caribbean Airlines, for instance, recently proposed to start a new triangular service between Trinidad, Guyana and Barbados, effectively giving Guyanese travellers the option of avoiding Port of Spain and thereby allowing business travellers to complete their business activities in Barbados within one day (Kirby 2007b). The proposed service quality improvement would have inevitably been more difficult to solicit for Caribbean Airlines had it not been able to gain traffic rights to carry Guyanese passengers to Barbados. The CMASA framework, as well as avoiding an extra level of bilateral bureaucracy, would also provide for a more competitive market condition given that any Guyanese start-ups wishing to enter this market would do so within the multilateral guidelines provided by the CMASA.

One proviso, however, which has been underlined by many authors (e.g. InterVistas 2006, Morrison et al. 1995) is that overestimations of benefit can lead policy makers into more problems than if benefit was underestimated. Thus, it is important to be prudent in the use of model assumptions. This especially holds for models which have to base computations on a number of predictions. As an illustration, Morrison et al. (1995), in trying to estimate the difference between airfares in a deregulated (actual data) and cost-based fares in a regulated (invented data) environment, predicted productivity gains in the deregulated environment were underestimated so that a prudent yearly improvement to unit costs became an input into an estimate of what airfares carriers would have charged in a regulated environment (given reduced productivity).

Finally, it is important to make conservative estimations if there are other deep seated structural barriers (e.g. airport slot issues, blanket airline subsidy) or temporal extraneous factors (e.g. an economic recession) preventing immediate liberalisation impact. Manuela (2007), in his analysis of domestic liberalisation in the Philippines, introduced a number of dummy variables into his causal model, for example, in order to account for both the Asian recession in the late 1990s and the terrorist attacks of September 2001.

2.2.11. Some views on liberalisation from Caribbean jurisdictions

From a policy perspective, it is important to summarise some of the current views relating to the subject of air policy liberalisation in the Caricom region. The dearth of rigorous economic evidence of consumer and/ or producer gains from liberalisation has created a vacuum in which the vociferous debate currently taking place in region about the most appropriate intra and extra-regional framework occurs. The views of local regulatory bodies, the Caricom Secretariat and local air carrier executives are of primary interest here.

A summary of the main arguments and their proponents are given as follows:

A. Caricom Secretariat

Continued government involvement in the provision of local services is necessary

- Invaluable local carriers have sustained losses continuously and therefore should not be exposed to full market forces.
- Local carriers have made greater losses as privatised organisations than under government ownership.
- Governments were forced to continue subsidising local carriers under private ownership.
- Foreign carriers would pull out of vital local routes at a moments notice.

Preferential and exceptional air policy agreements should be negotiated

- Local carriers with no comparative advantage must produce services at costs greater than revenue.
- Poor and unstable carrier performance after US and EU deregulation.

B. Jamaican Ministry of Transport

Must ensure the continued and sustained participation of its national carrier(s)

- Fair and not free competition preventing the marginalisation of Air Jamaica.
- Local, regional and international air transport as a strategic sector of the Jamaican economy must be provided consistently at all times.

C. St. Lucian Ministry of Tourism and International Transport (since 2007)

Local carrier route selection based on politics and not commercial interest

- LIAT is obliged to give preferential treatment in terms of service to its main subsidising states.
- American Airlines services were subsidised by the St. Lucian government while Air Jamaica services were not, creating an uneven playing field.

Heavily subsidised local carriers are not providing even a minimum level of service

- There has been limited structural change at the merged LIAT and little evidence of improvements in regional airfares and service levels.

D. Caribbean Tourism Organisation, World Bank and Caribbean Hotels Association

Diversification of air service providers results in increased and more reliable airlift at negligible cost to regional governments

- Carrier subsidy and financial struggles have a negative impact on the quality and reliability of regional services.
- Financial losses can be seen within the context of guaranteed provision of air services but evidence from Aruba, Chile, the Dominican Republic and Mauritius demonstrates the guaranteed provision of air service in more liberal air policy markets.

Open-skies across Cariforum[28] countries

- Domiciled airlines will no longer be route constrained as it would allow for the designation of "community of interest" principle.

E. Guyana Ministry of Transport and Works

- A revised Caricom MASA required.
- Some member states should not offer preferential agreements with 3rd countries on a bilateral basis.
- Foreign carriers like American Airlines taking advantage of disjointed regional policy, enjoying spiked airfares to many regional gateways.
- Extra-regional travel should continue to be provided by both regional and foreign carriers to provide checks and balances in pricing policies.

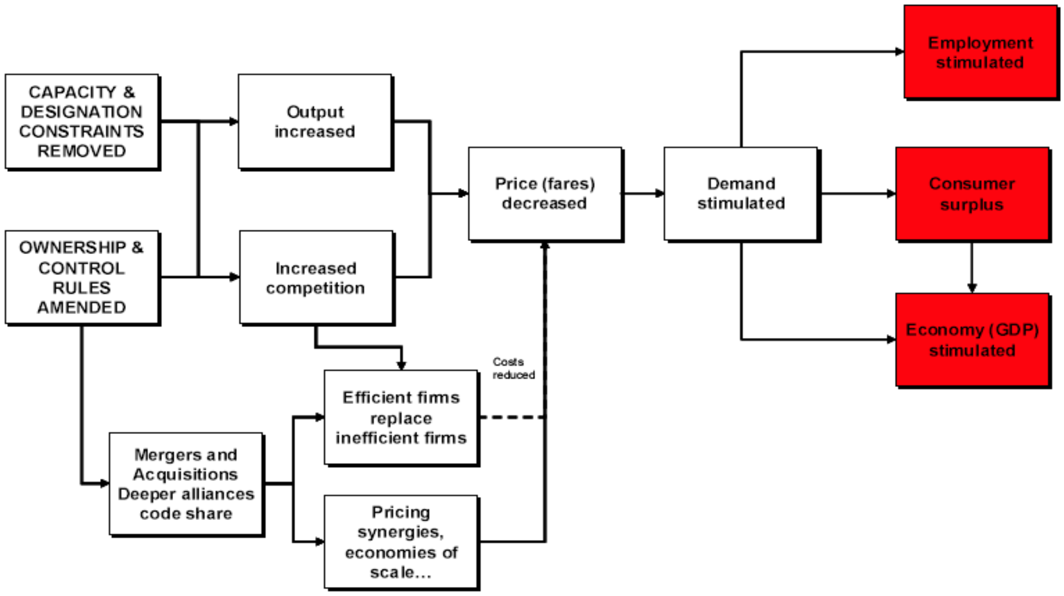
[28] Note that Cariforum includes the non-Caricom countries of the Dominican Republic and Cuba.

F. Policy recommendations from a recent Guyana transport sector study (GOPA and E&A 2005).

- Open-skies (liberalisation) would lead to increased competition and increased capacity.
- Wider pool of service providers needed, however.
- Ensuring key routes are served through tendering contracts for continuity of service.
- Encourage private sector participation.
- Increased visitor expenditure would increase capital for investment in air transport or other sectors.
- Important to limit arguments for continued national burdens (subsidy).

2.2.12. True macroeconomic performance estimated through changes in output

Figure 2.6 provides a useful linear view of how a change in air policy can improve a nation's macroeconomic performance. It is important to note that demand is not entirely stimulated by fare decreases as is suggested by the radial diagram. Improvements to quality of service, including frequency and stated carrier preferences, can also stimulate demand and tariff controls are not considered at all by the model shown below. A removal of tariff barriers can induce price reductions or increases independent of changes in output. In this scenario changes in output would follow price adjustments in accordance with the market's response (i.e. price elasticity of demand). Empirical evidence therefore suggests that the relationships that exist between air policy and supply, price and demand is not always a linear one and can often only be determined by non-linear models or extensive case-history evaluations.



Source: Booz Allen Hamilton (2007)

Fig 2.6 Elements of economic analysis of an Open Aviation Area (OAA)

Also, the above diagram fails to take the directional flow of traffic into account. Basic trade theory states that a proportion of the benefits of aggregate demand stimulation would leak into other economies as a result of the import of travel services. However, with the possible exception of Jamaica, the Bahamas and Trinidad & Tobago, it can be safely assumed that any aggregate traffic growth on a given country-pair market involving a Caricom country and a non-Caricom country will be heavily skewed towards incoming tourist traffic. This is frequently caused by the significant population and socio-economic differentials evident between small island Caricom countries and their main source markets. Even if it is discovered that any lower fares or higher service quality, promoted by liberalisation measures, benefit primarily local travellers who leak expenditure out of the region, or that an increased intensity in competitive behaviour leads to local airline losses and foreign airline profits, it is still inconclusive as to whether or not the net macroeconomic outcome of air policy reform will be positive or negative.

Goodovich (1998) concluded that this latter scenario can only be viewed as negative in his study of the effects of deregulation on the Israeli airline industry, but he failed to take into account the possible benefits, for example, of foreign airline profits as a result of the exporting of their services to other sovereign nations.

Aubeeluck (1984) alluded to these benefits in his Singapore Airlines example when he said that the importing of air services from Singapore would have provided extra traffic from a new market in addition to obtaining revenue in the form of landing fees, commercial fees and sales of fuels and victuals. Foreign airline profits are not all repatriated as some is re-invested in new and improved services to the exporting market and yet more profits are used to pay for ancillary services like ground handing, landing and parking fees, catering, re-fuelling and so on. Moreover, even if there was a net outflow of expenditure as a result of an increase in foreign airline competition, the unquantifiable value placed by local residents on their mobility and connectivity cannot be underestimated as a catalyst for productivity in other sectors of an economy.

As a local traveller skewed directional flow scenario is unlikely for many Caricom countries, it becomes even more critical to ensure that any macroeconomic assessment of air policy reform is undertaken comprehensively and thoroughly, and that local air carrier welfare (surpluses) should not be prioritised over consumer surpluses and the net impact to a national or regional economy.

It has therefore been recommended by various sources that the true economic impact of a change in traffic levels encouraged by further air policy liberalisation measures should be estimated in the following way:

Traffic growth (loss) can be linked to economic impact by creating a passenger volume to direct employment ratio based loosely on the work of the Airports Council International economic survey (2005). Using airport studies, government input-output indicators and (air) transport employment and output data, the number of geographic regions were increased to fourteen (14) in the InterVistas (2006) impact assessment[29]. A total of 13 regions were devised for the tourism impact part of the assessment, and by using a combination of international and individual country based tourism data sources, the ratio of inbound to total arrivals could be computed in order to ascertain net flows of expenditure, as well as average trip spend across all modes and the number of employees created by every $1 million of tourist expenditure. To avoid double counting, direct employment created though airlines and on-site airport

[29] Note that the Caribbean region was included in the assessment under the subheading "Developing Countries Mexico and Caribbean".

organisations were not included in the input-output analysis (which looked to capture only induced and catalytic impacts).

Using a number of other studies as benchmarks for catalytic impact, InterVistas (2006) came to the rather indiscriminate assumption that for every additional 1000 enplanements/deplanements, 30 full-time equivalent jobs are created in the wider economy. Button et al. (2000), who incidentally are included in the InterVistas literature search as one of the sources used to arrive at their above ratio estimate, clearly stipulate that there is a saturation point with regard to creation of high-technology employment associated with international air services and once that point is reached, employment growth levels off quite considerably. The use of a common saturation point is useless, however, as each local, regional and national economy would have different circumstances driving labour reactions in relation to an increase in air services. When it comes to catalytic impact, the issue of causality is not satisfactorily dealt with in previous studies (see, for example, Button and Taylor 2000), although in Breuckner (2003) it was found that air traffic was the net cause of service-related employment with a high level of statistical significance (not vice versa) using a Granger causality test. Empirical evidence has shown, however, that new air services have commenced both as a reactive measure and also as a catalytic (or proactive) measure. Perhaps a possible solution would be to compare the size of an economy to the size of the airport(s) which serves it (measured by output or employment). This may give an indication as to the extent to which the airport or its economy is playing the lead role in 'causality'.

Overall, uncertainty in the use of impact ratios can be minimised by adopting a 'within sample' approach to estimation. Both Airports Council International and InterVista impact ratios for instance, use average or aggregate ratios, which may not reflect the socio-demographic profile of the case-study markets in question. Subsequently, ratios derived from a representative sample of Caricom country-pair ratios should theoretically produce more reliable results than if ICAO, Airports Council International or any other industrial body's ratios were adopted. Finally, as the baseline ratios would take expenditure outflows and a number of leakages into account, any extra passengers, when multiplied by these ratios, would automatically account for the abovementioned net impact adjustments.

2.3. CHAPTER SUMMARY

This chapter firstly reviews the macroeconomic impact of the air transport sector as explored in previous literature principally covering European, North American and Asian economies. This is followed by an assessment of some of the socio-demographic and economic issues particularly affecting the sector's macro contribution in a small island, developing country context. It is then demonstrated that there has been little research into the impact of the sector in the Caribbean Community and some methodological and practical limitations are offered as possible reasons as to why this is the case.

The second section summarises the background and current debate surrounding the economic theory of the impact of deregulation on consumers, producers, airports and the wider economy. A search of liberalisation assessment methodologies is then discussed with particular reference to air passenger traffic volumes as the dependent variable. The dearth of academic research in the area of air policy and small island states then created an opportunity to modify previous methodologies principally used for North American, European and Asian markets, and a number of possible flaws of current techniques are suggested with respect to their unsuitability for the case-study region. Finally, procedures used to approximate the macroeconomic implications of air policy changes are evaluated. It was concluded that the GDP effect per additional passenger and additional passengers[30] per job ratios can be more reliably estimated by minimising the use of ratios offered by external studies (either global or from other regions).

[30] All types of passenger are covered by these macroeconomic ratios – Departing and arriving passengers, locals and visitor passengers as well as international and regional passengers.

3.1. RESEARCH PLAN

3.1.1. Introduction

Due to the failure of I-O and CGE models to address dynamic output effects caused by changing traveller attitudes (including catalytic effects) along with the heavy data shortfalls inherent in the Caricom region, a multi-method, net impact, 'as it is produced' approach (ICAO 2005) was selected as being the most appropriate by which to estimate socio-economic impact. It is important to note that this approach can be seen as a modified version of impact methodology already conceived by the Federal Aviation Administration (1986), Air Transport Action Group (2000) and Karyd and Broebeck (1992) among others. It also includes important elements of the wider economic impact argument of Pearce (2005) and the air transport economic impact linkages proposed by ICAO and the World Tourism Organisation (2003). The more established Input-Output (I-O) methodology for indirect impacts would have been possible if the Caricom Secretariat and/or individual member states had recently produced I-O sector tables. Moreover, even if the income statements and balance sheets of all air transport organisms, involved either directly or indirectly in the production of air transport services was available, the necessary data would not be obtainable as most annual or biannual statements do not disaggregate expenditure by product category nor is the location of every supplier disclosed. However, as most forms of research involve some kind of population sampling, it is rare to find a study which bases its findings on an entire population of values. Thus, while an estimation of the air transport sector's economic impact on other sectors was not possible through the use of I-O sector tables, a number of supplier probes were used in order to partially mitigate for the missing data required for a sectoral interaction analysis.

Table 3.1 summarises the multi-method research approach adopted for this study. It includes both quantitative and qualitative techniques and is broken down into four impact classifications (see section 3.1.2 for more detail). The main data sources used to capture the numerical and opinion data are provided within the relevant cells. Direct and indirect impact data were mainly gathered through secondary sources. The base year for analysis was 2006 with the latest available year being used in the absence of 2006 data. Induced and catalytic impact data were mainly sourced through primary survey and sampling methods, with 2006 again being the base year to which the information provided applies.

Table 3.1
Summary of multi-method research approach

Impact classification	Quantitative assessment			Qualitative assessment		
	Gross Added Value (GAV)	Employment	Consumer surplus	Counterfactual change in output/displacement	Business investment/productivity	Local carrier preference
Direct (on-site activity)	Balance of Payment National account data	Regional airports	-	-	-	-
Indirect (off-site activity)	National account data	Regional airports/off-site service providers	-	-	-	-
Induced (AT supplier income)	Supplier probe expenditure statements	Air transport sector suppliers	-	-	-	-
Catalytic (AT user activity)	Caricom passenger survey (2006)	Proportional estimate based on GAV	Caricom passenger survey (2006)	Caricom passenger survey (2006)	Caricom business survey (2006)	Passenger and business surveys (2006)

The remaining sections of this chapter aim to cover the above outlined methodology in more detail before the results and discussion are offered in section 3.2.

3.1.2. Chosen impact classification

Although practically arbitrary, it is still considered important to specify the chosen classification of economic impact factors, as well as the scope of each item to enable the reader to gain more clarity in the terminology used, such as 'direct impact', for example. This and the remaining classifications used for the purposes of this assessment are listed in Table 3.2.

Table 3.2
ICAO impact classification

Classification	Players	Activities
Direct	Airport firms and organisations based on-site	- Involved directly in the delivery of air transport services to end users and to industries -Order intermediate services and products from various suppliers -Create on-site employment, pay taxes and accrue profits (losses)
Indirect	Suppliers based off site	-Involved in delivery of intermediate products and services to airport firms based on-site -Order various intermediate inputs from various suppliers -Create off site employment, pay taxes and accrue profits (losses)
Induced	All concerned firms and individuals	-Deliver goods and services to off site suppliers -Direct and indirect employees spend wages in other sectors -Create employment, pay taxes and accrue profits (losses)
Catalytic	Passenger and freight transport users	-Expenditure in wider economy -Travel agent commissions and consumer surpluses -Create additional employment, payment of taxes and accrual of profits (losses)

Source: ICAO (2005)

The commonly accepted view held within the tourism intensive region of the Caribbean is that the wider economic impact (classified above as catalytic) of the presence of air transport infrastructure and services on an economy is disproportionately high in comparison with other regions of the world. It was therefore of critical importance to include this in the chosen impact classification despite the well documented complications relating to its measurement. Studies that only go as far as including induced impacts, in the form of disposable income invested in the local economy by air transport producers and suppliers, do not account for off-site expenditure by air travellers and freight users in the wider economy. An expanded approach, however, as advocated by ICAO (2005), includes both direct and catalytic impacts in the form of on and off-site demand stimuli respectively with the resulting indirect and induced impact reflecting this new, expanded demand activity. In the core approach indirect supplier expenditure and induced income spent in the wider economy is only supported by on-site or direct demand stimuli. The key link between air transport users and the Caricom region's travel and tourism industry made it necessary to adopt an expanded estimation approach.

The extent to which each category of impact is present in each sample member state will be estimated quantitatively using supplier probe data (induced) along with Balance of Payment (direct), national account (direct, indirect) and passenger/business survey (induced, catalytic) data and qualitatively using opinionated responses from the same passenger and business surveys.

3.1.3. Cluster analysis

It is important to note that an integral part of the remaining research methodology was to find a suitable sampling technique that would not compromise the study's ability to arrive at a representative set of conclusions; that is, representative of the current situation in any arbitrarily selected Caricom member state, as well as in any small island state(s) portraying similar socio-economic parameters. At the same time, the values to be captured had to retain a high incidence of significance for those autonomous countries chosen in the final population sample. It would be extremely impractical to conduct research in all 20 member states (including associate member states), which makes up the statistical population parameter for the Caricom region. The solution, therefore, was to devise a more manageable sample size by categorising the population into a number of groups headed by a representative member state (each state was selected based on a process called cluster sampling (Lind et al. 2005)). Using macroeconomic, geographic and air transport criteria, as well as making a personal judgement based on preliminary secondary data enquiries about access and availability of data, quality of contacts in each country and cost of travel for fieldwork, seven representative countries made the final selection for detailed analysis.

Dominica was chosen to represent Montserrat, for example, firstly because they are in a similar geographical location (Leeward Islands), secondly because they are both in the low GDP (PPP) per capita category and thirdly, in terms of air transport, because there are only limited feeder services to and from other sub-regional hubs, with growth in both islands being restricted by their respective air transport infrastructures. Once the cluster of Dominica and Montserrat was chosen, unlike the cluster sampling methodology as suggested by Lind et al. (2005), the final representative state in this case was selected in order to minimise travel inconveniences and inadequate access to data. For the remaining groups with more than one member state, however, random sampling was employed to arrive at the final selection for in-depth analysis.

An identical procedure was carried out for the remaining clusters. It was found that Jamaica and Trinidad & Tobago did not easily fit into any other cluster. Jamaica, for instance, is in a low GDP (PPP) per capita category unlike the other members of the north Caricom cluster, but nevertheless has a large home market to sustain a sizeable air transport sector. Trinidad & Tobago, with such a small service and tourism sector and a medium to high GDP (PPP) per capita level also indicated that it did not sit easily in any other cluster. Jamaica and Trinidad & Tobago therefore do not represent any other member state and can be termed ‘stand alone’ groups. There could have been other combinations of indicators[31] used in order arrive at the final sample but geographical location and level of air transport activity (total air arrivals) was considered to be an effective method by which to calibrate the sample.

[31] Other useful air transport indicators could include whether or not a member state has at least one home based carrier, the ratio of direct air transport employment as a percentage of the labour force or air transport usage per capita compared with GDP per capita.

A tabulated overview of the selection criteria and the resulting final selection of member states is now provided in Table 3.3.

Table 3.3
Sample member state selection criteria

County grouping (Caricom)	**GDP per capita (2006)**	**Air arrivals (2006)**	**Sub-region**	***Selected state***
Jamaica	Low	High	Northern	*Jamaica*
Trinidad & Tobago	Medium	Medium	Southern	*Trinidad & Tobago*
Dominica, Montserrat	Low	Low	Eastern	*Dominica*
Bahamas, Bermuda, Cayman Islands, Turks & Caicos	High	Medium	Northern	*Bahamas*
Antigua & Barbuda, Barbados, BVI, St. Kitts & Nevis	High	Medium	Eastern	*Barbados*
Anguilla, Grenada, St. Lucia, St. Vincent & Grenadines	Medium	Low	Eastern	*St. Lucia*
Belize, Guyana, Haiti, Suriname	Low	Low	Peripheral (landborder)	*Guyana*

Source: Index Mundi (2006), Caribbean airport statistics
Notes: Class boundaries: GDP per capita, Low (US$0-7,000), Medium (US$7,001-17,000), High (US$>17,001); Air arrivals, Low (0-1,000,000), Medium (1,000,001-3,500,000), High (>3,500,001)

As can be seen in Table 3.3, numerical criteria were converted into high, medium and low categories with the final geographical criteria broken down into relevant sub-regions. The net result was that states filtered into the same groups were assumed to have analogous profiles.

3.1.4. National account and Balance of Payment (BoP) data

Regrettably, national account data was, at the time of research, in a largely inconsistent form for the sample member states. It was initially intended that Gross Added Value (GAV) for different parts of the air transport supply chain would be presented for the seven sampled member states in the latest available year, but this information was not readily accessible for any member state. In fact, most air transport account data was locked within the broad category of “Transport, Storage and Communications”. It was subsequently decided that, as part of the supplier probe data collection period, the Trinidadian and Barbadian statistical services would be contacted for a more detailed breakdown of Gross Added Value for the air transport sector. This would give a much more accurate view of the direct and indirect contribution of the sector. Appropriate data was finally received on the back of the supplier probe and cross-checked with other secondary data (BoP data) for Trinidad and Barbados in order to get an indication of the data’s reliability.

Balance of Payment (BoP) secondary data related to the trading of air transport services and are provided by the Caricom Secretariat for the years 1990-2000 (2002). Despite the latest values predating the remaining data sources by six years, it proved to be a useful data source for attaining aggregate direct impact figures for all member states. The main benefit of the BoP data is that it takes into account outgoing expenditures relating to air transport as well as incoming expenditures, thus providing a realistic and comparative base from which the regions multiplier effect could later be calculated. Within the BoP statement's accompanying notes it is stated quite clearly, for example, that airfares paid to foreign carriers and profits repatriated to a foreign carrier's home country can be seen as a deficit in the region's trading in service accounts, which is clearly in keeping with Pearce's (2005) net value creation argument.

However, the shortfalls of the BoP data should also be documented. First, many transportation, and more specifically air transportation expenditures, were classified under tourism expenses. For instance, non-resident expenditure on regional carriers was included as a tourism expense when in most other classifications this forms a direct transport expenditure. Although every effort was made to separate out true transport expenses from tourism expenses it is quite possible that total transport expenses have been underestimated, whether outgoing or incoming. Second, indirect and induced expenditure in the production of air transport services was certainly not covered by the BoP data. This meant that primary indirect and induced data collected from Barbados and Trinidad could not be triangulated with any annual BoP data. Third, the net values shown for each sampled state would need to be extrapolated in order for the direct impact values to be used in conjunction with the supplier probe values which were collected six years later in 2006. Finally, there were no values shown for Guyana. As a result data shown for Belize were chosen in its place purely because it was the only member state from the Guyana 'cluster' that boasted a complete set of data values.

3.1.5. Supplier probe case-studies

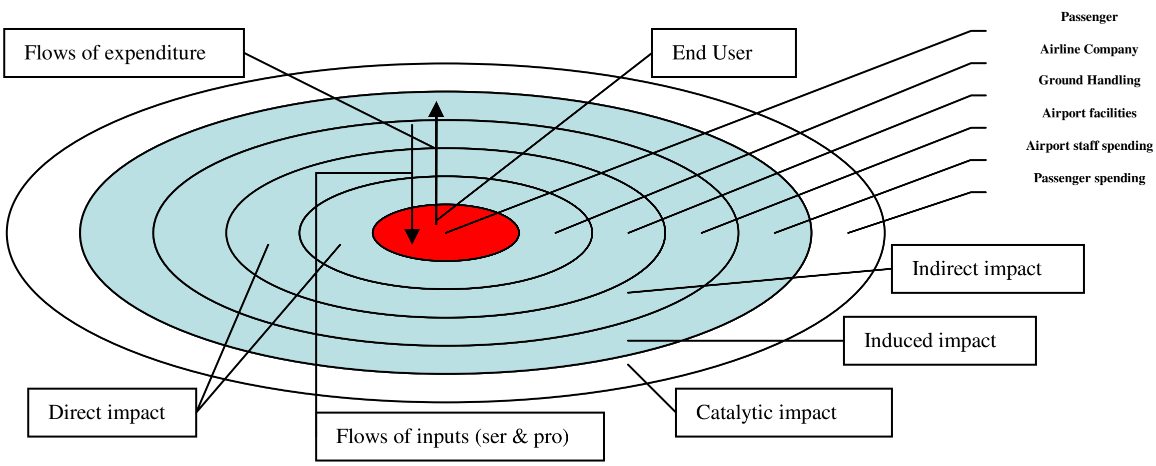
Organisations involved in the air transport supply chains of Trinidad and Barbados were probed through telephone or face-to-face meetings from July to September, 2006. The major advantage of this strategy was, of course, that aggregate expenditure and income data could be broken down, and product categories as well as supplier names/locations ascertained with a view to gaining a more in-depth and realistic deduction of the spillover effects into the economy at large emanating from the existence of air transport infrastructure. In Barbados, primary research coincided with a major reconstruction project of the island's only airport, Grantley Adams International (BGI), providing the author with the additional opportunity to combine and compare economic impact in a normal operating context with that of the sector's impact during an exceptional context.

The major objective of the supplier probe case study strategy was twofold: firstly to try to disaggregate quantitatively total expenditure and employment into different sections of the air transport supply chain (direct, indirect and induced impact only)[32] and secondly to give the reader a clearer understanding of the extent to which the provision of air transport services and competitive air transport infrastructure has infiltrated into many sectors of a typical island community. A given flow of intermediate products and services used to produce a given flow of end user expenditure is shown in the following air transport supply chain example along with its arbitrary economic impact classifications as devised by the Federal Aviation Administration (Figure 3.1 (ICAO 2005[33])).

Enlarging the sample size to further support region wide inferences was also considered and although it was deemed useful, it would have proven to be extremely laborious and resource intensive given the depth and range of organisms potentially involved in the supply of air transport services in each and every member state. Further, in choosing a tourism intensive island (Barbados) along with manufacturing intensive island (Trinidad), the heterogeneity of the mini-sample was considered to partly mitigate its small size. Thus the balance between direct, indirect, induced and catalytic impact along the air transport supply chain could be compared for the two islands perhaps leading to some indicative inferences for the region at large.

[32] Caricom BoP statements for the year 2000 (latest year available) only give values relating to direct impact of air transport to its member states. It was not possible to obtain aggregate indirect or induced impact values from the BoP data.

[33] Compare this to the actual supplier probe findings set out in section 3.2.3.3.



Source: Adapted from ICAO (2005)

Fig. 3.1 Diagram to show flows of expenditure in a typical air transport supply chain

Although secondary data was limited and narrowly defined for the two case study islands, it was envisaged that direct and indirect impact ratios of the supplier probes could be cross-checked against national account[34] and Balance of Payment data. Notable differences in publication dates, scope and definitions would result in discrepancies in the ratio as well as the aggregate estimations, but they were not significant enough to preclude the usefulness of cross-checking. The supplier impact probes were more broadly defined than published data for the two states. However, they were not considered to be representative enough of Caricom as a whole to be incorporated into the production of a disaggregated induced impact baseline. Rather it was intended that they would provide more evidence of the wider income effects in both Barbados and Trinidad than those provided by published data.

Despite the small sample size of some of the off-site companies involved in the production of air transport services, it was possible to estimate the induced impact of the sector to the economies of both Barbados and Trinidad in terms of GDP contribution and employment. With low standard errors of estimate (z-values), the business population's average total wage bill was estimated to be US$1.5mn for Barbadian firms and US$3.5mn for Trinidadian firms. Subsequently, it was found that, using a sample size of 39% and 29% of the population of firms in Barbados and Trinidad, sampling error was low, at US$-0.15mn for Barbados and US$-0.5mn for

[34] The national account data provides a net estimate termed GAV, whereas the supplier probe reports gross contributions to GDP before controlling for expenditure leakages in the form of imports/savings.

Trinidad. It is also more widely accepted to include the effects of direct, on-site employee spending in the wider economy, whereas expenditure allocation between sectors representing off-site tour company activity, for example, is more tenuous. It was critical, therefore, to ensure the majority of the sampled firms were directly involved in the provision of air services.

3.1.6. Survey questionnaires

It was proposed that two major surveys be conducted during the primary data collection period. Spanning from May 2006 to February 2007, a total of 327 air passenger questionnaire (see Appendix E for example) responses were collected from the departure areas of the major airports of the seven chosen Caricom member states: the Bahamas, Barbados, Dominica, Guyana, Jamaica, St. Lucia, and Trinidad & Tobago. The other on-line business survey (see Appendix F) returned a total of 211 responses from the same sample of countries during a similar period (May 2006 to March 2007)[35]. Of the seven versions of the business and passenger surveys, only the Guyana and St. Lucia business surveys returned a sample size of less than 30. The central limit theorem states that the sampling distribution of the sample means will be approximately normal when a sample contains at least 30 observations. Thus, by and large, the passenger and business survey sample mean can be said to reflect the unknown population mean to a reasonable level of confidence (Lind et al. 2005). For aggregate results on a Caricom level, the pilot passenger and business surveys produced an estimate of standard deviations of the population parameter which could then be used to calculate the required representative sample size for the remaining surveys. Total trip costs and number of employees were respectively provided as indicators which would encompass the total market mix of arriving and departing passengers, as well as the total variation in the size of Caribbean based businesses. The following equation was used to determine an adequate sample size: -

$$n = \left(\frac{zs}{E} \right)^2 \qquad (3.1)$$

[35] The breakdown of responses by member state was as follows: Bahamas 51, Barbados 41, Dominica 36, Guyana 50, Jamaica 50, St. Lucia 50 and Trinidad & Tobago 50 for the passenger survey, and Bahamas 32, Barbados 37, Dominica 20, Guyana 19, Jamaica 33, St. Lucia 35 and Trinidad & Tobago 35 for the business survey.

where n is the size of the sample, z is a normal value corresponding to the desired level of confidence, s is an estimate of the population standard deviation and E is the maximum allowable error.

Substituting equation (3.1) with a pilot standard deviation of visitor expenditure of US$1,787, a z-value of 1.96 (corresponding to a 95% confidence level), and a chosen margin of error of US$200 results in an estimated n value of 307. The actual number of responses was above this estimate, thus satisfying the variation discovered in the pilot passenger survey.

Substituting equation (3.1) with a pilot standard deviation of firm size (number of employees) of 37.91, a z-value of 1.96 (corresponding to a 95% confidence level), and a chosen margin of error of 5 employees, results in an estimated n value of 220. Including the pilot survey, the number of responses was above this estimate, thus satisfying the variation found in the business survey.

The major purpose of the passenger survey was to obtain empirical data on trip purposes, travel related expenditures, length of stay and other factors to determine average visitor expenditures in a given host country (ICAO 2005) and, in following the recommendation of Pearce's net benefit argument, the average expenditure of those passengers visiting other countries was also taken into account to arrive at a net estimate. These findings could then be used to test the net catalytic impact of the production of air transport services both for the region and for each of the sampled countries.

Although this formed the major focus of the passenger survey, secondary purposes included the collection of empirical data on average airfares and the value each passenger placed on them (consumer surplus). This enabled the author to compare a number of different combinations of variables and sub-groups: for example, revenues accrued to local as well as foreign carriers (direct impact indicator), the ratio of airfare expenditure to total trip expenditure (to attain a initial indication of the multiplier), the quantity of Caricom-residents travelling on foreign carriers to quantity of visitors travelling on local carriers (degree of importing/exporting of air transport services) and so forth. These secondary objectives are often established in order to satisfy the qualitative assessment requirements as they were based on stated opinions relating to willingness to pay, carrier preferences and so on.

It was assumed that, in triangulating this type of survey data with the other estimation methods described above, a clearer and more accurate picture would emerge, taking into account two-way flows of expenditure and the dependence of the region on catalytic output to perhaps compensate for any deficits or insignificant contributions (surpluses) in the other impact categories. It was important not just to present impact estimations rather like an accountant would, but to delve further into the relationships between variables with a view to familiarising the reader with the heterogeneity of the region, and why this leads to differences in overall economic impact between member states. It was envisaged that the disaggregated ratio between the direct, indirect, induced and catalytic impacts would vary among the sampled countries quite significantly. Also, in attempting to account for the non-quantifiable catalytic impacts, it was also important to describe and then explain the chosen measures and associations (Babbie 1990), which ultimately determine the final values and estimations. As Montalvo (1998) suggests, for any given country a range of indirect, induced and catalytic estimations can result from an impact analysis depending upon the measures and associations used.

In keeping with this particular research strategy and in order to draw some annual macroeconomic inferences from the survey data, a scaling factor was used and then compared with historical secondary data provided by the region's tourism organisations. It was considered that the assumed factor (total annual air traffic) would produce more accurate indicators if the sample was highly representative of the population. Thus, sampling was not carried out completely randomly. An approximately equal number of responses were collected from each member state. Out of the seven versions of the survey, four were carried out during the low season (May to November) and three during the high season (December to April); four on busy days and three on relatively quiet days. On a regional level this ensured seasonal variation could be accounted for by the sample. In addition, all responses were as evenly spread as possible throughout the designated survey day in order to capture variations between peak and off-peak periods, short, medium and long haul destinations, business and leisure passengers, resident and foreign travellers and regional and international carriers. This procedure of random sampling within a predetermined set of groups is termed 'stratified random sampling' (Lind et al. 2006).

Every effort was made to capture data from multiple airports if a sample country had more than one major gateway. Naturally, given the fieldwork time restrictions, it was impossible to sample all secondary airports in the region. However, it was calculated that only 12.2% of total airport traffic flows for the seven sampled states were not covered by the Caricom passenger survey. This high representation owes itself to the fact that most states in the sample are small islands depending on only one or two gateways for domestic and international air transport. The only notable exception to this rule was the Bahamas in that Nassau (NAS), the major international gateway, only accounted for 69% of total Bahamian O-D traffic (2006). Freeport (FPO), located on the island of Grand Bahama and Marsh Harbour (MHH), on the island of Abaco are also sizeable gateways in their own right with daily international flights to and from the United States. The results of the sample were deemed to be reliable if they were of relative comparability to the catalytic impact estimations proposed by the Caribbean Tourism Organisation (CTO)[36].

Between November 2006 and February 2007, a number of executive summaries of initial survey results were sent out to airport management (see Appendix C). This enabled useful feedback to be gathered on the value and relevance of the results to airport stakeholders. Largely positive reviews of the summaries were received as they were tailored to the interests of the airports/member states in question. For those member states with more than one airport, it is noted that the summaries provided useful flow and airfare comparisons between airports. This was especially the case for St. Lucia and Jamaica where responses were collected from each of the two major airports on each island. They also provided a pre-analysis overview of the representativeness of the raw data, key relationships between variables and the influence of sub-groups on these relationships. Finally, it highlighted any weaknesses in the data relating to sampling or non-sampling error. In the Jamaica summary, for example, the breakdown of respondents by country of residence showed that no surveyed travellers were from the United Kingdom (Appendix C) whereas

[36] Although in theory the Caricom passenger survey results should be more prudent given that they captured outgoing resident expenditure, whereas CTO data does not.

historical data from the Caribbean Tourism Organisation (2004) suggests that around 10% of all tourists came from the United Kingdom. When local residents are also included, a truly representative figure would be lower than 10% but greater than 0%. Although every effort was made to minimise such sources of sampling and non-sampling error in the passenger survey, the executive summaries served to highlight any discrepancies before the main analysis stage commenced. Overall, sources of passenger survey sampling error were both minimal and insignificant. The Jamaica survey returned a satisfactory spread of data in terms of airlines, purpose of trip, choice of airport and so on. Besides the United Kingdom omission, the spread of country of residence was generally realistic given the majority of travellers in the sample and the population came from the United States.

The business survey, which contained closed questions such as, "What proportion of your company's production costs is incurred by international air transport?" and "What is the *relative* importance of the existence of efficient air transport services in determining the company's decision to enter into new markets?", was also devised primarily to empirically test the extent to which the production of air services can impact the regions economy catalytically. The above questions were included so that the data produced could provide a basis by which to arrive at a set of impact measures adapted from those recommended by the World Tourism Organisation and ICAO (2003).

In this case the above questions attempt to specify, for the Caricom region, estimations which correspond to measurement number six (6) and number seven (7)[37]. In addition, it is suggested by Lian (2007), in his impact assessment of air transport in the remoter regions of Norway, that the industry's contribution to other sectors can be quantified nominally by looking into the share of each firm's activity level which is dependent upon the present air transport system. This could be performed in two ways: firstly, by estimating the aggregate percentage of sales which is dependent upon access to an airport, and secondly by estimating the percentage of total production costs which can be allocated to air transport. Again, stratified random sampling was the method used to reflect the socio-economic diversity of the region by ensuring that the sample sector breakdown was representative of the population. In practise, this

[37] Please see section 2.1.4 of literature review for more detail.

grouping strategy was not always possible as agricultural or light manufacturing sector organisations in Guyana, for example, were less likely to respond to a survey about air transport than banking and finance sector firms. To make the sample results more representative of the statistical population, estimations were weighted by officially published sector profiles from member state Central Banks.

In order to improve explanations of core relationships between the business sector and the air transport industry, supplementary questions were added such as, “In which sector is the company involved?” and “What is the estimated turnover of the company?”. These factors would clearly have an effect on a business’s amount of air transport usage as well as the type of usage. It must be added that although the focus throughout this thesis is on the passenger air transport market (due primarily to the fact that objective 2’s scope is limited to passenger markets given the greater accessibility of research data in this segment of the market), empirical data pertaining to the relative importance of the freight transport sector could also be weaned from the business survey results.

While it is not envisaged that the bulk of the results from the business survey will contribute quantitatively to the aggregate or disaggregate impact approximation, the generalised importance of the sector to the region’s business community can be compared and contrasted to those of other regions using studies discovered during the literature review stage. More interestingly perhaps, it can form the basis for discussion about the contribution of the sector as a facilitator (or not as the case may be) to each sampled member state. Business mobility and access to the globalised market is of increasing importance to many industrial sectors and the inclusion of some open questions at the end of the survey gave respondents the opportunity to specify how the air transport product can be improved in order to facilitate better intra and extra regional trade and investment.

For both surveys a pilot test was undertaken. As Barbados was the designated fieldwork base for the collection period, the natural course of action was to choose Barbados as the designated member state for the pilot surveys. The benefits of conducting pilot studies are well documented (Babbie 1990, Brace 2004, Fowler 2002). The argument for testing a research design before a major research effort is compelling and the following air passenger and business survey errors discovered during the 'dummy run' provides supporting evidence of its benefits.

- The initial method of distribution for the pilot business survey proved to be inconvenient. A file containing the survey had to be saved on the respondent's hard drive before it could be completed and then re-sent. As a result an on-line survey company was used and a simple hyperlink took the respondent from an e-mail sent by the author directly to the survey.
- Initial response rates for the pilot business survey were made worse by business listings as they often did not include names of executives. Including a personal touch in e-mails by including executive names improved response rates considerably (the final rate was estimated at 15%).
- The pilot business listing also proved to be problematic in obtaining a diverse response rate. A good variety of sectors needed to be targeted in order to reflect the variety of air transport usage by business passengers. If a business listing is manufacturing intensive, for example, a low response rate as well as a sample that is not truly representative of the statistical business population would result.
- The original air passenger survey was found to be about 2-3 minutes too long for the average passenger. A number of non-critical questions were therefore omitted from later versions. For example, during the pilot survey only 2% of Barbados respondents attempted to answer Q22. This can be explained by the fact that firstly, it was an open ended question and second, its output would not have created new data but instead would have only elaborated on responses given to the closed multiple choice question, Q21 that preceded it (see Appendix D). Q22, on reflection, was discarded as it was non-critical. Similar data on the subject of investment impediments caused by the air transport sector were already covered by the business survey.
- The original air passenger survey did not feature any question relating to passenger value placed on air tickets. Viewed as an important criterion for testing net welfare to passengers, the omission was quickly corrected in subsequent surveys. The Barbados pilot was repeated with the additional consumer welfare question.

- It was found that passengers situated in landside departure areas were less likely to agree to fill in the questionnaire whereas in airside areas; especially in the gate areas, passengers were more amenable. Also during the pilot, in some instances the surveys were not fully completed. To try to mitigate the risk of incomplete data, subsequent questionnaires were delivered verbally if the respondent so desired. If not then the surveyor ensured that he was always present to answer any queries or dispel any doubts.
- The pilot passenger and business survey provided a point estimate of the standard deviation of total trip expenditure (US$) and the number of employees per firm respectively, which were then used to estimate the optimal sample size for the surveys given a 95% confidence level and low margins for error. If this procedure was not undertaken a lot of research time and expenditure could have been squandered by doing too many surveys. Conversely, the sample may not have been representative enough of the variation around the population means if the sample size was too small.

The time and resource restrictions placed upon the fieldwork meant that, although beneficial, no trend analysis could be deduced from the survey data. Tourism data is collected periodically by the Caribbean Tourism Organisation and the respective national tourism authorities in the region, but this data does not capture outgoing traffic nor does it capture any detailed data on the air transport sector itself, unlike the two surveys undertaken in this research. The Caribbean Tourism Organisation does provide comparative results for the region's member states, but again the air transport sector is seen only as a component of a much bigger organism and thus some important variables featured in this study's surveys are not included in the Caribbean Tourism Organisation's yearly trend analysis.

The passenger survey was modelled on a combination of a typical Civil Aviation Authority (CAA) passenger survey (2005) along with a Caribbean Tourism Organisation (CTO) survey (2004), which was targeted at long-stay tourists travelling by air. This ensured that questions pertaining to air transport, socio-economic, air traveller, air travel choice, and expenditure variables were all taken into account, not just those relating to airport activity variables or incoming tourism activity alone. The business survey was adapted from an Oxford Economic Forecasting (OEF) survey of UK companies (2006).

3.1.7. Deriving the baseline aggregate impact results (2006)

As national account data included sector contributions to final demand only, the tables obtained for Trinidad & Tobago and Barbados provided the basis for direct and indirect impact calculations for the baseline year. On-site impact consisted of air transport (airlines only), storage and warehousing and airport and other service entries, while indirect impact was represented by travel agent/tour company and cargo handling activities occurring off-site. The remaining states did not offer recent national account data and so, as a measure of prudence, indirect effects were omitted and direct effects were extracted from the Balance of Payment surplus values provided by the Caricom Secretariat (2002). These values represent the value added contribution of all on-site activities net of import leakages.

Direct on-site employment figures were obtained from respective member state airport authority personnel databases at the same time as the face-to-face passenger surveys were being conducted. For the five member states not subject to a supplier probe, catalytic employment was estimated on the basis of the catalytic to direct impact expenditure ratio and cross-checked against the Caribbean regional average of 12.6% as estimated by the World Travel & Tourism Council satellite accounts (2006). Individual country estimates were also compared to their travel and tourism satellite account equivalents and were invariably found to be more conservative even in the case of the Bahamas, Barbados and St. Lucia. The same procedure was followed to derive catalytic employment for the two supplier probe member states, but on this occasion indirect and induced employment values were also estimated by calculating the average number of jobs per firm multiplied by the total number of air transport suppliers in Barbados and Trinidad & Tobago.

Similarly induced expenditure was derived by extracting the sample mean wage level and multiplying it by the population of air transport related suppliers in the island assuming a representative sample size (refer to Section 3.1.5.), which in the case of Trinidad & Tobago worked out at US$150 million (Sample average: US$3 million (US$42 million/14 firms) x population of firms: 50).

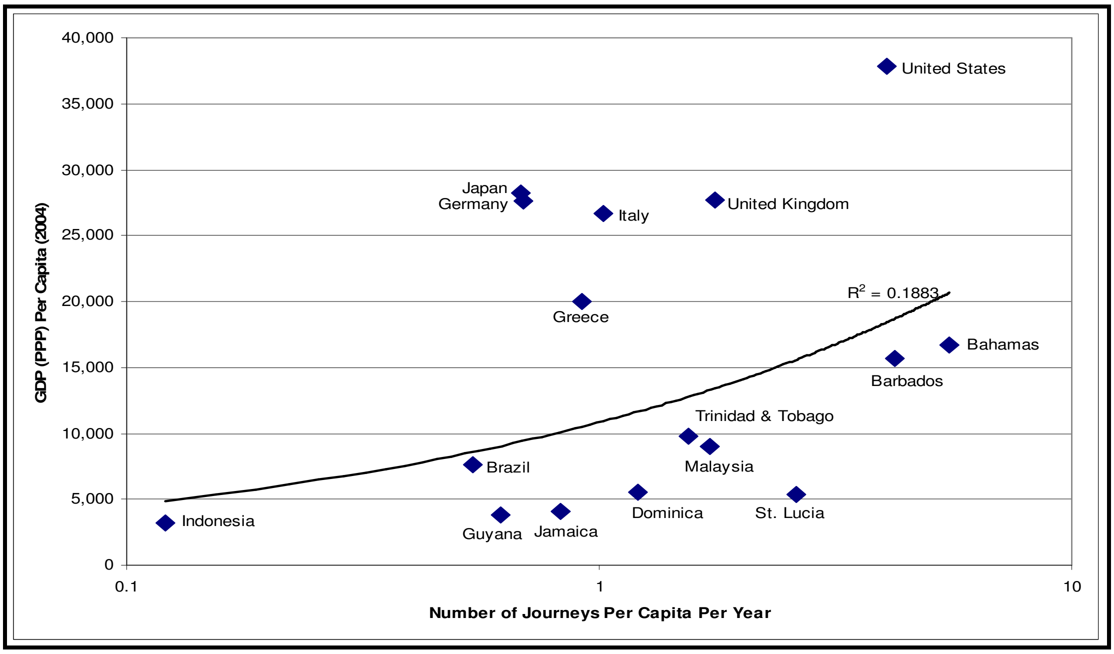
Catalytic expenditure was calculated from the expenditure values given in the Caricom passenger survey. Again, assuming a representative sample, a basic multiplier was introduced in order to scale up the sample's net visitor expenditure values captured in the survey. The most appropriate multiplier was considered to be the total number of passenger flows in each sample member state divided by two to avoid the double counting of expenditure.

3.2. RESULTS AND DISCUSSION

3.2.1. Impact overview: general indicators

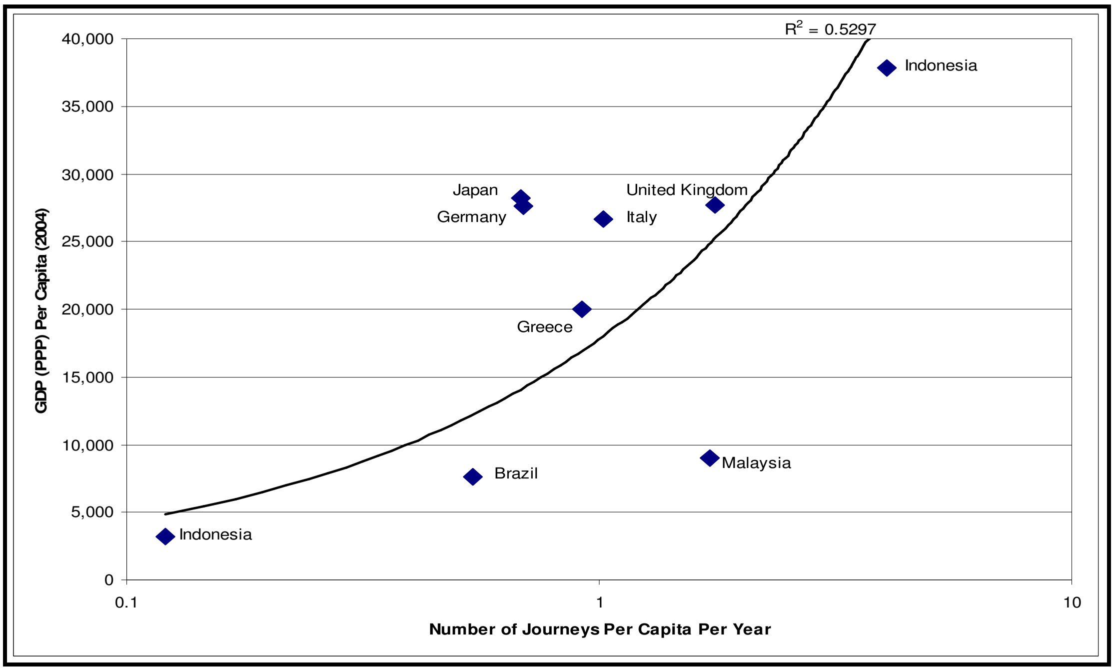
Before the main socio-economic impact results are revealed it is useful at this point to determine if there are any initial inferences which can be made using some widely used indicators. As these ratios are simple to derive and interpret, it provides an initial comparative snapshot which can be easily understood by both general and specialist readers.

For a selection of countries, Figure 3.2(a)-(c) attempts to illustrate the link between economic prosperity, measured in terms of GDP per capita, and air travel participation, estimated by the total number of journeys per capita per year for the year 2004 (inclusive of all types of traveller).



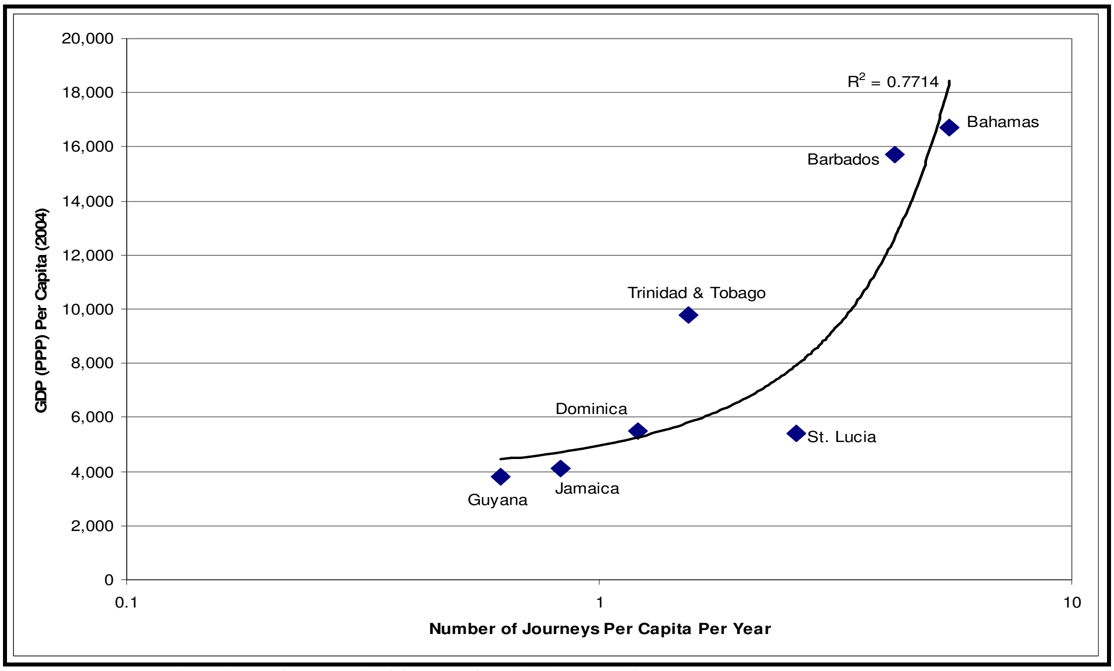
Sources: ICAO 2005, Caricom airport authorities (2006) and Index Mundi (2007)

Fig. 3.2(a) Air Travel Participation: Correlation between GDP per capita and number of journeys per capita per year for the sampled Caricom countries and a selection of non-Caricom countries



Sources: ICAO 2005, Caricom airport authorities (2006) and Index Mundi (2007)

Fig. 3.2(b) Air Travel Participation: Correlation between GDP per capita and number of journeys per capita per year for a selection of non-Caricom countries only



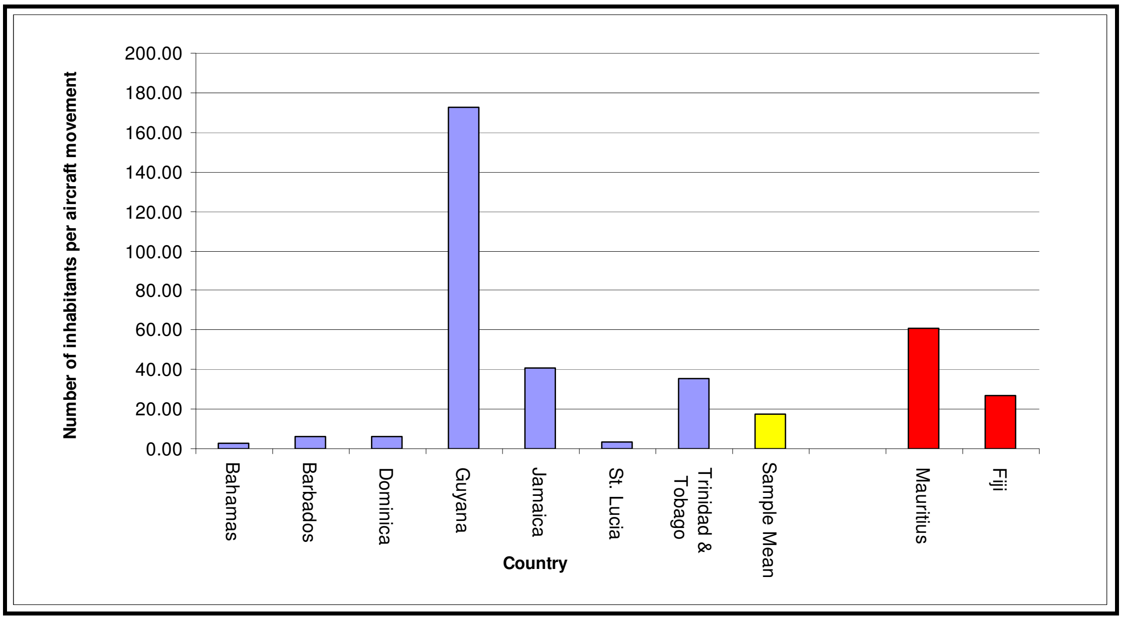
Sources: ICAO 2005, Caricom airport authorities (2006) and Index Mundi (2007)

Fig. 3.2(c) Air Travel Participation: Correlation between GDP per capita and number of journeys per capita per year for the sampled Caricom countries only

When the sampled Caricom country values are combined with the non-Caricom values, a low coefficient of determination results (R^2). That is, only 18.8% of the number of journeys per year are predicted by the variation in GDP per capita. However, when Caricom and non-Caricom countries are separated and re-plotted (Figures 3.2(b) and 3.2(c)), it becomes clear that the inclusion of Caricom country data values resulted in a decrease in the statistical relationship between the given *x* and *y* variables. This is because, in general, Caricom countries had lower than average GDP per capita values yet higher than average journey values. For example, despite a GDP difference of US$21,000 per capita between the United States and the Bahamas, the Bahamas still returned higher journey values per capita (1.46 more journeys). As a result higher coefficients are revealed when non-Caricom and Caricom countries are treated separately.

The atypical relationship between GDP per capita and the number of journeys per capita shown by Caricom countries warrants further investigation as to why this might be. It must be remembered that, first a high proportion of the journeys made to and from Caricom countries are made by non-Caricom residents, second, that low populations are evident from the sample and third, that for middle to long distance journeys air transport is effectively the only economical mode on offer to both visitors and locals. These three factors combined would help to explain the atypical coefficients shown in Figures 3.2(a) to 3.2(c).

Another way to assess the general extent of air transport activity in a nation is to compare the total number of inhabitants with the total number of commercial aircraft movements supporting those inhabitants. In general, air transport activity for Caricom states can be said to be highly intensive, with four of the seven sample member states having less than ten inhabitants per aircraft movement. Even when the relationship is computed for the more populous islands of Trinidad & Tobago and Jamaica, there is still a relatively high level of air transport activity, involving significant sections of society (see Figure 3.3).



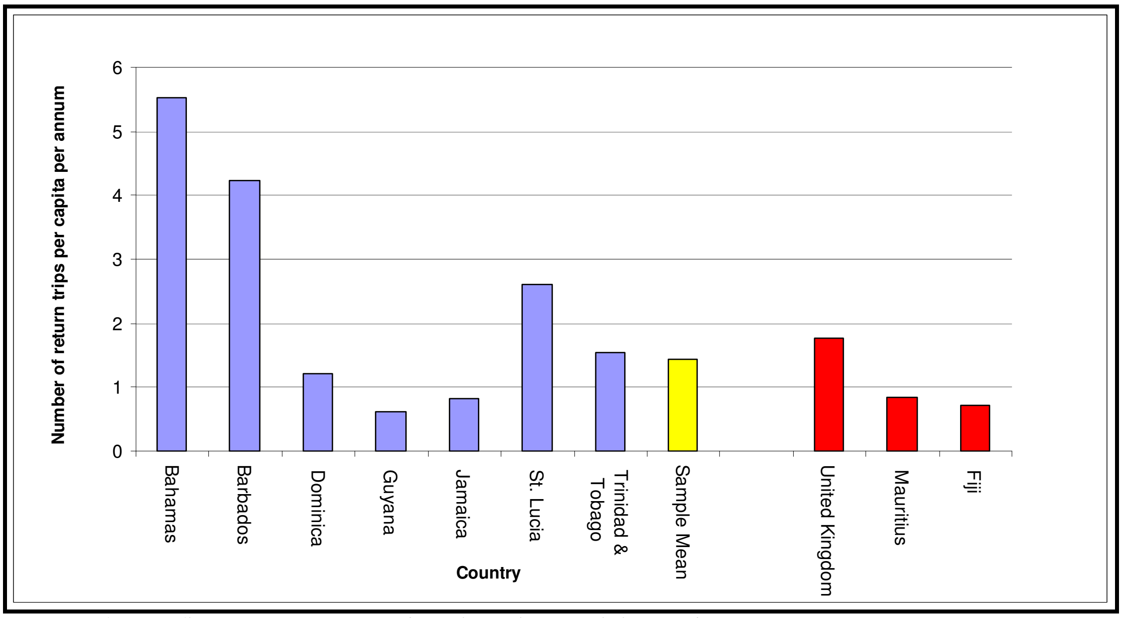
Sources: Index Mundi (2007), Caricom airport statistics (2006), Air Transport Intelligence (2006)

Fig. 3.3 Bar chart to show the number of inhabitants per aircraft movement (2005)

Guyana, with a low GDP and propensity to fly combined with the fact that access to airport facilities is hindered by poor infrastructure and inconvenient journey times, returned a much lower level of air transport activity. The remaining sampled state figures compared favourably with that of Mauritius, another island state located in the Indian Ocean. This can be partly explained by the comparatively high number of air transport movements required to support daily intra-regional traffic, using mainly 50 seater Dash 8-300 type aircraft. A higher proportion of flights to and from Mauritus, on the other hand, are operated using larger gauge aircraft on medium to long-haul sectors due to its more isolated position in the Indian Ocean as compared with many Caribbean island states. While a higher number of air transport movements do not necessarily imply higher traffic levels, they do encourage a more even spread of airport staff and other resource utilisation outside the peak long-haul flight periods.

The comparative participation values of Fiji provide for another interesting observation. Being an archipelago of islands in the Pacific Ocean surrounded by other island states, Fiji also returned a high number of aircraft movements relative to its population size. The socio-economic and geographic characteristics of Fiji are similar to many island states in the Caribbean, and this results in a comparable requirement for frequent domestic/regional services linking the islands, in addition to middle to long distance visitor traffic from Australasia, Asia, North America and Europe. It is still worth noting that the sample mean and four of the sampled states showed a higher level of participation than Fiji reflecting a slightly higher intensity of smaller gauge, intra-regional services.

The third ratio (Figure 3.4) represents a general indication of aggregate demand for air travel in both Caricom and a selection of non-Caricom countries, measured by the number of return trips per capita per annum (all traveller types)[38]. Results are broadly consistent with Figures 3.2(a) to 3.2(c) in that countries with larger GDP's per capita tend also to have greater Propensity to Fly (PTF) values. This expected relationship holds for all the illustrated countries except for the Bahamas, Barbados, St. Lucia and Trinidad & Tobago. Other similar small island states outside the region, with relatively low GDP per capita levels, do not show the same PTF values as these four Caricom states, again providing an indication that the majority of the sampled states benefit from aggregate air travel demand levels over and above what is normally expected of a small island state. The more typical PTF values for Guyana, Jamaica and Dominica ensure that the sample mean value (1.44) stayed below the UK's PTF value of 1.76.



Sources: Index Mundi (2007), CAA, ATI (2006), Caricom airport statistics (2006)

Fig. 3.4 Propensity to Fly (PTF): Caricom sample countries in comparison with other selected countries (2004)

[38] The UK Department for Transport used the following measure for estimating Propensity to Fly: The number of return air trips divided by the population (Hanlon 2007).

Turning to employment, the results shown in Table 3.4 are largely inconsistent with the findings of previous work. Airports Council International (2004) concluded, after surveying 142 airports worldwide, that larger airports usually have lower employment densities; that is, a higher number of passengers per employee. The reasons offered for this include the fact that airlines create hubs at larger airports in order to take advantage of economies of scale. Consequently, a larger segment of an airline’s labour force also gravitates towards those hubs, but due to economies of scale operation each additional employee is able to process a higher number of passengers.

Conversely, larger employment densities are expected at smaller regional airports (<5million passengers per annum) given the fact that airlines do not usually base operations there, limiting opportunities for scale economies and diversification into other commercial activities (ICAO 2005). All the sampled Caricom airports have yearly traffic flows of below 5 million but still return quite a high number of passengers per employee (low density). At these types of airports it is not uncommon for employee productivity to be higher than the average regional airport given the additional need to process arriving and departing long-haul aircraft, particularly in the case of tourist destination airports such as Nassau (Bahamas), Barbados and Hewanorra (St. Lucia). Outside the peak periods, it is typical for these destination airports to experience normal traffic levels in accordance with those expected of the average regional airport. Instead of incurring the additional cost of employing extra full-time staff to assist with peak periods, an optimal number of on-site staff is expected to be more productive (process more passengers) in the peak periods and less productive in the off-peak periods. The sample airports that are not considered to be major tourist destinations like Dominica, Guyana and Trinidad & Tobago returned notably higher employment densities in line with the findings of the Airports Council International survey although these airports still had densities that were lower than the global average.

Table 3.4
Airport productivity: Caricom sample countries in comparison with a Global estimate

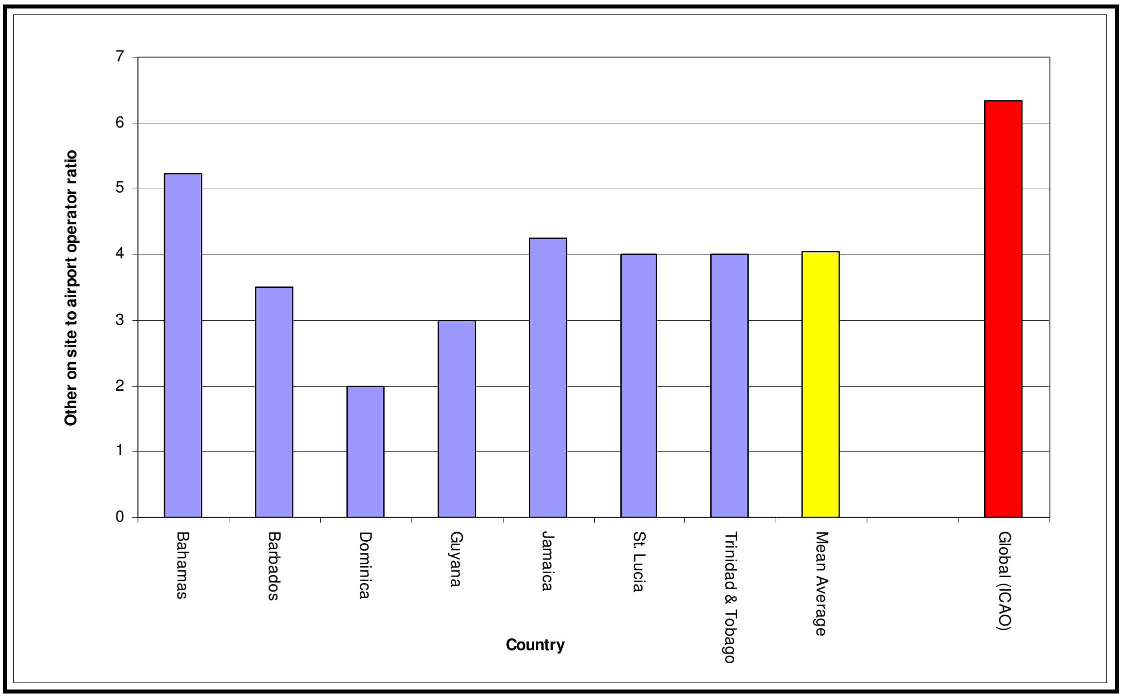
Airport productivity indicator (2006 data)

Member state	No. of passengers	No. of on-site employees	Passengers per employee
Bahamas	2,415,816	1,096	2204.21
Barbados	2,365,000	951	2486.86
Dominica	142,617	135	1056.42
Guyana	480,910	312	1541.38
Jamaica	4,874,000	2,568	1897.98
St. Lucia	914,000	375	2437.33
Trinidad & Tobago	2,364,000	2,011	1175.53
Sample	13,556,343	7,448	
Mean average	1,936,620	1,064	1,820.13
Global (ICAO, IATA)	2,065,000,000	2,200,000	938.64

Source: Caricom airport statistics & employment records (2006), ICAO (2005)
Note: Estimates do not include secondary airport traffic or employment figures for Tobago Crown Point, Dominica Cane Field, or any of the Bahamian secondary airports

Looking at the disaggregate figures, there is also quite a large range of values with Barbados having the lowest employment density at 2,487 passengers per employee and Dominica having the highest density at 1,056 passengers per employee. While Dominica's employment density is higher than the other sampled states, it was still higher than the global average which may, in turn, come into conflict with global findings of the Airports Council International survey (2004). However, it may be accounted for if one considers that there must be a size threshold below which density must again decrease, as a bare minimum amount of positions must be filled for the safe and efficient running of even the smallest airports. This could explain why, for only 142,000 passengers per year, Melville Hall airport employed 135 people directly.

By and large, Figure 3.5 shows that the ratio between airport operator and total on-site employment is smaller for the sampled Caricom states than it is at the global level. For every airport operator there are six other jobs to be filled at a typical airport, whereas in the Caricom region it is estimated that only 3.9 extra jobs are created as a result of the core output provided by the airport operator.

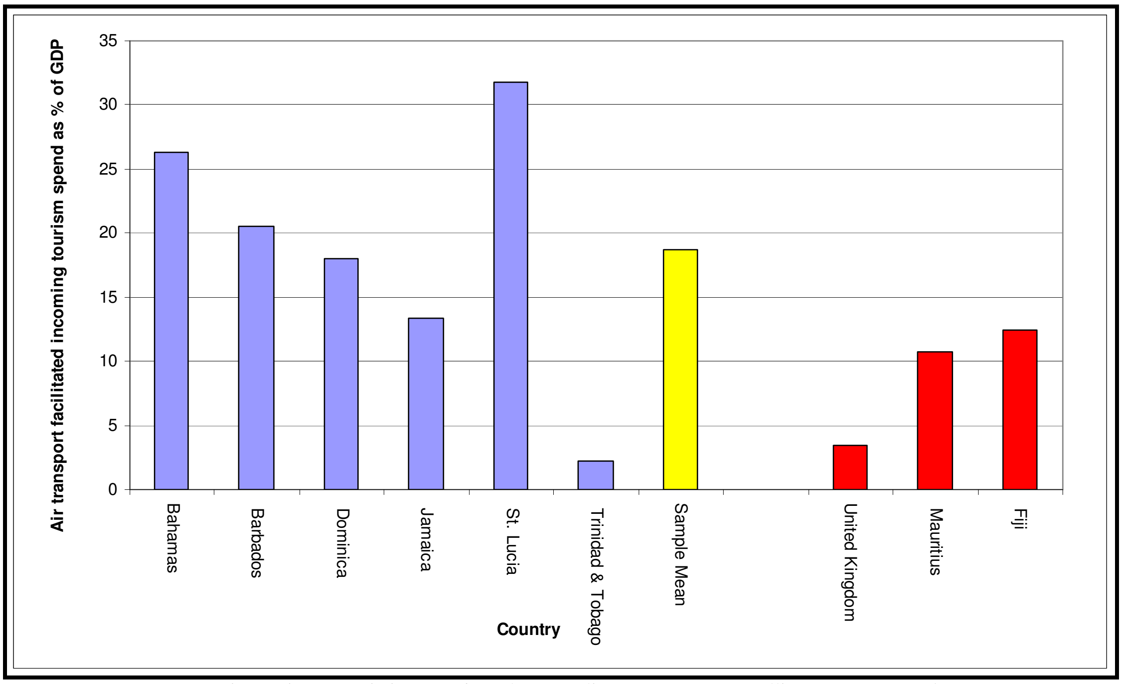


Source: Caricom airport statistics and employment records, ICAO (2005)

Fig. 3.5 Ratio between total on-site airport and airport operator employment

For those Caricom countries with lower on-site employment densities (see Nassau, Bahamas values in Table 3.4 for instance), the on-site employee to airport operator ratio was invariably higher. This resulted from the fact that airport operators at the larger airports in the region had a lower percentage of airport operator staff in comparison to the smaller airports. For instance, in 2006, 25% of Guyana employees worked for the airport operator whereas in the Bahamas it was only 16%. This again supports the argument that there must be a threshold below which airport operators have to hire a disproportionately high number of airport staff in order to ensure all the necessary functions of the airport run effectively. This comparatively high level of airport operator staffing levels contributes to the relatively high employment densities observed for both Dominica and Guyana.

It is also possible, using published tourism data, to retrieve a quantitative snapshot of the catalytic impact of the air transport industry to the region as compared to countries in other regions. Although it could be said that estimates for the Caricom states illustrated in Figure 3.6 are likely to be overestimated, due to the fact that they do not take into account outgoing expenditure flows by Caricom residents travelling to third countries, it does provide a useful initial baseline by which to compare and cross-check the net estimations provided by the passenger survey work undertaken in this study.



Sources: CTO (2003), Caricom airport statistics (2006), Index Mundi (2007), WTTC satellite accounts (2005)
Note: Only accounts for incoming tourist arrivals and hence, incoming flows of expenditure

Fig. 3.6 Gross catalytic impact of incoming tourism (2003)

Moreover, a trend emerges from the CTO data which suggests that small, poorly diversified, tourism dependent island states tend to return the highest expenditure flows facilitated by the provision of air transport services. Trinidad & Tobago, a comparatively large and highly diversified economy does not rely so heavily on tourist expenditures by passengers travelling by air or by any other mode of transport for that matter. Taking the outlier, Trinidad & Tobago out of the sample mean, average expenditure flows as a percentage of real GDP increases to 21.9%. This compares favourably with the catalytic impact of tourism for other island states outside the Caricom region and for the UK.

The other notable omission is that of Guyana which was not covered by the CTO tourist data (2003). Perhaps if Guyana had been included the mean air transport facilitated GDP contribution would have somewhat decreased.

3.2.2. Direct, indirect and induced value of air transport sector

3.2.2.1. Balance of Payment data

In terms of foreign exchange earnings, Table 3.5 shows that the aggregate direct contribution of the sector was positive for all member states net of the import of air transport related services from foreign countries. This includes all airline and on-site airport services where revenues are ultimately repatriated. Montego Bay, the largest airport in the Caricom region and now Nassau, for example, have both been corporatised and are managed by a Canadian firm called Vancouver Airport Services. Also, Girvan (2001) states that up to 70% of the services to and from the region were operated by foreign carriers. This deficit in revenue flows proved to be more than compensated by growth in on-site output as a result of the increase in air services that foreign carriers provided.

Table 3.5
Direct value of Caricom's air transport sector (2000) and home based carrier

Caricom Member Country	BoP surplus (deficit) $USmn	Home based carrier
Bahamas	419.08	Yes
Barbados	58.78	No
Belize*	22.09	Yes
Dominica	1.46	No
Jamaica	337.17	Yes
St. Lucia	44.18	No
Trinidad & Tobago	97.07	Yes
Aggregated Totals	979.83	Yes = 4, No = 3
Mean average	139.97	-

Source: Caricom Secretariat (2002), Trade in Services report.
*Guyana data not available. Belize used as a Caricom substitute (see section 3.1.3 for more detail on cluster sampling)

Also, for those member states that had a national carrier, the direct value of the air transport sector was generally higher than for those states without a flag carrier. The exception to this general rule of thumb was Belize which actually had two national carriers in the year 2000; Maya Air and Tropic Air. However, these airlines concentrated mainly on domestic routes, operating small turboprop aircraft and in 2000 only Guatemala and El Salvador were served as international destinations by local carriers. Tradable output and employment were therefore at minimal levels for Belize and is reflected in its below average BoP result. Barbados returned a notably higher result than the other islands without a national carrier. This could be due to the fact that BWIA and to a lesser extent, LIAT were using Barbados as a sub-regional hub in the year 2000, bringing with it more associated employment and output growth than would normally be the case. Barbados was also a major shareholder of LIAT during this period and although the carrier was plagued by financial losses, aeronautical (landing/parking fees) and non-aeronautical revenues (commercial and car parking expenditure) as well as payments to service providers (airport authority, ground handlers), may have compensated for this deficit. This also appears to have been the case for the Trinidadian, Bahamian and Jamaican air transport sectors with all three having to support poor performing local carriers in the year 2000. Even poor performing airlines, however, can provide a medium by which to increase foreign currency earnings.

Finally, the Bahamas and Jamaica returned higher than average results. This could be related to the medium to high number of tourists passing through the terminal buildings in the year 2000. Generally speaking, incoming tourists provide a major source of commercial airport revenues and these high foreign exchange earnings can often have a marked positive effect on the net direct contribution of the industry.

3.2.2.2. National Account data (Trinidad & Tobago and Barbados only)

In order to validate the results shown in Table 3.5, Barbados and Trinidad & Tobago BoP data values were compared to the national account values shown below. It is found that they are broadly consistent with each other, especially if one takes into account the time and classification differences. In line with the impact classification laid out in the methodology section (3.1.2.), results from Table 3.6 can be loosely said to cover both direct and indirect contributions given the introduction of off-site providers such as travel agencies, cargo handlers as well as outbased airline offices and tour representatives (with airlines or package companies). This could help to explain the higher values shown for Trinidad & Tobago, as indirect entries were not accounted for by the BoP data. However, the variation in the Barbados result cannot be explained by a broadening of impact providers given that the direct/indirect value is actually lower than the direct value shown in Table 3.5. The inference here, therefore, is that the continued subsidy of poor performing LIAT between 2000 and 2005 may have resulted in a lower direct contribution (US$3.86 million). Cyclical events and external factors may have also had a distorting influence on impact levels.

Table 3.6
National account extract for Barbados and Trinidad & Tobago (2005)

Caricom state	Sector	Sector components	Constant Prices (US$mn)	Full time jobs
Barbados	Air Transport (Airlines only)		3.86	255
	Supporting and auxiliary services		35.90	2,370
		Cargo handling	7.81	515
		Storage and warehousing	0.77	51
		Airport services and other support	8.79	581
		Travel agencies, tour companies etc.	18.53	1,223
	Total Barbados		39.76 (0.92% of GDP)	2,625
Trinidad & Tobago	Air Transport (Airlines only)		84.33	1,507
	Supporting and auxiliary services		158.42	2,835
		Cargo handling	61.45	1,100
		Storage and warehousing	5.45	98
		Airport services and other support	22.80	406
		Travel agencies, tour companies etc.	68.72	1,231
	Total Trinidad & Tobago		242.75 (1.78% of GDP)	4,342

Source: Barbados and Trinidad & Tobago statistical service (Central Banks)
Note: Disaggregated employment values were estimated iteratively using ratios between GAV's of different sector components

The air transport sector in Trinidad & Tobago contributed 1.78% to GDP whereas in Barbados the figure was at 0.92%. To help account for this difference it is important to contrast disaggregate impact ratios between Barbados and Trinidad. First, having a flag carrier meant that Trinidad & Tobago has invested in freight and technical facilities. BWIA's maintenance and cargo facilities have always been based in and around Piarco International Airport (POS). In addition, Caribbean Star opened a small crew and maintenance facility at Piarco in 2005, which was later incorporated into the merged LIAT entity. These facilities partly explain the direct (airline) and indirect (cargo handling) GAV differentials as shown in Table 3.6. For Barbados, a larger proportion (46%) of aggregate GAV is provided by travel agents and tour operators reflecting a higher level of tourist and visitor activity taking place outside the airport vicinity. Airport authority, ground handling, air traffic control, customs, excise, immigration, and airport security[39] services seem to have a disproportional contribution to aggregate GAV when calculated for both case-study countries. This could be because in Trinidad there is a much higher number of on-site airline staff, whereas in Barbados a higher proportion of airline ground operations are outsourced to Ground Handlers. In Barbados, airport service providers accounted for 22% of total direct and indirect GAV whereas in Trinidad this figure was only 9%.

[39] Shown in the national accounts under the subheading "Airport services and other support".

In Trinidad & Tobago, every full time air transport employee added US$55,907 towards GDP whereas the amount for Barbados was US$15,147 per employee. This broadly corresponds to the fact that Trinidad & Tobago had a greater direct GAV where it can be assumed that 100% of employee input contributes towards the production of air transport services, while a proportion of indirect provider input would logically leak into other sectors (e.g. the hotel or hospitality sector). Pro rata, it also signifies a greater dependence of the Barbadian labour force on the existence of air transport services and perhaps an indication of greater employee productivity within the air transport sector of Trinidad & Tobago.

3.2.3. Primary evidence: Supplier probe

3.2.3.1. Barbados Grantley Adams airport: Introduction

Grantley Adams, located 13 kilometres east of the capital Bridgetown, is the main and only airport on the small island of Barbados. With yearly passenger flows of over 2.3 million (2006) it is also one of the principal gateways for the southern and eastern Caribbean acting as a mini-hub for connecting traffic between Europe and points from Antigua in the north to Guyana in the south, as well as the more traditional point to point tourist and VFR traffic travelling to and from destinations across North America and the UK.

A newly expanded and refurbished terminal building along with the corporatisation of the airport operator (GAIA Inc.) stands Barbados in good stead for enhancing passenger flows and economic impact levels well into the next decade. The recent opening of a Concorde museum within the western perimeter of the airport is also forecast to boost on-site economic activity and employment.

3.2.3.2. Trinidad & Tobago's Piarco airport: Introduction

With approximately 90% of Trinidad & Tobago's international air traffic it can be concluded that Piarco International Airport serves as the twin island nation's major airport. Crown Point international based on Trinidad's sister island of Tobago does receive a notable amount of domestic traffic (0.6 million) and some international tourist traffic every year (0.2 million), but as it came under the auspices of the same airport authority and given that all domestic traffic originated from Port of Spain, it was deemed superfluous to treat Crown Point as a separate entity.

Piarco is a strategically placed mini-hub airport for the southern Caribbean region. It is located 25 kilometres from the island's capital Port of Spain. It sports a modern two tier terminal building equipped with 14 jet bridges, a runway long enough to handle any aircraft and is the base of flag carrier Caribbean Airlines[40]. With Trinidad being the largest oil producing country in the region, Piarco boasts competitive fuel rates, which, when combined with its ability to handle any aircraft gauge, makes it an attractive stop off point for carriers wishing to take advantage of the lower rates. The headquarters of the Free Trade Areas of the Americas (FTAA) is also to be based in Port of Spain and it is already home to the Association of Caribbean States (ACS), decisions possibly influenced by the fact that 18 passenger and 27 freight destinations are served from Piarco international airport both within the wider Caribbean region and beyond.

The scale of operations at Piarco makes it a major employer and economic driver for the Trinidad & Tobago economy. It is one of only 38 organisations (out of a total of 19,216) to facilitate the on-site employment of more than 500 persons (Trinidad & Tobago Central Statistics Office 2004).

3.2.3.3. Supplier probe results

Due to expenditure leakages in the form of capital or infrastructure investment and the associated importation of intellectual property, construction material and technology, the gross on-site and off-site expenditures as presented in Tables 3.7(a) and 3.7(b) have to be netted before being inputted into the national accounts as additional wealth creation for an economy (See Table 3.6). Thus, the fist notable observation from Table 3.7(a) is that airline and ancillary expenditure figures are significantly higher than the GAV figures as shown by the secondary data in Table 3.6. For Barbados, capital or infrastructure import leakages occur more frequently due to the island's poor industrial diversity. On the other hand, Trinidad is traditionally an export intensive country due to its wide ranging manufacturing base. The expenditure leakages in this case are not so marked if one compares total airline, airport authority and ground handling expenditures (Table 3.7(b)) in relation to their GAV figures presented in Table 3.6. Despite the leakages in Barbados a sizeable quantity of expenditure clearly flows down the air transport supply chains in both Trinidad and

[40] Formerly known as British West Indian Airlines (BWIA) until January 1st 2007.

Barbados. Airlines, whether foreign or home based, spent 132 and 70 million US dollars respectively in the form of landing/parking fees, payments to ground handling agents, airport space rentals and so forth. This expenditure trickles into the economy through expenditure on further off-site intermediate products and more importantly in the form of employee income. US$19.1 and US$42 million for Barbados and Trinidad respectively were put back into all sectors of the economy in the form of spending and savings and, although there may also be some income leakages through individual importing, it is important to account for this induced contribution which has not been included in the national account data.

Using the representative supplier probe sample, an estimation of total population income generation was derived from the computed average income per organisation. For Trinidad this equated to a total income generation of around US$150 million for the year 2006 whereas in Barbados it was valued at US$48.86 million. Net of any household leakages in the form of product and service imports, these values form an estimation of the induced impact of the sector to Trinidad and Barbados in extra internal spending and savings.

Table 3.7(a)
Barbados international airport supplier probe (BGI)

Account item (US$mn)	Airlines (n=9)		Airport authority (n=1)		Ground handling agents (n=2)		Travel agency (n=1)		Catering supp. (n=1)	
Department location	On site	Off site	On site	Off site	On site	Off site	On site	Off site	On site	Off site
Spending on inter. goods	70	12	12	0	2	1	0	3	0	2
Spending on investment	5	8	81	0	2	1	0	7	1	0
Wages/Salaries	3	2	5	0	6	0.2	0	2	0.3	0.6
Government taxes	13	3	7	0	1	0.5	0	1	0.2	0.3
Total expenditure	91	25	105	0	11	2.7	0	13	1.5	2.9
Jobs created	126	84	211	0	174	15	0	78	12	22

Note: All passenger and freight airlines with base, secondary hub or regional offices were included in sample

Table 3.7(b)
Trinidad international airport supplier probe (POS)

Account item (US$mn)	Airlines (n=9)		Airport authority (n=1)		Ground handling agents (n=2)		Travel agency (n=1)		Clothing supplier (n=1)	
Department location	On site	Off site	On site	Off site	On site	Off site	On site	Off site	On site	Off site
Spending on inter. goods	132	23	51	0	5	4	0	3	5	1
Spending on investment	12	31	28	0	1	2	0	2	7	0
Wages/Salaries	14	15	4	0	4	0.5	0	2.5	0.2	1.8
Government taxes	25	9	13	0	1	1	0	1	2	0.2
Total expenditure	183	78	79	0	11	7.5	0	8.5	14.2	3
Jobs created	682	738	160	0	214	22	0	95	6	56

Note: All passenger and freight airlines with base, secondary hub or regional offices were included in sample

Despite the fact that a sizeable proportion of infrastructure expenditure does not convert into GAV in the national accounts, the return on investment for most capital expenditure more than compensates for the initial outlay, facilitating extra employment and economic activity in the long run. For example, the investment of a new clothing shop in the terminal area at Piarco airport facilitated 56 new jobs from small local producers. This enabled the opening of an international marketing and distribution channel for small businesses which could result in further exporting of Trinidadian products in the future.

It is important to note that as the business activity moves further away from the customer, the sample size drastically reduces along with its representativeness of the supplier population. As an illustration, it is thought that there are up to 30 travel agents acting as service providers for the airlines and the airport in Barbados, but only one was targeted for telephone interviews. The sample spread was purposefully skewed towards direct and indirect contribution, however, in order to reduce the risk of double counting induced expenditures, which are frequently claimed by a number of different sectors (e.g. the travel and tourism sector). What was of equal importance was the statistical validity of the overall supplier probe sample sizes to a reasonable degree of confidence.

Further, the supplier probe was considered to be a useful in the sense that it provided evidence suggesting that small island airports are also capable of supporting and facilitating extensive, and far reaching supply chains, and that the induced impact from employee income/wages is a significant contributor that must be accounted for in a thorough impact assessment.

Another benefit emanating from the existence of an airport is that of fiscal revenues. The passenger/corporation taxes partially accounted for in Table 3.7(a), for example, enabled the Barbados government to set aside a budget for an ambitious airport expansion project which would stimulate further demand and consequently extra supply chain activity. Tax entries were not included in the GDP contribution data (GAV) as fiscal revenues are usually pumped back into an economy in the form of capital investment, but they should be mentioned with reference to the output stimulation they can potentially generate. Table 3.8 shows that an expansion project itself creates a hive of employment and expenditure activity. Given Barbados' small and poorly diversified labour market, international suppliers had to be contracted to ensure the establishment of world class facilities. Having said that, US$17.75 million was still distributed between local providers, creating 167 extra jobs in the process. The other advantage was that, as local and international corporations worked together to deliver the project, best practice and knowledge transfer assisted local Barbadian businesses in producing more efficient and competitive levels of output.

Table 3.8
Grantley Adams international airport expansion project budget sheet (2004-2007)

	Allocation of expenditure ($US mn)		Allocation of expenditure ($US mn)		Allocation of expenditure ($US mn)
Intial Government Budget	**100**				
Architects	**20**				
Queens Quay - Canada					
Main Contractor	**80** →	**Main constructor and sub contractor**	**71** →	**Electrical and Mechanical Engineers**	**10**
Sypher Mueller International	3.5	**E Pihl & Sons - Denmark**	11.5	Broudum - Canada	7
		Main quantity surveyor		Everson & Elcock - Barbados	2
		Cooper Kaufman - Barbados	4	ESSCO - Barbados	1
		Main lawyers and underwriters			
		Chancery Chambers - Barbados	1	**Construction engineering**	**6**
		Local engineering fees	**0.5**	CEP Engineering - Barbados	1.25
				CES Construction Engineering - USA	5
				Baggage Handling systems	**4.5**
				Glidepath Handling Systems - New Zealand	4.5
				Steel and tint structures	**9**
Total Expenses to local providers			**17.75**	Bird Air - USA	9
Total Expenses to foreign providers			**82.25**		
				Lift installation	**1.5**
Total Local employment generated by project			***167***	Lift Co. - Barbados	1.5
Total external employment generated by project			***250***		
				Terminal check-in and finishes	**4**
				Terminal frame Ltd. - Canada	4
				Wages/Salaries - local	**2**
				Wages/Salaries - external	**5**
				Extra materials - Locally provided	**4.5**
				Extra materials (externally provided)	**13**

Source: Data retrieved from telephone interviews with relevant firm accounts departments

Table 3.9 classifies the primary and secondary data into categories in line with the four impact measures laid out in the methodology section. For comparative purposes, data for the year 2000 has been included for Vancouver airport (YVR), Canada. When induced impact data is included along with the direct and indirect impact values from the national account data, it is evident that the existence of BGI and POS contributes significantly in terms of output and employment. As expected, direct impact at BGI and to a lesser extent at POS is not as marked as indirect and induced impact combined when compared to values originating from larger airports like Vancouver. This results in a larger multiplier for the sampled Caricom countries. The GAV multiplier for Barbados was calculated at 3.38, whereas for Trinidad it is significantly lower at 1.52, due primarily to the presence of Caribbean Airlines, which uses POS as its primary hub and operational base. For Vancouver, on the other hand, the multiplier value was below 1 at 0.74 showing that on-site output alone made a significant contribution to GDP. Employment multipliers were largely consistent with GAV multipliers for both supplier probe case studies.

Table 3.9
Supplier probe aggregate expenditure/employment as % of GDP (2005/6)

Impact measure	GAV	(%)	Employment	(%)	GAV (% of GDP)	Employ. (% labour force)
Direct	13.42	15.1	951	15.0	0.31	0.74
Indirect	26.34	29.7	2,370	37.7	0.55	1.84
Induced	48.86	55.1	2,958	47.1	1.01	2.30
Sub Total (BGI)	88.62	100	6,279	100	1.87	4.88
Direct	112.58	28.7	2,011	28.9	0.62	0.62
Indirect	130.17	33.1	2,325	32.9	0.72	0.40
Induced	150.00	38.2	2,679	38.1	0.83	0.16
Sub total (POS)	392.75	100	7,015	100	2.17	0.91
Grand Total	481.37	100	15,427	100	2.02	2.90
Direct	1,449.25	57.6	26,053	43.4	0.15	0.17
Indirect	447.10	17.8	14,694	24.6	0.05	0.10
Induced	618.80	24.6	19,097	32.0	0.07	0.12
Total (YVR)	2,515.15	100	59,844	100	0.27	0.39

Source: Caricom Secretariat (2002), Central Banks (2006) and data retrieved from telephone interviews with relevant accounts departments

A much larger segment of the Barbadian workforce is involved in the output of transport services than is the case for Trinidad & Tobago. This is perhaps due to the fact that Trinidad has a much more diverse economic base which is not dependent directly or indirectly on tourism, while a much larger percentage of the Barbadian workforce apportions notable contributions of work time and effort towards the end product of interest. The YVR contribution to national GDP and employment can be slightly misleading as Vancouver is one of only a number of airports which would have contributed to national output and expenditure in the year 2000. However, as one of the three major gateways in Canada, it does help to reinforce the point that BGI and POS like many other islands in the region are significant national assets whose effects reverberate around a larger section of society than it does in much larger economies.

3.2.4. Catalytic impacts: air passenger and business survey evidence

In addition to the direct, indirect and induced measurements, it is important to consider the catalytic impact of the air transport sector to the region both quantitatively and qualitatively. Quantitative estimations were largely performed by introducing a scaling factor to an extensive passenger and business survey, developed for the seven sampled Caricom member states. Yearly traffic flows differentials[41] were selected as a suitable factor for scaling (2006), which made annual estimates possible from the survey sample.

3.2.4.1. Facilitation of expenditure

Although invariably there are competing claims within an economy as to which sector(s) are to be credited with incoming visitor expenditure, it is important to consider the possible magnitude of expenditure facilitation when attempting to undertake an extended approach to the sector's socio-economic impact. It can be assumed therefore that non-apportioned visitor expenditure as estimated in this study equates to the maximum possible contribution or upper impact limit of net airport user expenditures in the wider economy[42].

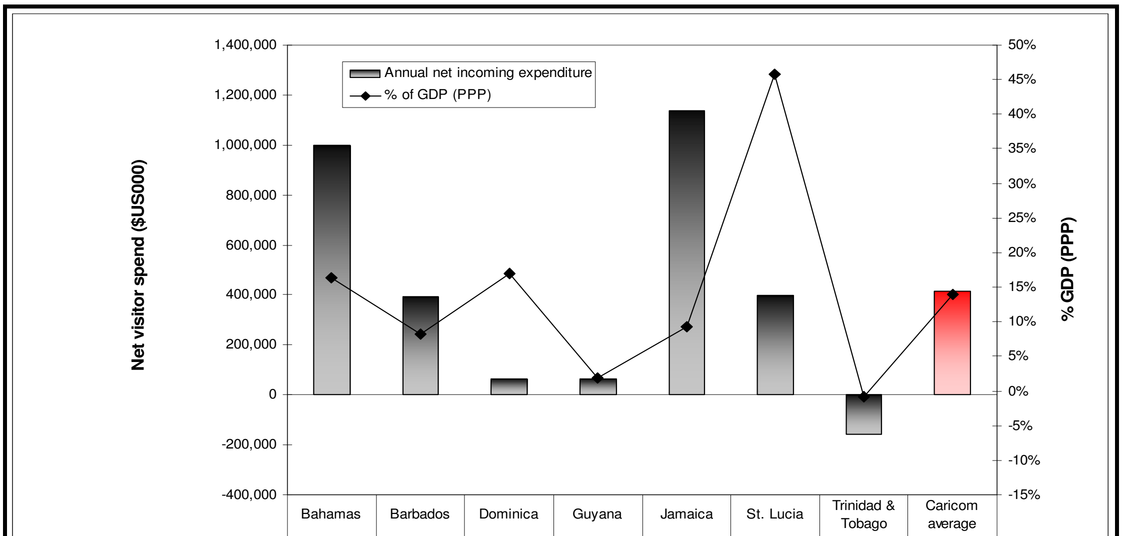
As predicted, the aggregate Caricom passenger survey results showed a net surplus of air transport user expenditure (Figure 3.7). This was supported by an approximate incoming traffic ratio of 70%. Moreover, outgoing local respondents tended to spend less per night than incoming foreign visitors. This served to increase

[41] Annual airline traffic flow data were used to scale airline revenue estimations.
[42] Note, however, that marginal contributions in terms of crew and general aviation visitor spend have been included in catalytic impact studies at other airports (e.g. Los Angeles, USA) yet they have not for this study.

the net incoming expenditure result further. Despite a high Caricom average, which was estimated at over US$400 million, disaggregated results show a high variability among the sampled states. Trinidad & Tobago was the only sampled state to return a net deficit, but due to the relatively small contribution of tourism spend to GDP (PPP), this deficit affected GDP by less than 1%. On the other hand, total visitor spend in St. Lucia was below average in absolute terms but this impact equated to approximately 46% of GDP (2006). This may be explained by the relatively high importance of visitor expenditure to the small island's economy when compared to the larger, diversified economies of Trinidad & Tobago and Jamaica. However, sampling error may have also contributed to what appears to be an overstated estimate. Only 14% of responses gathered in St. Lucia were local residents but according to St. Lucia airport authority statistics for the year 2006, as much as 34% of travellers were outgoing St. Lucian residents (St. Lucia Air and Sea Ports Authority 2007)[43].

On aggregate, air transport facilitated the earning of foreign exchange which was the equivalent to 13.9% of aggregate GDP. The observed variation among the sampled states is largely in keeping with the gross results provided by the CTO (2003). This adds a certain amount of credibility both to the sampling technique adopted for the passenger survey and also to the scaling factor used to establish annual estimations. As expected, controlling for outgoing expenditure can be cited as the main factor explaining the 5% reduction below the 2003 CTO aggregate estimates. If factors such as inflation and cyclical growth are also taken into account the true net impact reduction may be higher.

[43] The remaining member states reported more credible expenditure results, however, adding weight to the overall quality of the stratified sampling method undertaken for the Caricom passenger survey.



	Bahamas	Barbados	Dominica	Guyana	Jamaica	St. Lucia	Trinidad & Tobago	Caricom average
Annual net incoming expenditure	998,134	394,361	65,376	65,057	1,136,366	396,811	-158,284	413,975
% of GDP (PPP)	16.35%	8.19%	17.02%	1.89%	9.33%	45.82%	-0.87%	13.96%

Note: To arrive at annual net impact estimates, a scaling factor was derived from the ratio between the sample number of observations and their net incoming expenditure. A multiple was then applied using 2006 net yearly incoming passenger arrivals

Fig.3.7 Net incoming visitor expenditure (2006) and % contribution to GDP

Nevertheless, it is important not to cross-check results too literally given the time difference between the survey data and CTO data (3 years) along with possible differences in the sampling techniques used. In other words, if a CTO survey was repeated in 2006, using a similar set of sampling methods, it is likely that there would be more of a convergence in net impact estimations.

3.2.4.2. Consumer surplus

In accordance with Pearce's (2005) extended value creation model, it was considered important to test the sampled Caricom member state airfares for customer value. Value net of ticket cost is termed consumer surplus, which, when every individual in a market is sampled, measures the portion of a downward sloping demand curve that would have paid more than the price they were actually offered. This information was elicited in the main passenger survey by asking how much more each respondent was willing to pay on top of the airfare actually paid (Question 13(b) Appendix E). This question was split into eight intervals including a 0% option with the percentage mid-point of each interval multiplied by the original airfare to obtain an estimate of consumer surplus in US dollars (see Question 13(c) Appendix E). This value is frequently converted into extra expenditure at a destination, or further business travel which otherwise would not have taken place if air carriers were to capture every individual's consumer value. For this reason it is inextricably linked to the catalytic or spin-off effects of the provision of air services.

Table 3.10
Net consumer surplus segmented into type of resident, carrier and route

Explanatory variable	Net consumer surplus per passenger (US$)
Caricom resident (n=219)	108.26
Foreign resident (n=259)	176.87
Caricom average (n=478)	144.31
Caricom carrier (n=215)	98.39
Foreign carrier (n=187)	149.36
Caricom and foreign carrier combined (n=76)	261.79
Caricom average (n=478)	144.31
Intra-regional routes (n=121)	81.96
Extra-regional routes (n=357)	206.66
Caricom average (n=478)	144.31

Source: Caricom passenger survey
Note: *n* is greater than the total number of survey responses. This is because some responses consisted of groups or families covering multiple airfares. Sub-fields may not work out into the exact Caricom average due to rounding errors

Table 3.10 illustrates that overall, surveyed passengers would be prepared to pay US$144.31 on top of the airfares they actually paid. However, a significant variation is evident when the aggregate results are broken down and tested using different market segments. Respondents of Caricom residence placed less additional value onto their air tickets than foreign residents did. This could be explained by the respective differences in disposable incomes in addition to the higher airfares being charged to local travellers. Respondents making interline connections with both a Caricom and a foreign carrier gained the highest amount of consumer surplus. In order for a passenger to go through the inconvenience of purchasing multiple fares and connection waiting times, a high level of demand inelasticity is assumed. The practise of interlining may be a more viable alternative in the US, for example, where there is often a critical mass of frequencies and airline co-operation. In many cases this level of convenience does not exist in the Caribbean, adding weight to the idea that passengers interlining in the Caribbean must place higher values on their journeys.

Although not shown in Table 3.10, the survey results suggest that Caricom travellers, when the option is available to do so, usually choose to travel with regional carriers as opposed to foreign carriers and vice versa, reflected by the fact that only 35% of respondents chose to import air services from foreign carriers (see Figure 3.8 for a more in depth import ratio analysis). Consequently, the relationship between consumer surplus by place of residence and consumer surplus by air carrier could be commented upon to a reasonable degree of confidence given that the majority of respondents (65%) were not importing air services (i.e. they were purchasing local carrier tickets). As expected, those respondents who did travel with Caricom carriers also had a lower consumer surplus than those who travelled by foreign carrier. As distances are much lower for Intra-regional routes and regional carriers are normally the only option for Caricom residents, perhaps airfares appear unnecessarily high, resulting in a lower willingness to pay. On international routes with choice, local travellers generally continue to choose to travel with regional carriers despite the fact that the survey results suggest higher fares than those offered by competing foreign carriers. It may be the custom or norm for Caricom customers to avoid importing air services. Loyalty programmes offered by Air Jamaica, BWIA and LIAT may have also prevented carrier switching to a certain extent.

Value placed on air travel is highly dependent on an individual’s elasticity of demand. Typically, if a journey is considered necessary or indispensable then an individual would be prepared to pay almost any price in order to travel. The opposite is the case for unnecessary journeys. In the air transport industry these different types of journey are loosely categorised into business and leisure. For the Caricom survey analysis, purpose of visit was broken down further into an additional three categories (VFR, private ceremony and education/study). By and large, the elasticity hypothesis holds for the Caricom survey, thereby adding strength to the survey’s sample. For the most indispensable journeys consumer surplus was US$299.45 and for the most elastic journeys (i.e. holiday travellers have many destination substitutes even though they may value their holiday as highly as a business trip) value decreased to US$104.97. As a high ratio of survey respondents cited that their main purpose of visit was a holiday, this result had a significant impact on the aggregate surplus results (US$144.31). Perhaps the only surprising result was the VFR finding. However, as special family events like weddings, funerals, honeymoons etc. were put into a different category, it is possible that what was left in the VFR classification was regarded by many respondents as more dispensable perhaps than other types of journey.

The consumer surplus results were based on actual market data. That is, airline and flight service attributes could not be hypothesized in order to estimate the types of service that would maximise or minimise consumer surplus as is the case with a Stated Preference (SP) type survey. Thus, using a Revealed Preference (RP) consumer surplus question meant that a limited number of service attributes could be evaluated. On the other hand, as every respondent had already made a choice regarding the purchase of his/her flight, a higher level of knowledge was assumed given that such a decision would involve an expense whereas in the hypothetical scenario it would not. This included knowledge of actual travel alternatives and their associated convenience and service levels.

3.2.4.3. Producer financial performance

While the passenger survey mainly looked to capture catalytic flows of expenditure, it was also possible, using the sample's airfare data, to quantify the gross direct impact of local carrier revenues. In order to calibrate the ratios into annual prediction, yearly airline traffic flows were used as the selected scaling factor[44]. The predicted estimates were then compared to actual 2006 operational revenue data as reported by IATA to obtain an estimated sampling error. Net financial results provided in annual airline reports are then divided into the actual operational results to arrive at a net margin estimate for the year 2006. As no air carrier cost information was captured by the passenger survey, it was not possible to cross-check the reliability of producer impacts in terms of profit (loss). The results for a selection of local carriers are presented below in Table 3.11.

Overall, it is estimated that in the year 2006 Caricom carriers (producers) earned over US$815 million. But as indicated by the national account data and the recently well publicised financial problems of the regions main carriers, the vast majority of this income did not turn directly into Gross Added Value in the form of profits, but it did contribute to a substantial amount of intermediate product spending which in turn would have added value to GDP and the general economic development of the Caricom countries in question. Two general aviation charter carriers from St. Lucia (DEL) and Guyana (Roraima) were captured by the survey but their annual

[44] Total annual passenger flows by airline were used instead of total annual passenger flows by airport to better reflect actual yearly revenues to Caricom carriers.

contribution to revenues is predicted to be both marginal and inaccurate given the small number of respondents citing the use of these airlines. What it does highlight, however, is that the main regional carriers are not entirely responsible for the region's social obligation as there are a certain number of small commercial operators willing to serve the region's remoter routes. A large part of Guyana's rainforest interior, for example, is dependent upon Roraima airways for its social inclusion with the rest of the country.

Table 3.11
Local carrier financial performance data (2006)

Country of origin	Carrier	Predicted ops revenue ($USmn)	Actual ops revenue ($USmn)	Net profit (loss) 2006	Net margin (%) 2006
Trinidad & Tobago	BWIA	314.14	220.10	(50.0)	-22.72
Antigua & Barbuda	Caribbean Star/Sun	99.28	62.40	-	-
Antigua & Barbuda	LIAT	100.80	58.60	(20.0)	-34.12
Jamaica	Air Jamaica	471.54	393.20	(128.0)	-32.55
Bahamas	Bahamasair	106.70	71.60	(17.9)	-24.57
Bahamas	Western	4.35	-	-	-
Guyana	Roraima	3.93	-	-	-
St. Lucia	Helenair Caribbean	0.87	-	-	-
Total (Caricom carriers)	-	1,101.61	815.05	(215.9)	-26.49

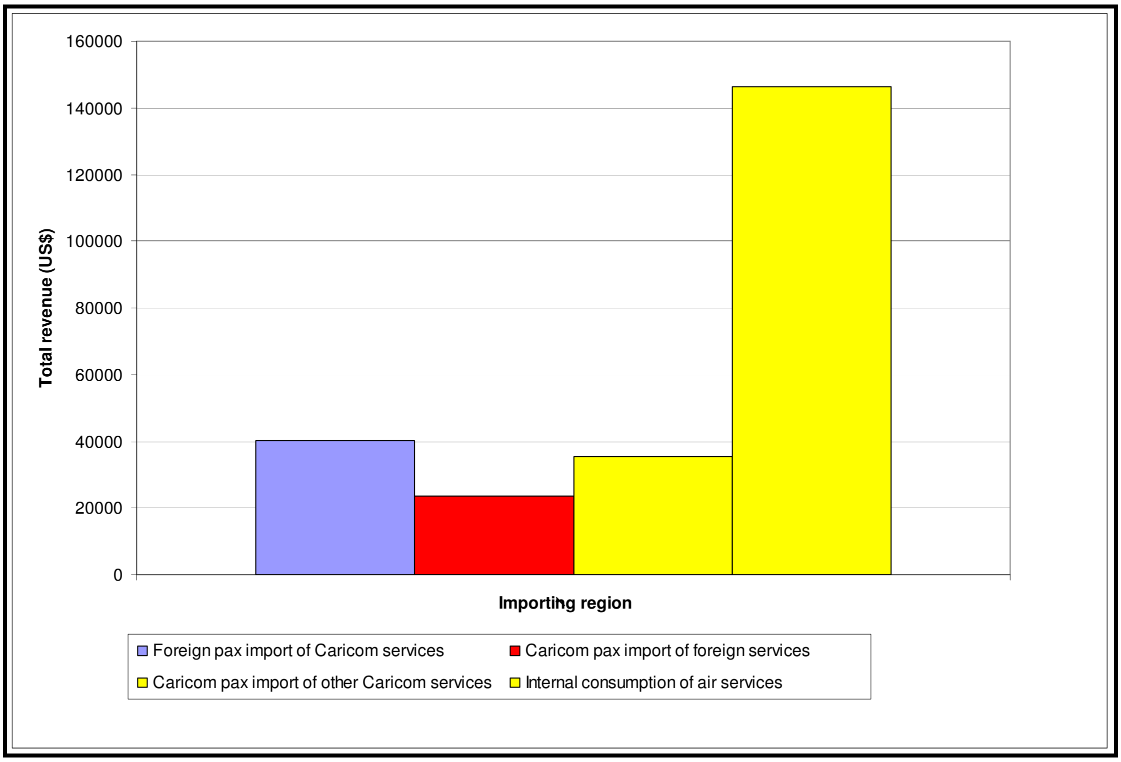
Source: Caricom carrier passenger statistics (ICAO data), IATA financial statistics, airline annual reports, ATI
Note: Carriers Helenair Caribbean and Roraima provide general aviation charters. They do not constitute national carriers, which are comprised of commercial charter or scheduled carriers

With an estimated sampling error of 26.1%, we can see that the sample aggregates have overestimated actual revenues earned in 2006. This error is relatively constant across the range of individual carriers, however, which can be explained by the nature of the scaling factor. The annual passenger traffic volumes provided by ICAO count connecting and in-transit passengers as separate entries leading to the double counting of airfares for these classes of passenger. As the bulk of Caricom traffic is direct, non-connecting traffic, however, the survey revenue estimates are still fairly reliable when ICAO traffic statistics are used as the scaling factor.

As expected, the survey results revealed that total foreign carrier revenue was in excess of local carrier revenue despite the fact that less foreign carrier respondents were surveyed. This is reflected by the fact that foreign carriers boast a larger share of the more lucrative medium to long haul routes. Although unit revenues on these extra-Caribbean routes were found to be lower, total revenue is greater when sector distance is taken into account.

3.2.4.4. Level of carrier importation

Figure 3.8 shows that a large majority of air transport to and from the Caricom region is consumed internally with over US$140,000 of revenue being spent on carriers based in the respondents' country of residence. Moreover, around US$37,000 of airfares were purchased from Caricom country carriers by residents of other Caricom countries. If this is also considered, for the purposes of this study to be internal consumption, then only 35% of all surveyed respondents cited that they were travelling with a foreign carrier. Of those surveyed passengers who were importing, the majority were foreign passengers who were purchasing Caricom carrier tickets, many of whom were making interline connections into St. Vincent, Dominica, Grenada, Trinidad & Tobago and Guyana. Such passenger loyalty to home carriers may be due to the presence of quite established frequent flyer programmes or to an air carrier's competitive advantage in home country marketing and distribution channels. Whatever the cause, it is found that the effect of the exporting and importing of airfares on net expenditure flows is somewhat marginal. What is of more significance in macroeconomic terms is the export and import of tourism and other services once travellers have arrived at their destinations.



Source: Caricom passenger survey

Fig. 3.8 The importing of air services to/from the region by Caricom country and foreign country residents

To further support evidence pertaining to the partial impact of airfares in relation to air transport facilitated expenditure in the wider economy, the ratio between airfare and total trip expenditure is provided in Table 3.12 (below), disaggregated for the seven sampled member states.

Table 3.12
Ratio of airfare to total trip expenditure per passenger by Caricom member state (2006)

Member State	Air fare expenditure	Other expenditure	Expenditure ratio
Jamaica	57,958	76,892	1.32
Bahamas	59,820	116,064	1.94
Trinidad & Tobago	48,939	62,065	1.26
Barbados	32,406	77,859	2.40
St. Lucia	57,940	97,670	1.68
Guyana	39,151	93,699	2.39
Dominica	20,714	59,493	2.87
Caricom total (n=7)	316,928	583,742	1.84

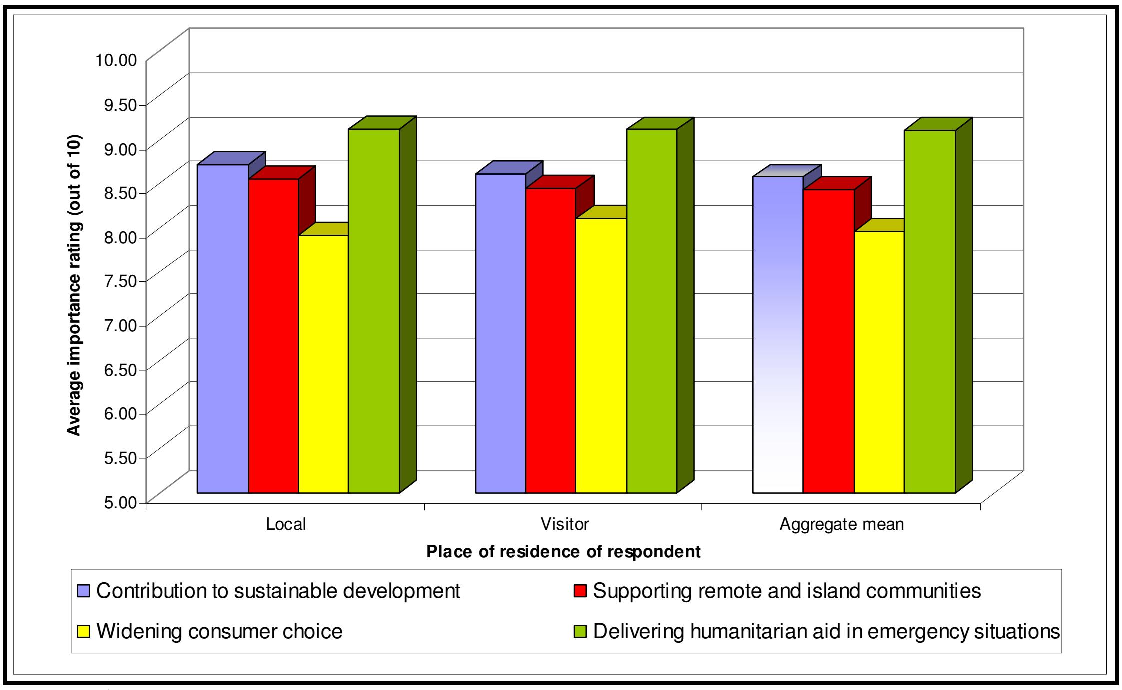
Source: Caricom passenger survey

Inevitably, internal expenditures on airfares were much higher than domestic visitor expenditures given that the majority of respondents were travelling to international destinations. Accordingly, Table 3.12 must be read under the proviso that approximately 57% of the shown airfare expenditure was neither imported nor exported, whereas the vast majority of destination expenditure can, of course, be directly converted into foreign exchange earnings, either by foreign visitors in Caricom countries or vice versa. Even so, the aggregate expenditure to air fare ratio is 1.84, indicating that for every dollar spent on airfares 84 additional cents are distributed into the wider economy in the form of *inter alia* hotel, ground transport, entertainment and shopping expenses.

For Trinidad & Tobago, airfares form a significant part of overall expenses in comparison to other member states. Although much of the airfare expenditure converted into revenues for home based carriers, it is also possible that airfares are atypically high for services to/from Trinidad & Tobago or additional tourism expenditure is uncharacteristically low. On the other hand, the Bahamas, Barbados, Guyana and Dominica all returned significant ratios supporting the idea that, for these countries, the economic impact of the industry with regard to its role in facilitating wider expenditure should be seriously considered in any producer/consumer trade off analysis.

3.2.4.5. Social value of air transport sector to region: Qualitative evidence

On aggregate, both local and visitor respondents confirmed that they highly valued the air transport sector's role in facilitating social and economic prosperity in the region. Respondents were aware that the importance rating was supposed to be given relative to the role other sectors would have on the four revealed socio-economic indicators. Although it was not possible for most respondents to consider all other socio-economic influences simultaneously, the survey results shown in Figure 3.9 are still unanimously positive regarding the sector's wider impacts on the region's economy. Its function concerning the delivery of humanitarian aid is consistently indispensable in accordance with both local and visitor survey respondents (mean average of 9.11 out of 10). It was also believed that, for the region to develop equitably in accordance with the goals of the Caricom Single Market and Economy (CSME), good levels of mobility and connectivity between the various member states are imperative. As local travellers were generally more knowledgeable about regional issues than visitors, the contribution to regional sustainability rating turned out to be 1% higher for locals. Conversely, visitors who generally have access to higher levels of disposable income were largely more agreeable to the consumer choice question. It can be said that locals are not quite as accustomed to such high levels of travel consumption for leisure purposes and thus the value placed on this indicator was not as high as the visitor rating.

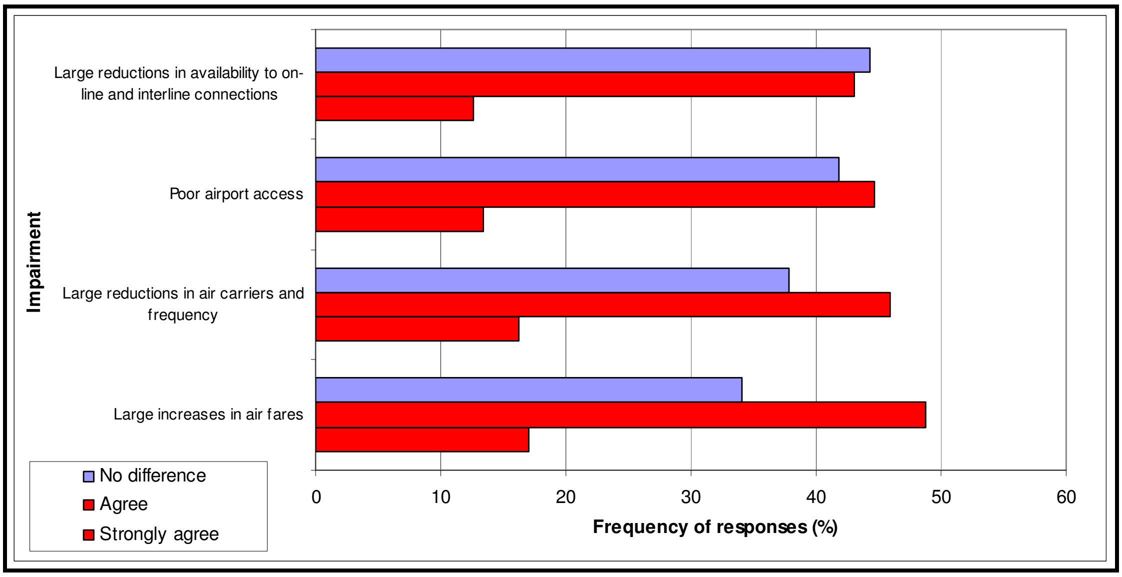


Source: Caricom passenger survey

Fig. 3.9 The relative importance of the Caricom region's air transport sector in supporting a selection of regional issues

Generally, air transport's relative role in widening consumer choice received the poorest aggregate rating (7.96), given the many other substitutes to which disposable income can be directed. Respondents that gave a high rating for the sustainable development indicator invariably gave an equally high rating for the remote and island development question. This suggests that these two indicators are not mutually exclusive. In fact, many interpretations of the sustainability question related to the sector's supporting role for the region's isolated islands and remote areas. In other regions, air transport's role in creating a "land bridge" between islands would not be so synonymous with concepts of regional sustainability.

In line with the notion of displacement (Montalvo 1998), a survey question was devised in order to qualitatively evaluate the extent to which travel behaviour into and out of the region would be affected if the air transport network was significantly impaired. This was designed to partially compensate for the lack of quantitative data which would have facilitated a more rigorous scenario analysis. The aggregate results of the relevant survey question are summarised below in Figure 3.10**.**



Source: Caricom passenger survey

Fig. 3.10 The extent to which the attractiveness of the Caricom region as a place to visit and do business would reduce under a selection of impairments to the air transport network

The choice of impairments was broadly based on the principle that completely hypothetical scenarios would produce unrealistic results. Thus, although unlikely in many instances, the chosen impediments have, at some point, occurred in the past and therefore were conceivable scenarios in the minds of the survey respondents. The majority of respondents either agreed or strongly agreed that large alterations to the region's air transport network would lead to a reduction in the marketability of the region as a place to visit and do business. 66% of all respondents agreed or strongly agreed, for example, that a large increase in airfares would undermine the attractiveness of the region. In turn, it can be assumed that employment displacement would increase if aggregate demand and expenditure into and out of the region were to reduce. It is important to take the views of the survey's respondents seriously, as the level of displaced expenditure and employment depends greatly on levels of demand. Further to this, for the region's poorly diversified economies displacement into other sectors is also an optimistic assumption and can only be contemplated to a certain extent for the economies of Trinidad & Tobago, Guyana and the Bahamas (of the sampled Caricom member states). If output is said to decrease by 10% as a result of a reduction in local carrier services; on average, it is estimated that on-site companies and off-site suppliers would have to downsize by approximately 164 full-time equivalent jobs. In turn, a further 72 jobs could be lost in the wider economy when displaced workers cannot find jobs in other sectors with equivalent wage rates.

The most unlikely causes of a downward shift in demand were the scenarios of a large reduction in the number of available air connections and poor airport access. In Dominica, Guyana, Jamaica and the Bahamas, it was the view of some respondents that poor access and poor connections already existed to a certain extent and that it had not affected their inelastic decisions to travel. At the time the survey was conducted, for instance, road infrastructure around both Montego Bay and Kingston airport was being upgraded, leading to inconveniences. For some respondents their willingness to travel despite these inconveniences led them to believe that this particular impairment would make no difference to levels of travel demand to and from the region. This may explain why over 40% of all respondents gave a "no difference" rating to these two impediment scenarios.

As it was assumed that good airport access, increased interline and on-line connectivity, improved frequency and a reduction in airfares would rarely disadvantage a region as a place to visit and do business, a three-point scale was employed. It is accepted that a five-point scale would have made the question appear less biased by including a 'disagree' and a 'strongly disagree' option but due to the nature of the question itself, it is reasonable to assume that nobody would have chosen such options. Like in the previous example, if respondents believed that other external factors had a more relevant role in supporting visitors and business in the region, they simply selected the 'no difference' option.

3.2.4.6. Percentage of Caricom sales pertinent to air transport

The business survey results illustrate that, overall, more than 50% of business sales were destined for foreign markets in 2006 (Table 3.13). 21.85% of these revenues were earned in other Caribbean countries while 28.83% were sold in international markets. Although there are a handful of other distribution channels through which local firms can access foreign markets (e.g. shipping, telecommunications, internet), Table 3.13 shows that Caricom countries are likely to consider air transport for the exporting of products and services covering at least 50% of total sales or around US$23 billion per annum. High value and time sensitive products, as well as service industries which rely on high levels of personal contact with their clients in order to improve sales revenues, are more likely to distribute their sales via air transport. According to the sector profile of the business survey responses, approximately 23% of all surveyed firms had a high propensity to utilise either freight or passenger air transport services on a regular basis (see ICAO 2005 for a list of sectors with a high propensity to use air transport services). This would correspond to nearly US$4.7 billion of sales which could potentially be distributed through the air transport supply chain.

Table 3.13
Percentage of Caricom business sales destined for foreign markets

Sales (output) breakdown between local, intra-caricom and international markets								
Member State	GDP (PPP) 2006	Total sales local (%)	Total sales intra-caribbean (%)	Total sales international (%)	Total sales local (Scaled Up)	Total sales intra-Caribbean (Scaled Up)	Total sales international (Scaled Up)	Standard error (%)*
BAHAMAS	6,105,000,000	42.89	25.97	31.14	2,618,434,500	1,585,468,500	1,901,097,000	17.73
BARBADOS	4,815,000,000	44.37	33.22	22.42	2,136,415,500	1,599,543,000	1,079,523,000	14.53
DOMINICA	384,000,000	64.75	27.89	7.36	248,640,000	107,097,600	28,262,400	10.00
GUYANA	4,500,000,000	69.06	8.49	22.45	3,107,700,000	382,050,000	1,010,250,000	18.80
JAMAICA	12,180,000,000	53.92	17.64	28.44	6,567,456,000	2,148,552,000	3,463,992,000	6.26
ST. LUCIA	866,000,000	26.36	9.85	63.79	228,277,600	85,301,000	552,421,400	9.90
TRINIDAD & TOBAGO	16,800,000,000	43.98	29.86	26.16	7,388,640,000	5,016,480,000	4,394,880,000	1.13
CARICOM SAMPLE	45,650,000,000	49.33	21.85	28.82	22,295,563,600	10,924,492,100	12,430,425,800	11.19

Source: Caricom business survey
*Please note that this is computed as the cumulated variance between sample output by sector and national output (GDP) by sector i.e. the presumed standard error of the sample

It is important to note that sales destined for other Caribbean markets should generally be considered, for the purposes of this study, as a domestic market. It is worth pointing out that, due to the geographical layout of the region, air transport would be the main distribution mode for sales dependent upon the use of transport in order to reach these markets. Consequently, if a larger quantity of sales was destined for Intra-Caribbean markets, the region would depend more heavily on the air transport sector to facilitate that growth. At present, however, a large minority of sales are still destined for domestic markets; this is especially the case in Guyana, Dominica and Jamaica.

Computing the statistical sample output against annual output for the Caricom region produced a sampling error of 11.19 when using published sector breakdown data as a weighting factor. That is, on average, the variation between the sample's sector breakdown (between agricultural, manufacturing and service sectors) and the published breakdown was 11.19%. Thus, the sample's aggregate output could be scaled up to arrive at annual output estimations with an 89.81% level of confidence. The chosen scaling factor was GDP (PPP) for the year 2006 for each respective member state. In this instance, GDP (PPP) comprises total business output which can be destined either for internal markets or regional and international markets. The sample breakdown of sales between different types of market is used as a point estimate of the breakdown of sales for the entire population of businesses and as around 89% of sector types reflect the variation of sector types among the population of local businesses, the breakdown of sale results in the sample can be interpreted with a reasonable degree of confidence. The remaining 11% error in sample variation can also hold for the remaining business survey results that have incorporated the same scaling factor, thereby giving a general indication of the reliability of the sample.

3.2.4.7. Production costs incurred by air transport

Table 3.14 shows that, in comparison to the larger economies of the UK and the US, transport costs as a percentage of total production costs are substantially higher for Caricom countries. Although a breakdown between modes is not known for the US and the UK, it is likely that it is primarily the abnormal air transport costs which determine the large differentials evident between Caricom based and UK/US based transport costs. Nevertheless, the fact that the average cost of transport is comparably high for the sampled countries, should not perhaps be interpreted as a poor reflection on the region's transport system but rather as a sign of the greater use of air transport and the importance placed upon it for the efficient production of goods and services. A number of business managers did comment, however, that they considered air transport costs to be too high and that at times it had prevented them from making important investments into new markets. This would not support the idea that air transport services are being produced cost effectively, otherwise Caricom business managers would see prices fall. In addition to this, other comments were made, alluding to the issue of high shipping rates and an infrequent service (by sea), suggesting that some other distribution channels to and from the region also need to become more globally competitive.

Table 3.14
Percentage of total production costs by transport mode and sample member state

Member State	% total production costs by air	% total production costs by ship	% total production costs international transport
Bahamas	15.22	6.22	21.44
Barbados	12.96	6.33	19.28
Dominica	13.02	5.48	18.50
Guyana	15.07	5.16	20.24
Jamaica	13.81	6.24	20.05
St. Lucia	14.40	6.98	21.38
Trinidad & Tobago	13.67	7.94	21.61
Caricom sample (n=211)	14.02	6.34	20.36
UK	Not known	Not known	4.50
USA	Not known	Not known	4

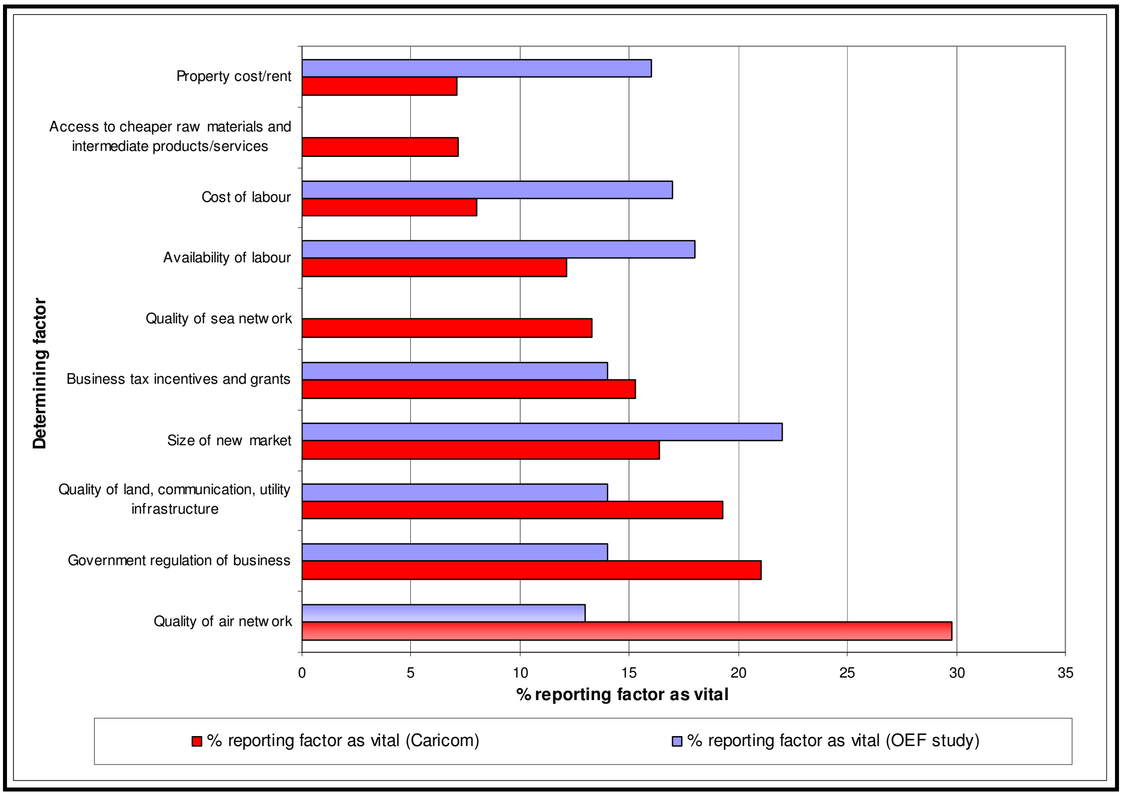
Source: Caricom business survey, UK and US Departments for Transport (2007)

Looking at the disaggregate results in more detail, it is evident that both international transport costs and the breakdown of those costs by mode is homogenous, with transport costs by air uniformly being over two times greater than those by sea. It must be remembered that in the Caribbean region, although the majority of merchandise products would be distributed by sea, sea transport does not compete in the courier or passenger markets and, therefore, a larger proportion of overall transport costs are attributable to air transport. The sector breakdown sampling error of the results may have also contributed to the large disparity. In comparison with published data on sector breakdowns, a moderately disproportionate amount of service industries responded to the survey. These industries generally have a higher dependence on passenger transport services. In other regions like the UK and the US, both competition and cooperation between modes is more widespread perhaps leading to a more even distribution of transport costs by mode.

3.2.4.8. Relative importance of the presence of good air transport services for FDI decisions

Figure 3.11 illustrates that nearly 30% of the business survey's respondents thought that the quality of an air network was vital in determining their actual or prospective locations for investment; that is in comparison to the Oxford Economic

Forecasting (OEF) survey carried out in 1999 for the UK and European business sectors. Clearly it is the respondents view that the quality of the Caribbean internal and external air network is seen to be more important than some of the more traditional determining factors like the cost and availability of labour. This is possibly because cheap labour can be found quite readily in many Caricom home markets, and decisions to invest are more likely to be determined by demand side factors (e.g. size of new market) than by trying to reduce the cost of factors of production. Similarly, other cost side factors are not rated as highly by Caricom companies as they are by UK and European companies. Property, raw material and labour cost factors all returned a 'vital' rating of below 15%.



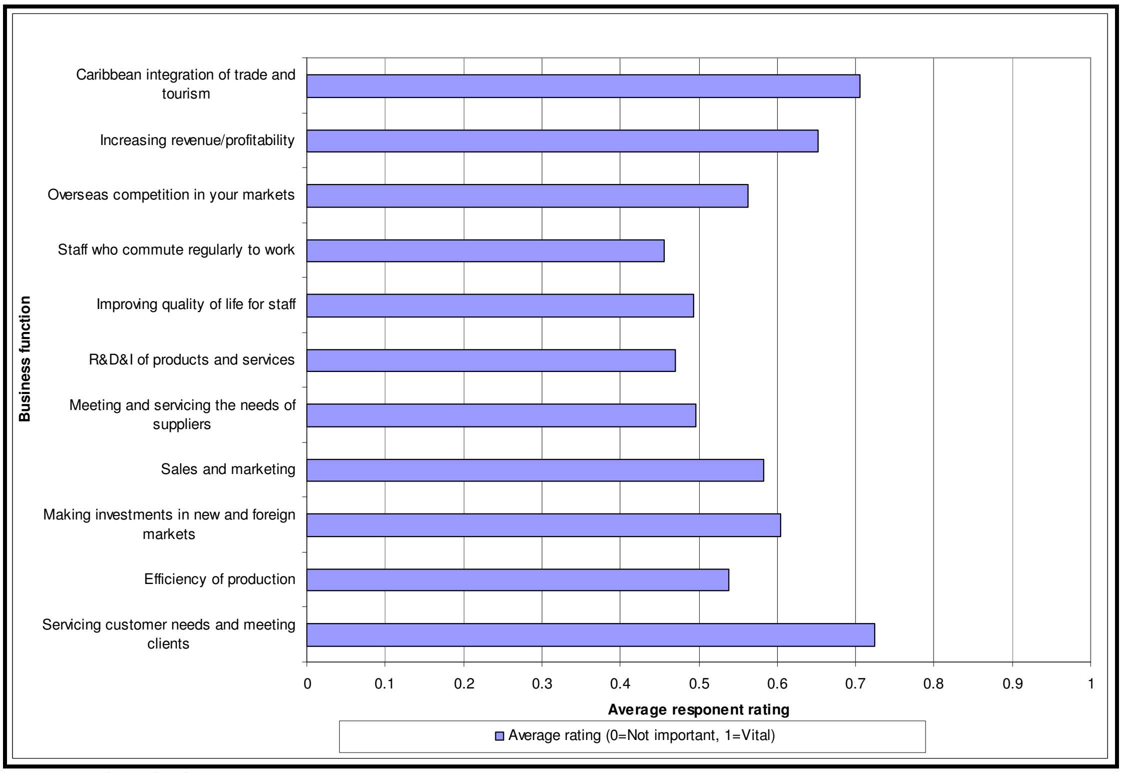
Source: Caricom business survey and OEF (1999)

Fig. 3.11 The relative importance of a selection of factors in determining the location of investment for Caricom businesses

The high air transport costs evident from Table 3.14**,** combined with the fact that 30% of company executives rated air transport as 'vital' in determining foreign investment decisions, suggests that if transport costs were reduced, perhaps more foreign direct and indirect investment would be possible within, to and from the region. However, it is impossible to verify that the opinions of respondents were not influenced by the contents of the other questions in the survey. All respondents would have also known that the survey was about the air transport sector and this may have inadvertently had an influence on their responses.

3.2.4.9. Elaboration variable analysis

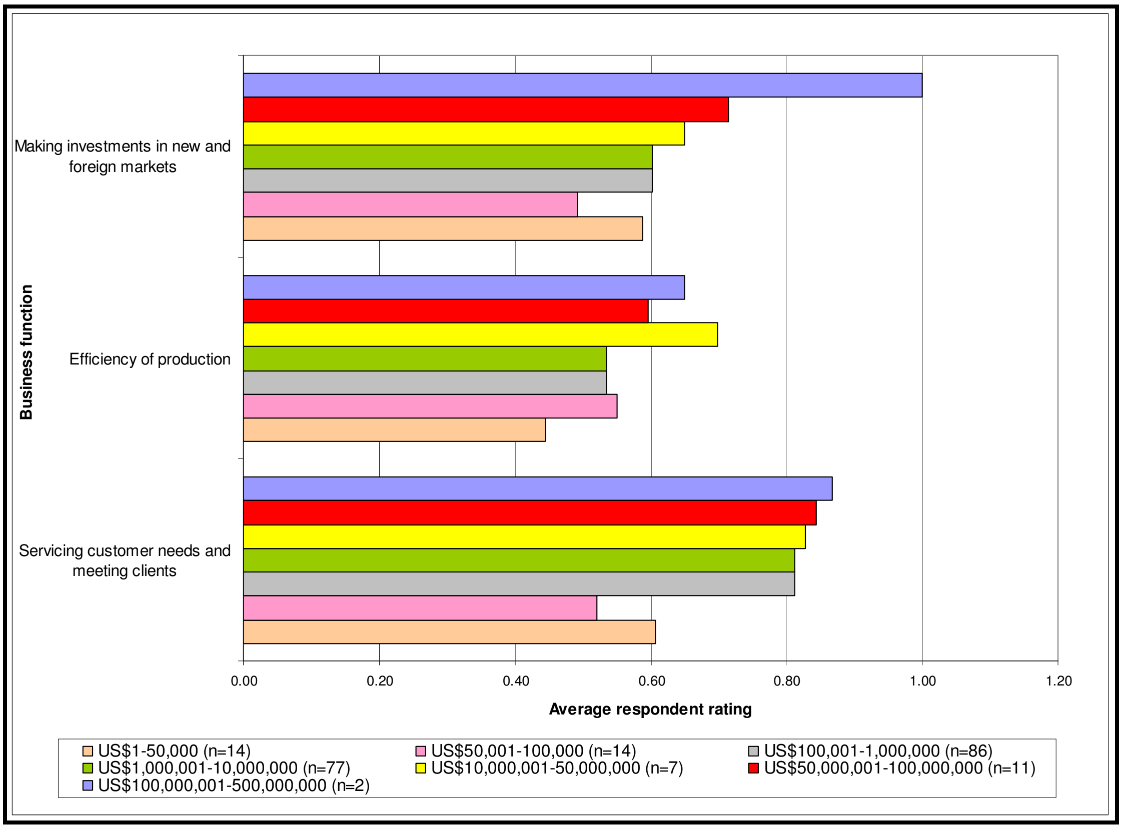
Other influences which could also help to explain the aggregate results of the survey's revealed preference data include location of headquarters, size of firm (annual turnover), number of employees and the hierarchical position of the respondent within the represented organisation. For example, the remaining qualitative questions regarding the relative importance of air transport for a number of business functions shows that aggregate results, when broken down by size of firm, return significant correlations. The overall results are presented along side these segmented values in Figure 3.12(a) and 3.12(b) respectively.



Source: Caricom business survey

Fig. 3.12(a) Importance of air transport for a number of business functions

As we can see from Figure 3.12(a), overall, Caricom business managers thought that good air transport links were most important for servicing customer needs and meeting clients as well as for Caribbean trade and tourism integration. On the other hand, it was viewed that air transport does not play such an important role for staff that commute regularly to work and for the Research, Development and Investment of products and services. Commuting by air is not widely practised in most regions including the Caribbean. Moreover, some passenger survey business respondents remarked that it was not possible for them to travel to another Caricom country to do business and return in one day, with low frequencies, inconvenient flight times and a low level of non-stop services being cited as current barriers. It is not surprising, therefore, that this business function was only given a rating of somewhat important (0.45/1). Similarly, the business function with the highest air transport value was also expected given the high number of service sector respondents. Good air transport links were considered very important for creating revenue streams in new markets, which are believed to have a greater effect on profit levels. This is especially relevant for Dominica, St. Lucia, Barbados and the Bahamas given that they all have relatively limited home markets. Efficiency of production received an average importance rating, again showing that demand side business functions were more frequently linked to the provision of air transport services than cost side functions.



Source: Caricom business survey

Fig. 3.12(b) Importance of air transport for a number of business functions by firm size (US$ revenue)

Figure 3.12(b) uses an elaboration variable to attempt to account for some of the disparity between the aggregate responses given in Figure 3.12(a). The first clear observation is that as firm size increases, the relative importance of air transport for all the illustrated business functions also increases. In other words, the larger the organisation, the more likely it is for air transport to have a larger influence on the success of serving customer needs and meeting clients, on the efficiency of production and on making new investments in foreign markets.

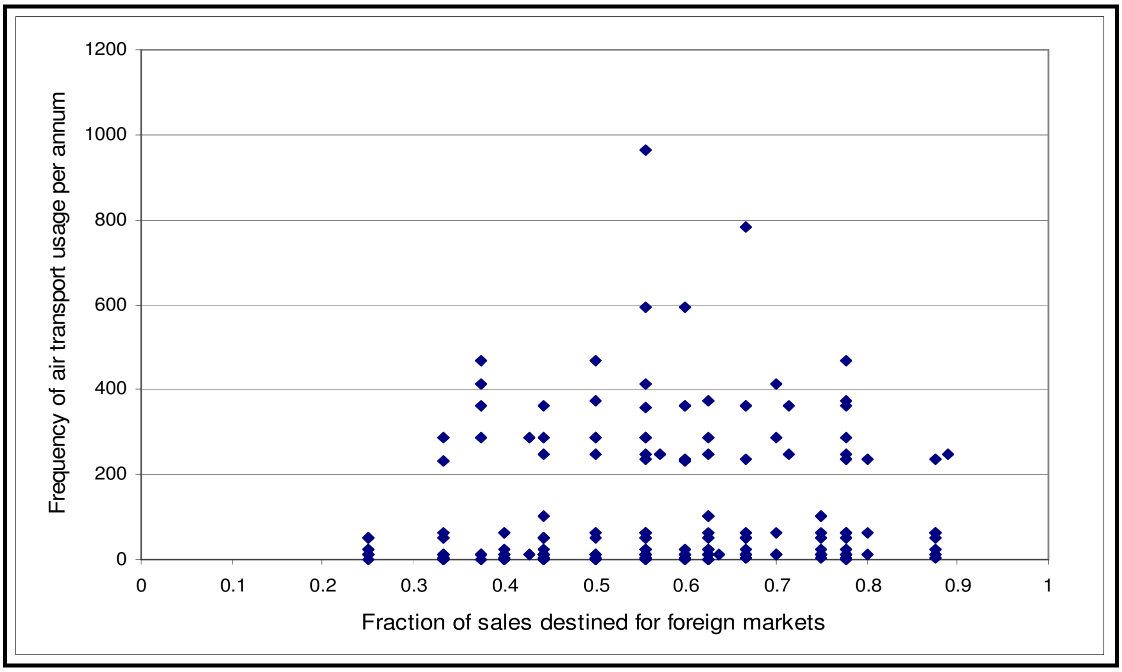
Testing the aggregate results by size of firm also partly explained why the relationship between air transport and efficiency of production was not rated as importantly as some other factors. Although the overall rating was somewhat important overall (0.45/1), firms with an annual turnover of more that US$10 million actually gave a rating of 0.58-0.69, showing that larger firms place more emphasis on cost control and view high transport costs as of greater importance than smaller firms which perhaps would be more concerned about securing new revenue streams for their products.

Similar inferences could be made by testing the subjective responses against sector type and location; accountancy firms, for example, gave a higher than average rating for air transport's influence on servicing customer needs and meeting clients and a lower than average rating on its influence on Research, Development and Investment of products and services. Conversely, manufacturing businesses, many of which are already well established within their respective Caricom home markets, put a higher importance on air transport's influence on making new investments in foreign markets. In addition to this, the location of business respondents generally had an influence on the level of scepticism in relation to the extent to which good air transport links can improve such business functions. Guyanese businesses, which, on average, distribute approximately 69% of all products and services to domestic markets, did not show as much propensity as St. Lucian businesses that frequently rely on air transport for the distribution of up to 70% of international sales on average. Smaller islands such as St. Lucia generally showed a greater propensity to give high importance ratings. This could be due to the fact that dependence levels on air transport for business mobility is exacerbated by the relatively large expanses of sea separating islands with small home markets and high import ratios.

Although a few clear cut trends emanate from the above tests, it should be noted that the general usefulness of elaboration variables for explaining subjective survey responses is limited by the fact that there could be a myriad of motives underlying responses. Thus, a conservative approach to the interpretation of the inferences revealed by the illustrative findings is advised.

3.2.4.10. Annual air transport usage for business purposes

Unlike the Airport Operators Association report (2005), the Caricom business survey results illustrate that there is a low correlation between the percentage of sales destined for foreign destinations and the frequency of freight, courier and passenger air transport usage. The majority of respondents, regardless of the amount of sales destined for foreign markets, contended that their frequency of air transport usage was weekly or less. However, a large minority of respondents stated that they used air transport services more than once a week.



Source: Caricom business survey

Fig. 3.13 The correlation between the frequency of air transport usage and the percentage of sales destined for foreign markets

Although the results illustrated in Figure 3.13 returned a poor coefficient of correlation it provides evidence that firstly, a variety of different distribution channels are used for those companies with a high percentage of foreign sales. Air transport is often used in conjunction with sea transport for the trading of products and in many instances services can be exported without the use of any transportation mode at all. With the advent of virtual services, or more importantly for the Caricom region, the sale of hotel rooms through indirect distribution mediums such as the internet or the telephone, indirect distribution channels can be explored and expanded. In these cases it is not necessary for businesses to utilise any transportation services for the sale and marketing of their services. This argument holds given that a sizeable number of respondents cited on-line services and tourism as their principle business activity.

Secondly, some respondents cited that, although they had a relatively low level of foreign sales, air transport usage was actually quite high. This could demonstrate the fact that many small to medium-sized firms in the Caricom region are currently looking for new opportunities and new revenue streams. Thus, these businesses may have incurred personal travel expenses without actually commencing any new revenue streams in foreign markets. Thirdly, despite the low correlation it is important not to ignore the responses that did return a more predictable outcome (i.e. a positive relationship between frequency of air transport usage and foreign sales). Whilst not reflected in Figure 3.13, the segmented survey results indicate that the larger, service oriented and more established firms with many trade links both within and outside the region showed more propensity to have high levels of passenger air transport usage as well as foreign sales. The same pattern was also apparent for larger, established firms involved in the distribution of products, but in this case it was related to air freight transport. The larger custom electronics firms, for example, returned much higher coefficients than the aggregate results.

Finally, all of the Caricom countries with the exception of Trinidad & Tobago have significant current account deficits. As the practise of importing is more widespread throughout the regional economy for both finished and intermediate products and services, perhaps the correlation between the percentage of production costs originating from foreign markets and usage of air transport would have produced more consistent correlations. However, given there was no question posed regarding the percentage of production costs attributable to importing in the business survey, it was not possible to test this hypothesis.

3.2.5. Summary impact results and the multiplier (including catalytic impact)

In order to produce a baseline estimate of the socio-economic impact of the industry for the year 2006, it is important to summarise the quantifiable results into a format that can be simply inputted into the liberalisation analysis. Although the baseline incorporates published economic data for the seven sampled Caricom member states, it is the addition of the net induced and catalytic impact as well as the ability to compare between different Caricom states, which adds value to the primary data's findings. It is also envisaged that the inclusion of direct and indirect contributions may be of interest to tourism bodies in the region that have hitherto primarily focused their findings only on the gross catalytic impact of the sector. This summary data, however, is to be considered in conjunction with other findings which were not included in the baseline, relating to producer revenues and consumer surpluses along with the qualitative passenger and business survey findings, such as the relative importance of the industry to business productivity, investment and mobility, and the role air transport plays in supporting remote and island communities.

As Table 3.15 shows, catalytic impact is substantially greater than any other impact for Barbados, but not for Trinidad & Tobago. In Barbados, the fact that no carrier has a base there combined with the islands heavy dependence on incoming foreign visitor earnings facilitated by air transport, exacerbates the multiplier effect of the industry in comparison to the GAV multiplier for Trinidad & Tobago. Catalytic employment for the two countries was estimated using published tourism employment data (World Travel & Tourism Council 2005), which could be said to be a direct result of the incoming tourism flows by air.

Regrettably, airport supply chain case studies were only performed for Barbados and Trinidad & Tobago. It is possible to estimate the indirect and induced impact of the industry by applying Barbados and Trinidad results to the remaining five sample member states. Yet given the socio-economic heterogeneity evident between the countries in the sample it was considered that this method would produce unrealistic estimates. Nevertheless, a quasi-multiplier was computed for the remaining states using only direct and catalytic impact results from published Balance of Payment and primary survey data respectively (refer to Section 3.1.7.). Consequently, it can be assumed that the estimated multipliers for the remaining states are underestimated, given that a more comprehensive assessment would also include indirect and induced impact factors. Finally note that, as the air transport sector has erroneously been shown to account for all catalytic GAV (See Table 3.15 notes), the fact that indirect and induced contributions are omitted for the remaining five states may have actually resulted in more realistic aggregate impact values.

Table 3.15
Estimated direct, indirect, induced and catalytic impact of the air transport sector for the selected Caricom member states

Impact measure	GAV	(%)	Employment	(%)	GAV (% of GDP)	Employ (% lab. force)
Direct	13.42	2.8	951	2.7	0.31	0.74
Indirect	26.34	5.5	2,370	6.9	0.55	1.84
Induced	48.86	10.1	2,958	8.6	1.01	2.30
Catalytic*	394.36	81.7	27,946	81.8	8.19	21.75
Sub Total (Barbados)	482.98	100	34,225	100	10.03	26.63
Direct	112.58	48.0	2,011	18.1	0.62	0.62
Indirect	130.17	55.5	2,325	20.9	0.72	0.40
Induced	150.00	63.9	2,679	24.0	0.83	0.16
Catalytic*	-158.28	-67.5	4,125	37.0	-0.86	0.67
Sub Total (Trinidad & T)	234.47	100	11,140	100	1.31	1.81
Direct	419.08	-	1,096	-	6.86	0.62
Indirect	-	-	-	-	-	-
Induced	-	-	-	-	-	-
Catalytic*	998.13	-	18,589	-	16.35	10.64
Sub Total (Bahamas)	1,417.21	-	19,685	-	23.21	11.16
Direct	1.46	-	135	-	0.38	0.54
Indirect	-	-	-	-	-	-
Induced	-	-	-	-	-	-
Catalytic*	65.38	-	6,082	-	17.03	24.33
Sub Total (Dominica)	66.84	-	6,217	-	17.41	24.87
Direct	22.09**	-	312	-	0.64	0.13
Indirect	-	-	-	-	-	-
Induced	-	-	-	-	-	-
Catalytic*	65.06	-	2,757	-	1.89	1.12
Sub Total (Guyana)	87.15	-	3,069	-	2.53	1.25
Direct	337.17	-	2,568	-	2.77	0.23
Indirect	-	-	-	-	-	-
Induced	-	-	-	-	-	-
Catalytic*	1,136.37	-	43,275	-	9.33	3.80
Sub Total (Jamaica)	1,473.54	-	45,843	-	12.10	4.03
Direct	44.18	-	375	-	5.10	0.86
Indirect	-	-	-	-	-	-
Induced	-	-	-	-	-	-
Catalytic*	396.81	-	12,630	-	45.82	28.84
Sub Total (St. Lucia)	440.99	-	13,005	-	50.92	29.70

Sources: Survey data, Central Banks (2006), Caricom Secretariat (2002), WTTC (2005)
Notes: Consumer surplus values (catalytic) evident from the passenger survey results are not included in the annual statements
*Catalytic GAV must be interpreted with caution. Although the air transport sector facilitated large sums of incoming expenditure into the region, much of the demand stimulation is actually derived from other sectors. As a result, other sectors must be accredited with an appropriate percentage of the net expenditure gains
**For direct impact GAV estimation, Belize was used as a substitute for Guyana due to the omission of Guyana BoP data
GAV Multipliers: Barbados = 5.45, Trinidad & Tobago = -0.40 (*Bahamas = 2.38, Dominica = 44.78, Guyana = 2.95, Jamaica = 3.37, St. Lucia = 8.37)*

3.3. CHAPTER SUMMARY

Aspects of impact assessment work carried out by ICAO (2005), Karyd and Broebeck (1992), Pearce (2005), the World Tourism Organisation (2003) and others were calibrated and incorporated into a viable and holistic multi-method net impact assessment for the Caricom region. Both quantitative and qualitative techniques are explored for numerical and intangible contributions of the air transport sector respectively. A cluster sampling method indicated that an in-depth analysis of seven representative member states would be sufficient to cover the socio-demographic and air network variation inherent in the wider Caricom population of twenty member states (including five associate states). It was then proposed that a number of primary and secondary data sources would be used to capture information regarding foreign exchange, Gross Added Value (GAV), employment (and employment displacement), consumer surpluses, local carrier financial performance, net visitor expenditure, business investment and productivity and social mobility for the year 2006. The data was then disseminated and accounted for using the four Federal Aviation Administration recommended impact categories; direct, indirect, induced and catalytic.

It is estimated that the baseline air transport output (15.316 million passengers), for the seven sampled Caricom states, contributed on average 16.8% towards aggregate real GDP and created 133,184 jobs. These baseline impact values include direct on-site airport activity as well as indirect, induced and catalytic contributions which occur off-site and within the wider economy. The averages hide a large variation which were primarily determined by exogenous factors, namely relative size of a state’s real GDP, relative contribution of other sectors, relative levels of trade dependency, and the relative level of socio-economic development; with larger impacts being noted in smaller, poorly diversified islands, chiefly dependent on sustaining a net surplus of air transport facilitated incoming visitor expenditure. When catalytic impacts are excluded the average contribution of the sector in percentage terms reduces to 2.8% of GDP, with all sampled member states returning comparatively high multiplier values with the exception of Trinidad & Tobago, which experienced a net deficit in visitor expenditure. This non-catalytic average still compared favourably with global estimates.

4. LIBERALISATION ANALYSIS: METHODOLOGY

4.1. Introduction

Having critically considered previous literature on the subject of air transport liberalisation and its well documented effects on air transport markets (and subsequently, national and regional economies), it was necessary to modify previous work in order to obtain a more appropriate and manageable methodology for the inimitable Caricom region. This would take into account the variations in member state socio-economic and geographic nuances, the independent development of each member state's air transport sector, the available data sources as well as the reliability of the available data. More specifically it was of critical importance, in cases with little or no history of liberalisation, to simultaneously apply reform evidence from comparable county-pair markets with similar traffic volume scaling factors. This simultaneous approach would take the limited outgoing market potential of some Caricom states into consideration regardless of the extent to which air policy has been relaxed.

Forecasts which looked to isolate air policy variations whilst controlling for as many other influencing factors as possible were assumed to give the most robust results. To this end it is proposed that a fixed-effect regression analysis is supported by an initial time-series assessment, designed to inform a pilot and subsequently the main regression specifications, giving a pre-trial indication of the key variables as well as those that should be left out of the final specifications. The flow chart shown in Figure 4.1 helps to clarify the linkages between the main evaluation components. Note that although the final set of partial factors returned a high level of predictive and explanatory power, they can only be seen as representatives of other related factors also considered to stimulate air traffic (Hair et al. 1998). Thus a secondary objective of the time-series analysis is to fill the intuitive gap created by the limitations of the OLS methodology allowing for more realistic and comprehensive interpretations required for real world policy decision making.

Consequently this chapter is set out as follows. Section 4.2 establishes the country-pairs to be included. Both reformed and 'status quo' markets are detailed for the period 1995-2006. Next, a preliminary time-series analysis plan (4.3) is proposed along with a selection of variables and data sources before the main regression plan is formulated (4.4). The selected dependent and independent variables are finally tested for statistical performance and the overall variate outputs are validated in section 4.6.

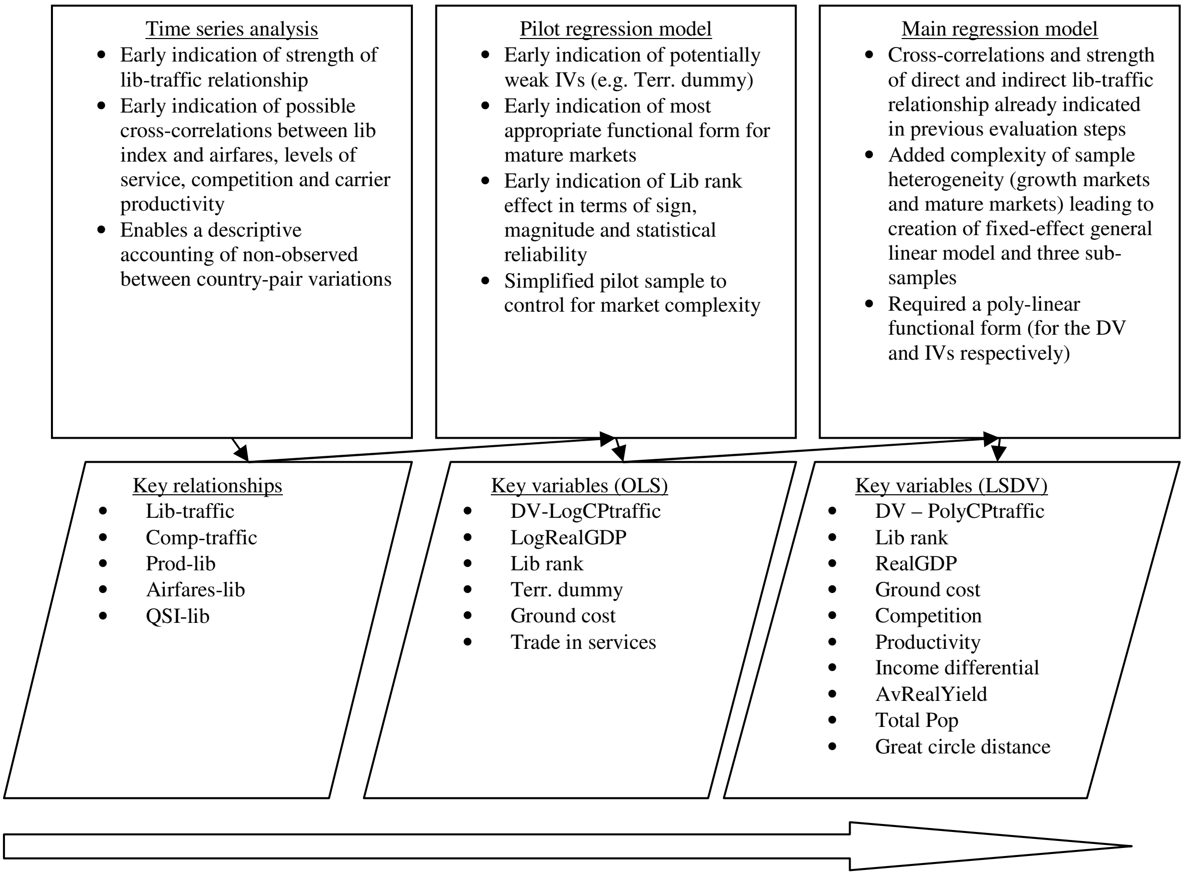


Fig. 4.1 Evolution of liberalisation effect evaluation process:
The three estimation components

4.2. Air policy development: Introduction to sampled Caricom country-pairs

As mentioned in the introductory chapter, it can be generally assumed that the Caricom region is still in a relatively early stage of ASA relaxation in comparison to other world regions. However, due to its socio-demographic and air transport heterogeneity it was imperative that any evidence emanating from the Caricom region itself in support of or in opposition to further liberalisation was gathered in order to provide a basis from which to consider before-after evidence from the wider Caribbean region.

If any benefits have thus far been accumulated as a result of the two multilateral ASA’s in the region, they would only be evident on Intra-regional routes as, up to the time of writing, no extra-regional jurisdiction has been willing to negotiate blanket traffic rights to/from all Caricom ASA member states simultaneously. Thus, all Caricom-North America -Europe and -Latin America air transport rights are still negotiated on a bilateral basis. Another point of note is that on some Intra-Caricom markets it was not necessary to split O-D data into different routes given the fact that many islands are considered by air carriers and consumers to be one market, even if there are multiple airports, as they frequently serve the same catchment area. The implication this has on the data collection methodology is three-fold:

- Evidence of the linkages between market conditions and multilateral liberalisation were only gathered for applicable Intra-Caricom country-pair markets. Country-pair data was equal to route data on those O-D markets comprised of only one route (e.g. Barbados-Antigua, Antigua-St. Lucia, Dominica-St. Lucia etc).

- Evidence of the linkages between market conditions and bilateral liberalisation were principally gathered for extra-regional North America and European markets. It made practical sense to restrict before-after sampling to US/Canada-Caricom and UK-Caricom markets due to the irregularity and inconsistency of historical recording on the other minor source markets, which would have led to an incomplete set of data values.

- The output is macroeconomic in nature where air policy impact on aggregate country-pair traffic is most relevant. Interactions on different city-pair routes were therefore only considered for variables like competition and quality of service, which can only be estimated at the route level. These data were simply aggregated into country-pair averages to be directly compatible with the remaining aggregate variables. This would have been a complex process with a sample of country-pairs that consisted of hundreds of city-pairs.

It should be noted that on some Intra-regional O-D markets, bilateral agreements still provide the regulatory framework for the imposition of artificial restrictions to traffic rights because one or both of the contracting states may have not ratified the Caricom MASA (e.g. Bahamas-Jamaica). In other cases the Caricom MASA, although ratified by both member states does not actually take precedence over the previous bilateral agreement which, in accordance with the terms and conditions set out by the agreement, is a perfectly permissible procedure for the contracting states. After consultations with the Caricom Secretariat, however, it can be assumed that for the nine (9) signatory states, adherence to the Caricom multilateral agreement is practically in force on the corresponding markets. This reduces regulatory complexity for carriers as, for example, capacity and pricing policy for any island hopping routes would have to be negotiated multiple times within a bilateral framework but only once under the terms stipulated by the Caricom MASA.

The final set of country-pair markets chosen for bilateral, extra-bilateral and multilateral air policy analysis is described in Table 4.1. County-pair developments over the twelve year period 1995-2006 were of particular interest and were compared and contrasted to the control group of markets where effective air policy 'status quo' was maintained throughout the period. Both the control and reformed country-pairs are shown together in Table 4.1 along with their respective geographical locations in Figure 4.2(a) and 4.2(b). Figure 4.2(a) covers both Intra- and UK-Caricom country-pairs while Figure 4.2(b) includes the North America-Caricom sub-group only.

Table 4.1
Sample country-pair sector distances and resulting sector groups

County-pair	Distance (miles)	Sector type	Sector designation
*US-Bahamas	865	North America-Caricom	Medium
*US-Dom Rep	1,259	North America-Caricom	Medium
*US-Jamaica	1,064	North America-Caricom	Medium
US-Barbados	1,941	North America-Caricom	Medium
US-Dominica	892	North America-Caricom	Medium
US-Guyana	2,343	North America-Caricom	Medium
US-St.Lucia	1,846	North America-Caricom	Medium
US-T&T	1,999	North America-Caricom	Medium
Canada-Barbados	2,424	North America-Caricom	Medium
UK-Bahamas	4,368	UK-Caricom	Long
UK-Barbados	4,220	UK-Caricom	Long
UK-St. Lucia	4,246	UK-Caricom	Long
UK-Jamaica	4,723	UK-Caricom	Long
UK-T&T	4,433	UK-Caricom	Long
Bahamas-Barbados	1,441	Intra-caricom	Short
Bahamas-Jamaica	453	Intra-caricom	Short
Barbados-Guyana	463	Intra-caricom	Short
Barbados-Jamaica	1,288	Intra-caricom	Short
Barbados-St. Lucia	121	Intra-caricom	Short
Barbados-T&T	213	Intra-caricom	Short
Dominica-T&T	343	Intra-caricom	Short
Guyana-T&T	354	Intra-caricom	Short
Jamaica-T&T	1,241	Intra-caricom	Short
Suriname-T&T	550	Intra-caricom	Short

Source: Great Circle Mapper (2007)
Notes: a. * Country-pairs used for regression pilot and prototype model
b. Mid-point distance between county-pairs represents the average distance shown above. For the US and Canada, an east coast mid-point was taken given the lack of non-stop services between west coast cities and Caricom countries
c. US-Dominica mid-point represents the distance between Puerto Rico and Dominica, reflecting the only non-stop route on this country-pair

Based on the principle that all sampled member states import and export a sizeable amount of air travel to/from short, medium and long haul destinations it was important that the final selection of ASAs reflected the geographical scope of the Caricom air network to improve the generalisability of the aggregate results. Further, as the socio-demographic, air transport and economic variance in the region was deemed to be captured by a sample of seven representative states for the socio-economic impact assessment, it was considered both reasonable and practical to extend this sampling strategy to the liberalisation analysis as a way of carrying forward the generalisability of the data. As a large share of Intra-Caricom air transport is now operated under the auspices of the Caricom MASA, it provided the author the opportunity to compare the effects of being able to negotiate traffic rights multilaterally with that of the remaining examples where traffic rights continued to be negotiated either bilaterally or on an ad-hoc basis.

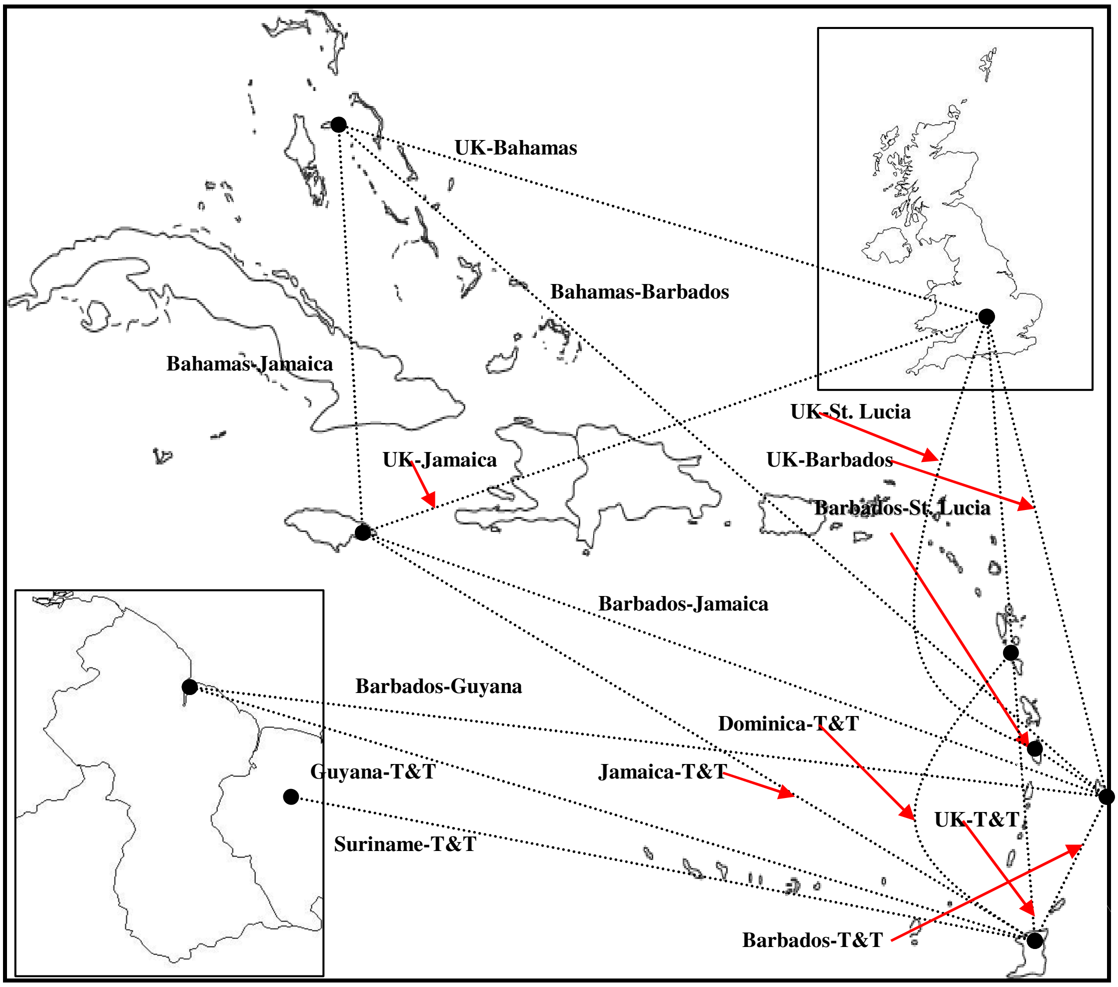


Fig. 4.2(a) Map showing the sample of Intra- and UK-Caricom country-pairs

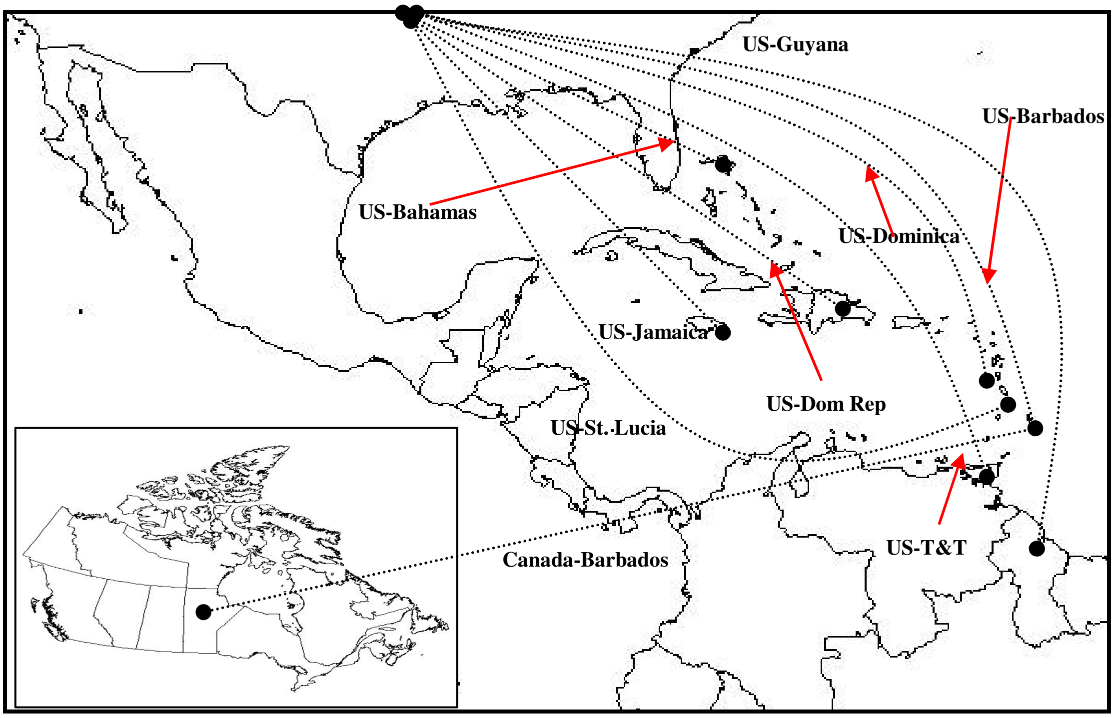


Fig. 4.2(b) Map showing the sample of North America-Caricom country-pairs

The Caricom MASA came into force in 1998; hence any benefits witnessed subsequent to that year in applicable country-pair markets provided the focus for further analysis. For comparative purposes the UK and the US were selected as the common long and medium haul trading partners except in cases where data was not readily available. In order to clarify exactly what was amended and when, an air policy history was compiled for the period 1995 to 2006 showing which particular policy lever was liberalised and in what year (See Table 5.1, Chapter 5).

Where air reform happened to be negotiated extra-bilaterally or extra-multilaterally a note was added that, in practise, the sector was operating to different terms than those stipulated by the official ASA's. This would help pinpoint exactly when air reform took place and the time it took before any market effects were actually felt (observed time-lag effects).

'Status quo' and recent variation in economic terms relating to tariffs, carrier designations, capacity/frequency, 5th freedoms and access points were corroborated as the five principle indicators affecting the supply of air services to the sampled country-pair markets, and were largely available from individual contacts at the Caricom secretariat, the US Department of Transportation and the UK Civil Aviation Authority. Market development on country-pairs that maintained their air policy 'status quo' throughout the time-series period were descriptively contrasted with markets that had seen at least a minimum level of partial relaxation of regulatory controls. Policy relating to 'cabotage' as well as ownership and control rights was not considered in detail for the liberalisation analysis. This is principally due to the fact that the availability of historical evidence of these types of policy relaxation within the Caricom or wider Caribbean region is non-existent and indeed very limited in other more liberalised markets. Nevertheless, the incorporation and evaluation of these two important levers could provide a useful extension to the findings of this study as and when efforts to increase such rights are documented.

4.3. Time-series analysis

Where possible the contacts used for the impact assessment data collection phase were also approached for the liberalisation analysis. This was deemed to be a better use of the resources available for research, without compromising the generalisablility of the data for the entire Caricom member state population. This further supported the use of the cluster sampling strategy, as devised for the socio-economic impact assessment, which could be directly applied to the remaining secondary data research activities in the liberalisation analysis.

As previously mentioned, the first necessary step was to attain an accurate depiction of the historical and current regulatory framework in operation within the seven sampled member states. In this way any liberalisation activity which has already taken place in the region in the last twelve years, no matter how marginal, could then be related statistically to any supply side changes witnessed on some key air transport markets with specific reference to the following indicators: -

- *Traffic levels* (variation in RPK and/or passenger numbers)
- *Capacity* (variation in ASK/aircraft seats and aircraft gauge)
- *Carrier designation* (variation in number of carriers and type of carrier) *Productivity* (variation in two partial productivity indicators relating to labour: RPK/FTE job and revenue/FTE job)
- *Airfares* (variation in real average yield by route group)
- *Service quality* (variation in flight frequency, carrier choice, number of stops)

- *Levels of competition* (Inverse of HHI, number of carriers, including imperfect substitutes)

In the Caricom region there is clearly an unknown level of interdependency which exists between the aforementioned indicators. For example, it can be said that there is a two way relationship between traffic levels and airfares. It is beyond the objectives of this section, however, to conduct an in-depth analysis of the significance of these interrelationships and to what extent one is a cause of the other. If it is assumed that there is a typically positive correlation between a rise in capacity, carrier designation, performance, service quality and traffic levels and a generally negative correlation between a rise in airfares and traffic levels then traffic can be taken to be the *'root'* indicator from which to measure macroeconomic performance. This also implies that if a variation in air policy is said to lead to a change in one of the other indicators aside from air traffic then any increase or decrease to air traffic levels can be *directly* linked back to air policy variation. As revealed in the literature review, changes in consumer welfare and air traffic levels (Gillen et al. 1999 and 2001, Oxford Economic Forecasting 1999, Brattle Report 2002, among others) are the most frequently used variables to measure the resultant changes to national or regional GDP, employment and tourism so traffic volumes was the natural choice for the author as the designated *'root'* indicator.

The time-series indicators outlined above are now described in more detail below and their methods of estimation are considered: -

4.3.1. 'Root' variable: Traffic volumes[45]

Country-pair or route traffic is measured either in terms of total passengers enplaned and deplaned or in Route Passenger Kilometres (RPK)/Route Passenger Miles (RPM). Most policy makers that have agreed to liberalise or partially liberalise ASAs tend to have the expectation that it would lead to lower prices and increased passenger volumes (Dresner et al. 1998). The incentive for governments to do this is clearly reflected in the assumption that increased traffic flows lead to an increase in

[45] For a detailed discussion of the selection of IVs chosen for the main regression analysis refer to section 4.4.2-4.4.5. Please note that some of the time-series and regression variables are the same, in which case the time-series section serves to introduce the variables while the regression section presents the same variables in more detail, covering aspects relating to measurement and data sources.

economic activity, consumer welfare, fiscal revenues and in some cases greater airline profits if the resulting competitive environment is properly managed. Although many factors influence air transport demand between two countries, it is possible to isolate the influence of a change to an ASA if there is evidence of a step change in traffic levels in the period after the ASA change came into effect. This view would clearly hold for a country-pair if there were no known step changes to GDP levels or any external or internal shocks during the same period. If such events did accompany a change to an ASA, it would clearly be difficult, through a basic trend analysis, to trace the effect of a change to an ASA. The terrorist attacks of September 11th 2001, for example, may have produced a time-lag before any benefits accruing from an ASA change in 2002 or 2003 actually appeared on a trend analysis. Having said that, a more robust regression analysis, which covered the same period of unexpected external events, would also fail to produce a low standard error coefficient or a high R-squared (R^2) statistic if x = air policy reform.

As the core indicator, other air transport benefits arising from a change to an ASA were also correlated with changes in traffic levels to try and corroborate the interrelationship between traffic variables and those of capacity, carrier designation, service quality, airfares and airline productivity. Evidence of an increase in traffic volumes that can be explained by an air policy induced change to these industry variables could then be converted directly into a secondary input for the macroeconomic performance analysis (i.e. consumer and producer gain estimates)[46].

4.3.2. Capacity

Capacity is especially useful when it is related to traffic levels as one arrives at a load factor or an average indication of the extent to which all available seats are occupied. A low load factor would frequently indicate either poor market demand and/or an overly competitive air carrier environment. Yet occasionally it could signify a restriction to designation rights, for example, which can also lead to low load factors. An inefficient carrier without the threat of entry may continue to operate a service purely to hold on to its exclusive traffic and airport slot rights.

[46] Each regression sub-group contained at least one other supply side variable. The partial effect of this variable could then be combined with its cross-correlation effect with air policy to derive an indirect air policy effect. Due to the strength of the overall variates, however, cross-correlations between partial variables were kept to a minimum resulting in weak and uncertain indirect air policy effects.

A Change in the supply of air transport passenger services reflects the level of optimism air carriers have for any given market and the liberalisation of market access (including number of points), designation of carriers, permitted frequencies, increases in aircraft gauge, traffic rights (allowing beyond or intermediate rights, for example) and price controls can all be said to influence the supply decisions of air carriers. Airlines are inevitably the first to react to any change to an ASA whether positive or negative, so in certain circumstances the immediate causal link between an ASA amendment and capacity can be clearer than that between actual changes in demand, which may actually occur many years after an ASA amendment. Finally, it is an imperfect, yet useful substitute for traffic in the absence of reliable time-series RPK data.

4.3.3. Carrier designation

By extension, a relaxation of ASA rules governing carrier designation may also lead to the provision of extra traffic, greater competitive efficiency, a higher frequency, a better quality of service and so on. This has been seen especially in cases where low-cost carriers have been able to enter a route or a market. In Europe it has been found that low-cost carriers benefited directly from the 3rd Package of liberalisation measures, which effectively allowed for the granting of 5th to 9th freedom rights across all member states (and even some non-member states), as there were no longer any ASA imposed restrictions on the number of carriers allowed to serve a route (Gillen and Lall 2004). In the Caribbean, the regulatory framework is more fragmented with the Caricom MASA allowing multiple designations on community routes, but some of the more traditional bilaterals still retain a hold of market entry on selected international routes. Assuming a customer base is present or latent, then permitting the free determination of entry can encourage the creation of new airlines[47] (Dobruszkes 2006).

4.3.4. Service quality

In Gillen and Hinsch's (2001) Air Liberalisation Model (ALM) they suggest that service quality can be measured quantitatively using flight frequency and an increase of carrier choice as a result of market entry. Passenger service quality

[47] See, for example, proposed new Trinidadian start up CWIA (Constellation West Indian Airways) which, as a result of free entry on traditional Caribbean Airline routes have promised competition on those markets in their business plan (Kirby 2007c).

assessments can also be subjective, however, and non-quantifiable service quality indicators like traveller satisfaction can be addressed nominally through revealed or stated preference air passenger surveys. Both quantitative and qualitative indicators could then be combined and linked back to any variation witnessed in the relevant country-pair ASAs along with any variations in traffic levels that are well predicted by an improvement in service quality. As the Caricom passenger survey is purely cross-sectional, it is proposed that customer satisfaction will be categorised nominally, cross-tabbed and statistically tested for correlation with the degree of liberalisation for each country-pair in the year 2006. Finally, it was possible to perform the quantitative time-series comparison of air policy reform and changes in service quality using the FAA accredited QSI rating selected for the final regression specifications.

4.3.5. Airfares

Provided other barriers to contestability are also low (e.g. hub concentration), the liberalisation of airfares and the abolishment of government involvement in the setting of fares can lead to an increase in capacity and a natural decrease in airfares in accordance with the market mechanism. The subsequent reaction in an open market is for the losers to exit the market resulting in a long-term increase in airfares (Barrett 1992), but on this occasion to levels consistent with the market.

It was impossible to obtain disaggregated airfare data for all carriers that have operated on all routes between the given country-pair markets for a twelve year period. Even if there was consistent data availability this is clearly a data intensive method by which to arrive at some partial inferences. In order to support the link between tariff/entry liberalisation and changes to actual airfares, it was proposed that airfares by route group should be contrasted on country-pair markets that have recently experienced liberalisation to those that have not. It was considered more useful if comparisons could be made between country-pair groups purely involving Caricom countries[48], but in the absence of such data it is proposed that country-pair data with similar case histories be selected from outside the region and differentials accounted for.

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[48] That is, if data were available for a Caricom member state ASA that has recently relaxed its pricing controls, the before/after evidence of changes in airfare could be compared to another Caricom country-pair still facing artificial barriers with regard to the setting of airfares or entry.

4.3.6. Airline productivity

As mentioned in the literature review, given complete freedom of access to airline cost and revenue information, Total Factor Productivity (TFP) has been suggested as the most comprehensive measure available for productivity analysis (Oum et al. 2005, Caves et al. 1981 and Gillen et al. 1985). TFP is defined as a measure of total output produced per unit of input (Windle and Dresner 1992). Windle et al. (1992) states that in the airline industry capital is the hardest input to measure correctly given that the book value of capital rarely coincides with its economic value. He goes on to say that certain other inputs and outputs are also hard to measure as they involve the aggregating of different employee types and airline services.

Given the problems of productive aggregation cannot be solved in the Caribbean at the time of research, a combination of partial indicators were used as recommended by the findings of Windle et al. (1992). It is found that two or more labour related indicators used in tandem would produce the highest correlations with TFP results especially if produced as a cross-section between carriers in the same nation or region. The correlation reduces, however, if the partial indictors are used over long time-series and on a variety of international sector lengths. This is not considered to be a methodological compromise for this study, however, as the range of sample sector lengths are split into three homogenous groups, and productivity in itself forms only one of many partial indicators in the testing of potential liberalisation induced macroeconomic gains. Clearly, where airline productivity levels formulate the major focus of a study, more attention would need to be given to more comprehensive measures like TPF.

A note should also be made about the practise of outsourcing airline activities to external companies in areas such as IT, ground handling, feeder services, administration and maintenance. Outsourcing can affect partial productivity measures by increasing the output measure while the labour input value remains the same. If it forms a major proportion of an airline's total labour input, one can account for such activity by including outsourced workers as part of the total labour input. In practise, however, airlines do not currently report outsourced employee numbers to ICAO or other international aviation bodies. Thus, the partial labour productivity indicators used in this study are subject to overestimations. Yet as none of the sampled airlines reported outsourced employee numbers, this effect would be constant across the sample and would not impact on change in productivity comparisons between airlines operating on the examined country-pairs before and after further liberalisation.

4.3.7. Levels of competition

Carrier entry on a previously protected route or market can often lead to above normal growth in annual traffic figures. This has especially been the case on routes where Low-cost Carriers (LCCs) have been granted operating rights. Pitfield (2008), for example, observed the 1990-2006 effect of Southwest airlines entry in 1993 on the Washington-Chicago (US domestic) corridor. As their market share increased, relative to that of incumbent carriers, United and American, traffic numbers increased at unprecedented levels (19%). If it is assumed market openness results in greater competitive forces (Gillen and Morrison 2005), then this does not only have implications for market entry decisions, but also for decisions relating to every aspect of an airline's operation with the aim of gaining a strategic or tactical advantage over its competitors.

The basic dynamic relationship between air policy openness and levels of competition can be investigated on Caricom markets by selecting the most appropriate indicators or combination of indicators that take relative market share, absolute number of operators and the strategic timing of entry into account. The extent to which carriers compete on cost, price and the differentiation of their services before and after air reform can only be detailed by gaining access to time-series data relating to carrier operating and non-operating costs at the route level, as well as average yields broken down by carrier and by route. Data relating to when new aircraft interiors and loyalty schemes are introduced, for example, would also give an indication of the responsiveness of carrier product differentiation to changes in levels of competition. In the absence of such data it was not possible to analyse these components of regulated or deregulated airline behaviour.

4.3.8. Exogenous factors affecting air traffic levels.

Analytic trade theory (Gillen et al. 1999) takes into consideration other non-liberalisation partial variables that have a direct relationship with the air transport indicators mentioned above. For instance, there is clear evidence that a positive relationship exists between GDP (PPP) growth per capita and traffic growth. Other more important determinants of traffic between any given country-pair include the level of trade in services and geographical variables. According to InterVistas (2006), variables that reflect the severity of the artificial restrictions imposed by bilateral agreements actually play a smaller role in defining traffic, although it can be significant both statistically and in a wider social context. They add, however, that it is a variable which can be controlled and changed relatively quickly and at relatively low cost (InterVistas 2006).

It follows that the priority for policy makers is to ensure that there are no artificial restrictions which lead to a suppression in the trading of air services, which ultimately is determined by the socio-economic and geographic relationships present in a country-pair. The Caricom case-history analysis as described in the results section, along with comparisons with other country-pairs outside the region[49] attempted, as far as possible, to descriptively decouple ASA variables from other exogenous influences in order to give an informed and intuitive estimation of liberalisation induced changes to the air transport network to from and within the case-study region. Combined real GDP values weighted by annual traffic flow differentials along with combined and weighted flows of trade in services on each country-pair market were thus introduced to the time-series analysis as a first attempt to decouple these effects from those that could be related to air policy reform.

This pre-trial descriptive methodology is in agreement with the earlier analyses of Marin (1995), Morrison et al. (1995), Goodovitch (1998), InterVistas (2006) and Clougherty et al. (2001) among others who have all attempted to isolate the price, demand and market structure effects of liberal bilateral air agreements from other unrelated determinants by considering a number of external markets at different stages of air policy development and with similar socio-economic and demographic historical profiles. This group of comparable markets is often referred to as a ‘control group’. A similar descriptive research design is adopted in this study before a Caricom liberalisation regression model is specified using a set of comparable country-pairs that have experienced air policy reforms akin to those proposed for the

[49] These country-pairs will include at least one country located in the wider Caribbean region.

more fragmented framework still in effect for the bulk of the sampled Caricom markets.

4.4. Causal and regression modelling research strategy

4.4.1. Objective of the multiple regressions

For the purposes of this thesis we are interested in isolating the effect of air policy liberalisation from a bundle of demand, supply and exogenous predictor variables considered to statistically account for observed traffic levels witnessed in the Caricom region, net of the measurement error term associated with perception driven passenger behaviour. To this end, based on historical evidence across a sample of 24 country-pairs and 12 time periods[50], a multiple regression analysis was performed to identify the factors that led to increases in traffic levels and inform the assumptions surrounding the prediction of country-pair traffic when controlling for non-liberalisation explanatory variables; that is, to support hypotheses about the possible output gains that can be said to be attributable to a relaxation of air policy controls.

An adequate regression procedure was devised using annual county-pair traffic levels as the dependent variable (*Y*), which was to be predicted by a stepwise selection of the following independent variables (IVs):

X_1. Combined and weighted real GDP
X_2. Average yield (airfare)
X_3. Liberalisation index
X_4. Extraneous event dummy variable (e.g. September 11th 2001)
X_5. Quality of Service Index (QSI)
X_6. Levels of direct (indirect) competition
X_7. Airline productivity
X_8. Trade in services
X_9. Tourism ground costs (as a proxy for destination price competitiveness)
X_{10}. Total population with propensity to travel
X_{11}. Great circle distance
X_{12}. Absolute difference in income per capita (as a proxy for the trade imbalance impedance effect)

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[50] More detail on the variables used and their panel data values can be found in Appendix K.

With the exception of competition and quality of service levels which can only be properly estimated at the city-pair or route level, all the explanatory variables reflect aggregate country-pair variations. However, like the other IVs, final estimations of competition and quality of service levels represented an aggregate average of a vector of city-pairs which produced total country-pair output for any given year.

The choice of IVs does not result in an exhaustive list of air traffic determinants but instead provides a commonly used representation of the major components of the following demand function (Clougherty et al. 2001):

f (Price, Demographics, Consumer tastes, Service Characteristics) (4.1)

Price is the average fare paid by passengers in a market. Demographics include generative factors such as income, population and levels of trade and impedance factors like distance and unforeseen extraneous events. Consumer tastes reflect variation in consumer preferences across country-pairs and over time and can be determined by a destination's level of price competitiveness relative to its close substitutes and/or by using a time trend dummy variable to reflect the non-quantifiable change in consumer preferences over the observed regression period. Finally service characteristics include a representative combination of supply side variables except for price[51]. Metric variables include frequency, available capacity, levels of competition, aircraft type used and the number of intermediate stops provided by the air carriers on a county-pair market. The degree of market liberalisation reflected in a country-pair's air policy agreement is also included as a service characteristic given the direct impact it can have on a market's level of supply and competitiveness. Another way to look at the demand function would be to define the IVs in terms of being a combination of supply and demand side influences with price and service attributes falling under supply effects and demographics and consumer tastes falling under demand effects.

An explanation of how each variable was derived along with a description of the relevant data sources is now provided below:

[51] Although considered as a supply side variable, it typically requires exclusive treatment given its inverse relationship with demand compared with other supply side variables and its interrelated yet overwhelming relationship with these other supply side factors.

4.4.2. Dependent variable: Annual country-pair air traffic

Three main sources were used to obtain aggregate country-pair traffic figures between the years 1995 and 2006. Statistics Canada and the US Department of Transportation T-100 data provided North America-Caricom traffic figures, the Civil Aviation Authority (UK) counts the total number of passengers either going to or returning from Caribbean destinations and the Caribbean Tourism Organisation (CTO) proved to be the most reliable and consistent data source for Intra-Caricom passenger movements during the given twelve year period. Although airlines are obliged to report traffic figures and airports also provide useful insights into origin and destination data, both would have overestimated Intra-Caricom traffic due to the double counting of passengers who had a final destination or origin outside the Caricom region. By using final destination data revealed in immigration entry forms (E/D), the CTO data does not count online or interline connecting traffic unless a connection involves a stop-over of more that 24 hours. Further, it is important to note that the CTO definition of a tourist would include all categories of Intra-Caricom travellers including those that are involved in education, receiving health care, visiting friends and relatives or are primarily travelling on business.

4.4.3. Air transport explanatory variables

4.4.3.1. Service quality

One of the first attempts to quantify quality of service was carried out by the US Civil Aeronautics Board (CAB-1970) using the following formula for the creation of a general index identified as QSI:

$$QSI = (\text{stops value}) \times (\text{equipment value}) \times (\text{number of operations}) \times 1{,}000, \qquad (4.2)$$

where the stops value reflects the number of intermediate stops before a passenger's final destination and takes on a range of four interval level values between 1.00 for 0 stops and 0.03 for 3 stops; the equipment value reflects the gauge of aircraft used on a route assuming any one of a range of four interval values between 2.10 for a Boeing 747 to 1 or less for a range turboprop aircraft, and the number of operations reflects the actual number of arrivals or departures within a specified period. This type of index accounts for the fact that an increase in capacity or frequency, when accompanied by more direct routeings and larger aircraft can result in a more pronounced increase in service levels. As mentioned in section 4.3.4., there are a number of other ways to assess customer service levels, including asking air passengers themselves to rank airline and airport service levels in order to pick up any non-measurable aspects not covered by the above QSI index. Core improvements to the network, for instance, may be tainted in the mind of the passenger if staff attitudes are poor, scheduled flights are delayed or baggage is lost. These elements were covered in the Caricom passenger survey and are discussed further in section 5.3.2.4.

In order to account for any directional differences in quality of service between country-pair $_{ij}$, the standard mean of QSI_{ij} and QSI_{ji} was estimated. Also, as the differences in speed and comfort levels between jet and turboprop aircraft as well as within different types of turboprop aircraft are particularly relevant to the Caricom region, given the lion's share of intra-regional routes are served by Dash-8 turboprop aircraft, it was important to leave the variable within the sample in order to endogenously test for quality of service differences between the few routes served by jets, those routes served by advanced turboprops and those served by smaller turboprop aircraft.

On those country-pairs with evidence of O-D traffic but with an incomplete or non existent record of direct non-stop or stopping services, a connectivity ratiodevised by Doganis and Dennis (1989)[52] was subtracted from an assumed minimum service level foregone by not benefitting from any direct services. The standard Connectivity Ratio (CR) takes the following form:

$$CR = \frac{N_c}{N_r} \tag{4.3}$$

where N_c is the total number of viable connections offered at an airline hub during a typical day and N_r is the approximate number of viable connections that would be expected to occur in the case of a purely random arrival and departure timetable across the typical day.

This was then adapted in the following way:

[52] As cited in Danesi (2006).

$$CR(i,_{ij})(o,_{ij}) = \frac{DFo_i * DFt_j}{\sqrt{DFo_i - DFt_j^{2}}} \tag{4.4}$$

That is, the connectivity ratio of interline *(i)* and online *(o)* traffic passing through the designated hubs for country-pair *ij* equals the typical number of departing flights from the origin *i* to the transfer hub(s) multiplied by the typical number of departing flights from the transfer hub(s) *t* to the destination *j* between 45 and 90 minutes after the arrival of each flight from origin *i*. This is then divided by the difference (always a positive integer) between the number of arriving flights and the number of onward flights to destination *j* reflecting the assumption that the larger the disparity between the number of arriving and departing flights the smaller is the number of possible arrival times at destination *j*. The same process is then repeated for direction *ji* and the two ratios are uniformly averaged to arrive at a country-pair non-direct CR estimate. The assumed QSI for a minimum level of direct services (QSI_{ms}) is then divided by CR_{ij}-*1*[53] to arrive at an adjusted QSI of indirect services (QSI_{io}) connecting through *n* hub airports net of the minimum direct service level foregone as indicated by:

$$QSI_{io} = \frac{QSI_{\mathrm{ms}}}{CR_{ij} - 1} \tag{4.5}$$

OAG schedules analysis was considered to be the most reliable data source with service records available throughout the required time-series period (1995-2006). Moreover, the most recent version of the software allows direct flight searches for journeys with up to 2 stop off points. Thus, it is assumed that there is a quality of service improvement through the introduction of direct services even if it involves stopping at 1 or 2 stop off points given the inconveniences associated with making aircraft transfers as well as the ticketing and booking conveniences associated with an airline marketing and selling an O-D pair as a direct flight.

4.4.3.2. Levels of competition

Combining the findings of Morrison et al. (1995) and Lijeson et al. (2002), the inverse of the Herfindahl index was used as a proxy to estimate the number of effective competitors in each country-pair market between 1995 and 2006. The index

[53] A ratio of 1.0 suggests connections are not better than would be expected with a random pattern of schedules (Doganis 2003).

not only takes the number of carriers and their respective market shares into account but it also considers imperfect substitutes internally by disseminating indirect city-pair flight data and calibrating it to appear alongside a city-pair's selection of direct services. As competition is largely applicable at the route level, major city-pairs had to replace country-pair aggregate data for this independent variable. For Intra-Caricom country-pairs with only one international airport at both ends of the route, city-pair data provided an exact replica of country-pair data. This was the case for 60% of the Intra-Caricom country-pairs in the final sample. For the remaining Intra-Caricom and Caricom-US and UK markets, multiple city-pairs were used if the most concentrated route on the country-pair represented less than 70% of total country-pair traffic. For country-pairs with low city-pair concentration ratios and many distinct routes, a multiplicative threshold of the three densest city-pairs was assumed to be reflective of the upper limit of effective country-pair competition. Each city-pair index was averaged using individual city-pair shares of the country-pair market as the most appropriate weighting factor to derive an aggregate country-pair estimate.

Two other averages were used in order to arrive at the final values to be inputted as yearly observations. First, carriers compete not only in capacity terms but also in terms of frequency thus it was important to compute the mean of both factors to yield a more genuine picture of route level competition. Second, as is the case with all the other independent variables, differences pertaining to travel direction were also considered by using the following arithmetic mean calculation:

$$\frac{\sum Traffic_{ij}, Traffic_{ji}}{2} \tag{4.6}$$

On country-pair markets where there is no or patchy evidence of direct services, the effect of indirect competition on traffic levels is said to be directly proportional to a carriers quality of service provided by their online services through their intermediate hub(s) airport(s). Interline services are excluded from the competition sample as, in these cases, carriers are said to be colluding as opposed to competing for end-to-end county-pair traffic. Indirect services also carry a weighting of 50% of the competitive value of direct services reflecting the fact that indirect services are assumed to be inferior substitutes in the majority of cases.

A time-lag can be represented in a panel data set by repeating regressions for T+0, T+1….T+*n* years until statistically significant positive correlations are yielded between the DV traffic volumes and levels of competition. If no pattern emerged then models were rerun with a uniform time specification thereby denoting either the absence of a time-lag or a poor statistical relationship between the variables[54]. Again the most reliable source for the time-series data was provided by the OAG back schedules database.

4.4.3.3. Liberalisation index

Taking into account the inadequate reporting of air policy developments in the Caricom region and the convoluted status of the region's bilateral and multilateral air service agreements (as alluded to in the literature review), it proved to be a major undertaking just to obtain reliable and accurate air policy data spanning the twelve year period 1995 to 2006. Often the actual terms in effect for any given year were poorly represented by official country-pair ASAs and were frequently superseded by extra-bilateral amendments or legally binding Memorandums of Understanding (MoUs).

It was also unclear as to when reform actually took place and what the pre-reform status of a particular economic clause was. Thus, the only way to gain an accurate time-series picture of air policy development was to formulate an original database of *de facto* air policy governing the trading of air services on country-pairs involving Caricom states. For this to occur, it was necessary to solicit the help of experienced regulators as they were the only parties who retained access to restricted policy negotiation files. This resulted in the creation of data probes targeted at the US Department of Transportation (Office of Aviation Affairs), the UK Civil Aviation Authority, Transport Canada, the Caricom Secretariat and individual Caricom state Ministries of International Transport[55].

[54] After initial testing, the added complexity involved in introducing dynamic time-lags was not compensated by a comparable improvement in regression reliability. Upon closer inspection, time-lag variability among the sample would have necessitated a separate single equation model for every country-pair. This would have come at the sacrifice, however, of the simultaneously estimated sub-group liberalisation coefficients.

[55] A full list of data sources and contacts used from these organisations is given in the list of contacts (see Bibliography and fieldwork section).

For Caricom country-pair markets it was necessary to devise an intuitive scale that takes into account more modest approaches to the relaxation of competitive air policy levers. Incorporating a nominal scale of 'liberalness' devised by Gillen et al. (1999), five economic levers relating to capacity/frequency, tariffs, 5^{th} freedom rights, carrier designation and the number of permitted access points were each given the values 0, 0.5 or 1 to replace the nominal classifications of Gillen et al. (where the value '0' replaces the nominal classification 'restrictive', '0.5', the classification 'moderate' and '1' the classification 'facilitating'). The original qualitative classification proposed in Gillen et al. (1999) is reproduced below in Table 4.2.

Table 4.2
Classification of selected international air transport air policy controls

Policy Control	Restrictive	Moderate	Facilitating
Access points	-Single point access	-Multiple with specific access points restricted	-Open access to all points
Designation	-Single designation -No foreign ownership	-Multiple designation with restrictions -Limited foreign ownership	-Multiple designation -No ownership restrictions
Capacity/Frequency Controls	-Agreement between airlines -Predetermined (Quota)	-Increases subject to approval	-No controls
Tariffs	-Airline agreement mandatory	-Refer to IATA -Single disapproval	-Double disapproval
5^{th} freedom rights	-No 5^{th} Freedoms	-Limited 5^{th} Freedoms	-Full 5^{th} Freedom rights

Source: Gillen, Harris and Oum (1999)

The generic terminology given by Gillen et al. (1999) is often not exactly comparable to the terminology found within the sampled air policy agreements. As a result, at times there was an element of personal judgement involved in the categorisation of certain policy terms which were either defined differently or defined in a more detailed or specific way, in accordance with the requirements of the country-pair of interest. Placing an ordinal value on terms proved to be unproblematic, however, as the majority of terminology could easily be represented by one of the descriptions offered by Gillen et al. (1999). The Caricom MASA policy for 5^{th} freedoms, for example, was defined as "liberal for community carriers only". This is clearly represented by the generic "limited 5^{th} freedoms" description, which in turn was considered to reflect a moderately liberal status. This simple iterative process produced essentially trustworthy results but for a few notable exceptions whereby a lever's status could not easily convert into any of the three ordinal values of 0, 0.5, or 1. The pricing policy on the US-Jamaica market between 2003 and 2006, for example, was defined as "double disapproval with 15 days notice". The inclusion of 15 days notice suggested that this lever's status lies somewhere between the values of 0.5 and 1. In the spirit of prudence, these between category clauses were always rounded down and thus, the US-Jamaica pricing clause took on a moderate value of 0.5.

To develop an overall index of 'liberalness', the given ratings for the five economic terms were aggregated and inputted into the data set for each year. Using the US-Dominican Republic market as an illustration, between 1995 and 2000 capacity and frequency was said to change subject to government approval. Hence, when applying Gillen et al's policy classification, this lever assumed a value of 0.5 to reflect its 'moderate' status. In 2000, however, the terminology relating to the same clause changed and thereafter no controls were placed on carriers. Thus, between 2001 and 2006, the lever took on the value of one to reflect the lever's 'facilitating' status. The same iterative process was then repeated for all five economic clauses to arrive at an overall index of liberalness for each of the 12 observed years.

To reflect the differences in the relative importance of each air policy lever for the various country-pairs, different weightings were tested but subsequently discarded given the insignificant impact they had on the liberalisation scale coefficients. Greater 5^{th} freedom rights, for example, are more applicable on US-Jamaica and US-Dominican Republic routes than on US-Bahamas routes. The number of possible intermediate and beyond routes to the Bahamas is limited when compared to the Dominican Republic and Jamaica, who both have airports vying to become regional hubs, connecting South and Central American as well as Caribbean gateways with points in North America for those travellers wishing or having to avoid more established hubs like Miami. The overwhelming influence of combined real GDP along with interrelationships between individual policy levers may have had a dampening effect on the impact of these policy lever weightings.

4.4.3.4. Airline productivity

In line with the findings of Windle (1992) and the objectives of this study an average of two labour related indicators were used as proxies to record changes to levels of airline productivity over the twelve year time series. Total annual revenue and employee data provided by airline annual reports were used in conjunction with aggregate RPK data provided by the Civil Aviation Authority (UK), the Department of Transportation (US), Statistics Canada and ICAO flight stage data to yield two separate partial measures; RPK's per employee and revenue per employee. These approximations represent an estimation of productivity for an airline's entire network of operations and thus had to be controlled for airline services only operating on each of the 24 Caricom county-pairs and then weighted by carrier market share. Coefficient signs are expected to be positive given the general assumption that an increase in output or revenue per employee would be the natural outcome of greater airline cost efficiency. In accordance with Bieger's (2007) customer value model, a stable airline with a cost effective business model often leads to a competitively priced, high quality and frequent supply of air services which would in turn increase air transport demand.

4.4.3.5. Average real yield (airfare)

Real yield data by Caribbean route group was available from an ICAO traffic forecasting study (ICAO Air Transport Bureau 2006). Although it was not possible to compare variation in airfares between country-pairs in the same sub-group, it did allow for a time-series, cross sectional evaluation across the time period 1995 and 2006 and between the three sub-samples, which closely followed the breakdown of route groups (NA-Caribbean, Intra-Caribbean and Europe-Caribbean) offered in the ICAO study. Therefore model calibration using these real yield averages could still give a valuable indication of the strength, sign and statistical significance of this key determinant of air traffic levels.

Airlines typically offer a multitude of different fare classes and carriers operating to, from and within the Caricom region are no exception. But given the dependent variable (air traffic), in this study, was not split into different passenger segments it was not necessary to disaggregate the average yield figures into different fare classes. The Department for Transport (2000), for instance, who specified two separate regression variates to predict leisure and business traffic levels would gain more insight into the impact of changes in airfare if the most relevant classes (e.g. discount fares for leisure passengers) were used for each type of traveller.

4.4.4. Socio-economic and demographic variables

4.4.4.1. Real GDP

Some derivative of Gross Domestic Product, as the principle indicator of a nation's economic activity, is the most widely cited driver of air transport demand. The Purchasing Power Parity (PPP) method of calculation uses the long-term equilibrium exchange rate between two countries in order to account for differences relating to local inflation rates and the cost of living for locals. Real GDP is the preferred method of calculation as it determines whether production actually increased or not by keeping price increases constant. Thus, as these two adjustments take both exchange rates and price increases into account; real GDP (PPP) was selected as the most appropriate economic IV for the regression analysis. Actual yearly changes to output and income levels provided by the International Monetary Fund statistical digest for each of the sampled states were then combined using directional traffic flow data as the logical weighting factor. The Caribbean Tourism Organisation's annual tourism reports, immigration and customs form data, and annual airport traffic data were the main data sources for calibrating directional flows for the 12 year period 1995-2006. Current place of residence as opposed to nationality was collected to ensure Caribbean nationals living abroad and foreign nationals living in the Caribbean were allocated to the correct directional flow.

Variation inherent in the directional traffic flow data caused some disturbances in the resulting weighted real GDP levels. For instance, in 2001 the ratio of US to local travellers on the US-Bahamas market was 80.7%; the following year, however, this figure increased to 85.8%. As a result, the combined and weighted real GDP trends were less linear than the separate US and Bahamas real GDP growth trends. It was found, however, that this process actually improved the likeliness of the resulting coefficients for otherwise unrealistically positive and over-significant correlations between real GDP and air traffic levels would have overwhelmed the partial effects of the other selected traffic determinants.

4.4.4.2. Absolute difference in per capita income

Real GDP growth has a direct effect on personal income. Although combined real GDP growth was weighted by traffic flow ratios (to better reflect the fact that a change in GDP for the source state would impact aggregate country-pair flows more than a change in GDP for the destination market), the aggregate negative effects of a country-pair's income imbalance is not satisfactorily reflected in combined real GDP figures which are in themselves expected to yield positive coefficients and high beta values with the dependent variable country-pair traffic.

This impedance factor, which was first investigated by Linder (1961), is highly relevant to the Caricom region given the large income imbalances evident on many Extra- and even Intra-regional country-pairs. This income disparity can lead to trade imbalances which would then negatively effect business oriented travel decisions. Thus, sample member states with mature source markets for tourism and good levels of tourist infrastructure are predicted to suffer notably less from this income disparity and may even experience a reverse effect in cases where source market income growth proves to be the main driver of tourism fuelled traffic growth. Alder et al. (2005) uses the absolute yearly difference in GDP per capita as a reliable proxy measure for country-pair income disparities. The relative ease with which time-series GDP per capita data can be sourced was also an important supplementary benefit of using this measure. The International Monetary Fund provided the annual data in US dollars across the required time-series and sample of country-pairs.

4.4.4.3. Trade in services

Data on flows of commercial services were gathered from the World Trade Organisation's International Trade Statistics report (2006). This import/export data was originally revealed in $US millions for each sampled state and then converted into a comparative index which took into account each country-pair's commercial trading potential net of its trading imbalance as a likely anti-catalyst to the realisation of a given trading potential. Note that rather like a gravity model, actual trade in commercial services between the sampled country-pairs is not offered by the index but instead a prediction of trade potential based on each of the sampled country's aggregate import and export activities.

The process described above to arrive at a comparative commercial trading potential index ($CTflow_{ab}$) is given by the following calculation:

$$CTflow_{ab} = \frac{\left(E_a * I_b + E_b * I_a\right)}{\sqrt{\left[\left(E_a + I_a\right) - \left(E_b + I_b\right)\right]^2}} \tag{4.7}$$

where a is country A and b is country B, E is aggregate commercial service exports in \$US millions and I is aggregate commercial service imports also in \$US millions.

This particular IV had to be discarded from all of the final sub-group specifications due to its highly significant statistical correlation with the real GDP variable. The backward stepwise elimination method confirmed this finding as the inclusion of both the real GDP and commercial services variable resulted in both unstable t-stats and unexpected signs. As the GDP indicator explicitly accounts for exports less imports in its calculation, it could act as a suitable representative of commercial trade potential between the sampled country-pairs.

4.4.4.4. Destination price competitiveness

Few airline deregulation models have been specified for tourism intensive markets where factors such as changes in destination price competitiveness and the strength of destination marketing may have a greater influence on the observed changes in traffic levels. This called for a revision of the typical socio-demographic variables when calibrating for largely tourism intensive Caricom markets.

It is expected that country-pairs with a high proportion of leisure traffic from US, Canadian and UK source markets will be the most responsive to changes in destination ground cost levels. The data was obtained from the Caribbean Tourism Organisation which collects time-series data pertaining to changes in average daily expenditure by conducting periodical passenger surveys at member state air and cruise terminals. This average ground cost data can only be considered a proxy for a destination's price competitiveness, however, for two main reasons. First, the CTO questionnaires included a non-exhaustive list of destination goods and services to a sample of the total number of travellers entering the respective host countries. Secondly, travellers have greater access to total travel cost information and can quickly compare overall trip costs between competing host markets. Thus hotel, bar, excursion, duty free shopping and car rental costs can only be seen as one integral part of the overall travel decision criteria. As the trend towards dynamic packaging continues and travellers become more knowledgeable about total trip costs, a greater number of travellers could choose alternative destinations, particularly if they can discern between comparable substitutes effectively. This could have some implications for incoming tourism demand to some of the more traditional Caribbean destinations, especially for those states which rely quite heavily on repeat visitors. Combining airfare and ground cost variables may have gone some way to achieving a total travel cost indicator, but it was important to keep controllable factors like airfares separate from those external drivers over which the air transport sector has little influence.

As expected, the variable had more of an impact on US-, Canada and UK-Caricom markets than on Intra-Caricom markets where journeys were inelastic and airfares generally made up a much more significant percentage of total trip costs due to the shorter trip durations and higher VFR levels on these markets. Ground costs make up a relatively smaller proportion of total trip costs on short business and leisure visits and an even smaller proportion for Caricom VFR travellers who often stay with friends or relatives in the host country.

In order to yield a more accurate proxy, average daily expenditure data was also captured from the traditional source markets in order to account for those travellers on tourism in the US, Canada and the United Kingdom. The respective data sources were the US International Tourism Association, the UK Civil Aviation Authority passenger survey data and Canadian Tourism Commission data. Directional flow weightings were introduced and nominal prices were adjusted for combined country-pair inflation to give a real change estimate. This frequently led to reductions in average daily ground costs over the observation period although there were some notable exceptions. A final calibration to the values would have yielded a comparative index in order to achieve an exact estimation of cross-price competitiveness. This would have come at the cost of the absolute dollar values, however, which were useful for partial effect coefficient interpretations of the poly-linear regression outputs. Nevertheless, the cross-sectional component of the panel data set ensured that between country, ground cost differentials were reflected both in the IV coefficients and also in the unique fixed-effect between-country intercept values. A traditional OLS model would have only captured the within country time-series effect of change in ground cost, hence losing the important destination price substitute effect present in Caricom markets with homogenous tourism products.

The quality of tourism products and services also change over time and a true comparative index of imperfect substitutes would need to take account of this. Moreover when new, enhanced services are introduced, this puts downward pressure on older service pricing and upward pressure on aggregate price levels, especially if new products and services become popular very quickly. A hedonic price adjustment can be made between superior and inferior products by regressing a number of explanatory variables against price. Turvey (2004) uses the price of new and old Television sets as an example. That is, price can be seen as a function of screen size, brand and text-video retrieval features *inter-alia*. As there is an absence or inferiority of such features on older versions, the price effect of the new features or quality adjustment can be extracted directly from the regression variates. In the tourism sector, deriving hedonic price adjustments for package holiday prices has been found to be a useful exercise (Mangion, Durbarry and Sinclair 2005). It would become less useful, however, when total trip costs are disaggregated as they have been in this study, as quality adjustments in ground costs may not result in a significant change in overall trip costs if changes is airfares do not follow suit. Explicit quality adjustments and the creation of a comparative index prior to regression were therefore avoided in this study.

4.4.4.5. Total weighted population

Adjusted for consumer purchasing power parity (PPP) in order to take exchange rate differences into account, the total population of each country-pair market was converted into a more realistic indicator of the numbers of residents at each end of the country-pair capable of air travel participation. Relative PPPs were yielded by indexing the US PPP to a base integer of 100. As a result it was assumed the entire US population had potential for air travel participation even if it had not actually occurred for all residents yet. All other Caricom populations along with the populations of the UK and Canada were adjusted accordingly before being combined with the estimated travel population for the other state in each country-pair. The source for absolute populations over the time-series was the International Monetary Fund, and Penn World tables were consulted for the relevant indexed weightings. Of course, the other advantage of controlling for PPP is that the GDP per capita variable X_{12} fails to take account of the fact that airfares are often sold in local currencies, which whether for domestic or international travel are often adjusted to levels that the local market can bear. The index was calculated as follows:

$$\text{Total net population}_{AB} = \left(\text{Pop}_A * \frac{\text{PPPindex}_A}{100} \right) + \left(\text{Pop}_B * \frac{\text{PPPindex}_B}{100} \right) \qquad (4.8)$$

4.4.4.6. Great circle distances

Great circle distance is a commonly used between country-pair variable that often appears as a denominator in air transport passenger market gravity models. As this variable (mid-point distances) is constant over time it was dropped from the model specification and was considered to be reflected in the fixed effect country-pair dummy variable coefficients by comparing them with the overall models' intercept values, which in themselves would reflect constant country-pair specific fixed effects like distance for the models' omitted country-pairs. Data on country-pair distances were easily obtained from GPS visualizer.com.

4.4.5. Accounting for extraneous distortions

The statistical relationship between air traffic volume and GDP, airfares, levels of competition and destination ground costs can only remain stable in the absence of external shocks and non-cyclical events. Between the years of 1995 and 2006 a number of exceptional events may have had an impact on the sampled country-pair markets. First, the late 1990's recession led to financially troubled Caricom and US carriers, a situation which was exacerbated by the events of September 11th 2001. A fear of flying reduced airline profitability even further as carriers failed to respond quickly enough with capacity cuts to keep prices at marginal cost levels. The introduction of security measures from 2002 onwards further delayed a return to normal rates of traffic growth.

The SARS epidemic in 2003 mainly effected Asian economies although it may have had an indirect impact on Caricom services provided by foreign carriers suffering directly from the SARS downturn. Finally, the failure of the US government to arrive at a permanent solution after the 2002 and 2003 wars in Afghanistan and Iraq has also acted as a negative moderating force on air traffic levels up to the year 2006 and beyond. Fuel prices became an unsustainable problem after 2006 although uncomfortable increases have been taking place since the year 2002. Caricom markets whose currencies are pegged to the US dollar, like the Bahamas and Barbados dollar for example, have not tended to suffer as significantly from the weakening US dollar as have European and Asian economies. For those states whose currencies are not pegged to the US dollar, the weakening trend has been even more marked than the observed weakening of the US dollar, suggesting that US travellers would still be able to leverage a reasonable purchasing power in these countries (e.g. Jamaica and Trinidad & Tobago).

An analysis of the sampled country-pair traffic trends, however, suggests a remarkable resilience to the aforementioned events with constant shock effects evident on most markets only for the 2000 to 2002 period. It was concluded that, as negative responses to shocks outside the observation period were so varied, it would be impossible to capture this variation within the aggregate sub-group regression variates. Thus, a dummy variable was only deemed feasible for the years 2000 to 2002 which would have incorporated the recession, terrorist attack and security measure effects for all Caricom markets during that period. The control variable took on a unity value for the years 2001 and 2002 and zero for otherwise. However, the partial effects of this appear to have been overwhelmed by other explanatory variables and the resulting coefficients were both insignificant and minor in magnitude. A unity value was also tested for the three year period 2000 to 2002 but this did not make much difference to the resulting shock effects. The variable was thus discarded and assumed to be captured by each sub-samples' respective error terms.

4.5. Regression model design

A pilot single equation model estimated separately for three preliminary country-pairs indicated an overfitting of the sample, thereby limiting the number of possible explanatory variables that could be selected and reducing the generalisability of the observed coefficients to the entire population of country-pairs involving Caricom states (Warnock-Smith and Morrell 2008). The simultaneous estimation created a Time-Series, Cross-Section (TSCS) matrix of $24i$ x $12t$ = 288 observations. This increased sample size satisfied two criteria. First, with an 80% probability (power) the regression's overall coefficient of determination (R^2) can detect relationships with R^2 values of as little as 0.04 at the 0.05 significance level. This clearly allows for more realistic and statistically reliable R^2 estimations. That is, if R^2 is high, for instance, it is highly probable that a sample size of 288 observations can reliably validate the statistical significance of the model. Second, using the minimum observation to independent variable guideline ratio of 5 to 1, the generalisability of the regressions are considered to be sufficient enough to apply to other country-pairs involving Caricom states given the sub-samples' much higher average ratio of 24 to 1 (96/4)[56].

4.6. Compliance with regression assumptions

The relationship between each independent variable (IV) for selection and the dependent variable (DV) as well as the overall relationship between the final specification's IVs and the DV must be tested, the first prior to model testing and the second subsequent to model testing.

In their relationship with the DV, the initial selection of IVs must all be tested for conformity to assumptions relating to linearity, and homoscedasdicity. Also, each of the variables should individually follow a roughly normal frequency distribution which in itself forms the base assumption of R^2, confidence intervals and other tests relating to statistical significance. If any of these tests are violated, corrective or remedial action is required which typically involves a curve transformation of the non-compliant variables into a number of non-linear forms (exponential, polynomial, logarithmic or power).

The pilot regression analysis generated for a limited number of country-pairs gave an early indication of the statistical relationship between a smaller selection of IVs and the DV in its transformed and non-transformed specification (Warnock-Smith et al. 2008). Hence this initial process of IV dissemination not only hinted at what the final model specification may look like, but it also assisted in the familiarisation of the extent to which any Caricom traffic volatility could be reasonably predicted by a final stepwise selection of IVs. In many country-pairs, underlying trends were corrupted by yearly volatility. As expected the country-pairs chosen for the pilot regressions

56 See Chapter 2 for a detailed discussion about the cluster methodology used to arrive at seven representative Caricom states representing the total full and associate member population of 20 states.

returned smoother traffic trends which are typically seen on more dense and/or maturer markets[57]. The DV time-series patterns for the main data set showed more variation reflected by the introduction of a number of smaller and/or newer country-pair markets involving southern and eastern Caribbean states. On these markets IV/DV correlations improved as traffic spikes were stabilised and underlying trends identified through the process of DV value transformation. As an illustration a linear to polynomial transformation of the US-St. Lucia market was substantiated using the following steps:

1. Generate linear trend curve for actual time-series traffic values

$$y \text{ (US-St.Lucia}_{\text{c-ptraffic}}) = 7477.2_x + 123927 \qquad (4.9)$$

$$R^2 = 0.258$$

2. Generate poly-transformed curve yielding improved predicted values

$$y \text{ (US-St.Lucia}_{\text{c-ptraffic}}) = 339.78_x^{\,3} - 3089.1_x^{\,2} - 2651.8_x + 184824 \qquad (4.10)$$

$$R^2 = 0.841$$

That is the transformation uses a polynomial curve with two points of inflection (order of 3) to reflect the U-shaped appearance of the original traffic trend curve.

3. Recalculate each of the twelve yearly observations using the transformed curve equation to yield a set of predicted values

Table 4.3
Difference between actual and fitted traffic values after transformation

Year	US-St. Lucia actual	US-St.Lucia fitted (Poly)	Difference +/-
1995	173,648	179,423	5,775
1996	179,310	169,882	-9,428
1997	149,104	158,241	9,137
1998	155,486	146,537	-8,949
1999	166,512	136,810	-29,702
2000	74,387	131,098	56,711
2001	146,396	131,440	-14,956
2002	146,608	139,875	-6,733
2003	164,406	158,440	-5,966
2004	179,918	189,176	9,258
2005	245,240	234,120	-11,120
2006	289,332	295,311	5,979

[57]Logarithmic transformations are typically applied to maturing/mixed markets while power orders are normally indicated for growth/leisure markets. The DV was therefore log-transformed for the pilot regressions and poly-transformed for the main sub-samples.

4. Compare actual linear relationships of IVs to DV against fitted linear relationships and make decision

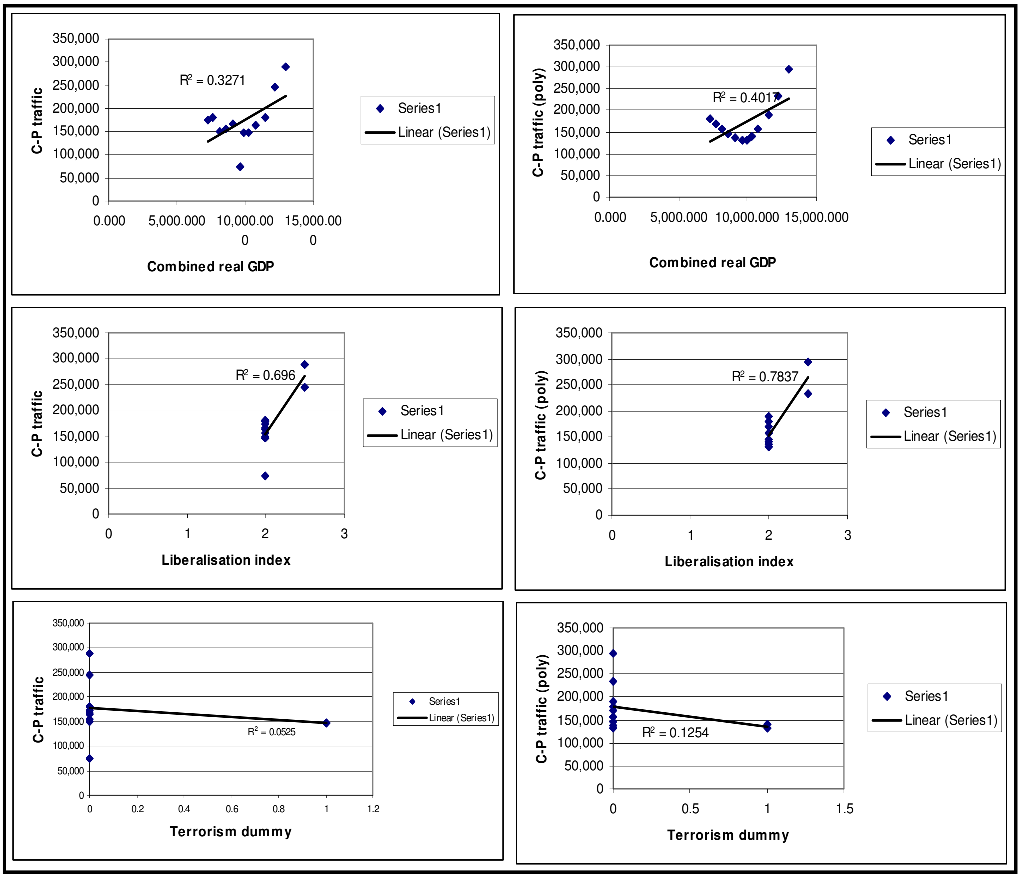


Fig. 4.3 Scatterplots of a selection of independent variables and the dependent variable (US-St. Lucia market 1995-2006)

Scatterplots of IVs X_1, X_3 and X_4 against DV yearly traffic show consistent linear R^2 improvements by uniform amounts when the transformed actual traffic values were replaced by the fitted polynomial values. Improvements were often not dramatic enough in many cases to make individual IVs good stand alone predictors of traffic[58] but it made intuitive sense to make additive IV selections under the condition of controlling for DV volatility during the observational time period. This four step DV transformation appraisal process was then repeated for all the remaining country-pairs in the sample before the adjusted and original values were inputted into the chosen statistical software package (SAS). This avoided the typical 'black-box' effect of allowing statistical packages to automate variable transformations. That is; consistent

[58] Also, Hair et al. (1998) alludes to the fact that a correlation analysis for dichotomous IVs like X_4 extraneous event dummy is not well represented by the traditional Pearson coefficient but this does not mean they should not be included as IVs in a regression analysis.

IV to DV correlation improvements, using a constant non-linear transformation, were evident before the IVs were regressed against the DV simultaneously within the statistical software package.

4.6.1. Previous study curve transformations and coefficient interpretations

In order to linearise and stabilise correlations between the DV traffic volumes and the given explanatory variables, it is common practise to either take the log of traffic values as is the case on many business markets or an exponential in order to reflect trends caused by maturing leisure markets (Department for Transport 2000). This also allows for forecasts which are based on more customised and intuitive market behaviour but the downside to this is the complexity of interpretation of the resulting coefficient values.

Logarithmic transformations are usually interpreted in terms of percentage change of *y* relative to percentage change in *x*. Consequently, log interpretations are synonymous with estimated elasticities of demand for a given change in income, airfare and so forth. The use of exponents or power terms represent a point of inflection evident in traffic trends and can be interpreted either directly as a stabilised best-fit estimate of actual traffic values or by reversing the exponent to obtain an adjusted set of coefficients that still conform with the restraints imposed by OLS regression (Department for Transport 2000). Both options are available for the curvilinear transformations performed on the observed Caricom traffic trends.

Reversing the transformed coefficients would give an exact interpretation both of the overall variate's effect on actual traffic volumes as well as each of the sampled country-pairs real traffic effect but would increase the complexity of interpretation for the reader. The following example will clarify how the coefficients explaining the transformed DV can be reversed[59].

[59] This along with the remaining coefficients and model equations can be found in the regression results section (section 5.4 Chapter 5).

Example: North America-Caricom subgroup

$$\beta_4\text{NOCOMP}_{backtransformed} = \beta_4\text{NOCOMP}_{transformed}\sqrt{182{,}801}^{\,3} \text{ x } \sqrt{182{,}801} + 182{,}801$$

$$= 207{,}064 \qquad (4.11)$$

$$\beta_4\text{NOCOMP}_{original} = 208{,}579$$

$$\beta_4\text{NOCOMP}_{original} - \beta_4\text{NOCOMP}_{backtransformed} = 1{,}515 \text{ (error term)}$$

This procedure can be substantiated by Gaudry and Laferriere (1989) who found that DV Box-Cox transformations were invariant to simple power transformations of such DVs even without the presence of a regression constant (i.e. without incorporation of the regression intercept). Thus, interpretation of a series of simple power transformations for the Caricom regression models can be undertaken by using a direct and uncomplicated reversal of the power terms.

Although the majority of transformations were performed using 3rd order polynomial functions, some notable exceptions namely the US-Bahamas and US-Trinidad & Tobago country-pairs were estimated with linear transformations. This caused a minor error[60] when overall subgroup coefficients were back-transformed using power inverse or root terms. It is important to note that this discrepancy was minimised due to the fact that 3rd order polynomial transformations invariably approached a similar R^2 estimate to those given for the most appropriate DV curve transformations on markets that were not transformed using a 3rd order polynomial equation, whether they were linear, logarithmic, exponential or power. In total only 7 of the 24 Caricom country-pairs were transformed with a different functional form.

The Department for Transport based their future leisure traffic forecasts in 2000, for instance, on coefficients obtained from transformed traffic values using lower order power terms with the justification that they would provide more realistic and perhaps more conservative long term traffic estimates (i.e. declining income elasticties). This practise is not just limited to the UK Department for Transport but is considered to be common practise in the field of air transport econometrics with power terms featuring as direct interpretations of traffic growth in the regression work of Profillidis (2000) and Lai and Lu (2005). Log transformations are also frequently used in aviation forecasting as it allows for convenient percentage change

[60] Rounding error also contributed marginally to the original and back-transformed coefficients.

interpretations which are relatively easy to follow as well as assisting in the mitigation of the common OLS problem of heteroscedacity of the fitted values of the DV against the residuals.

Critically, manipulating the dependent variable using mainly polynomial transformations has not altered the IV coefficients significantly from those shown for the IVs predicting traffic volumes in their original metric. Given the similarity between the original and transformed DV coefficients combined with the fact that t-values in some cases improved quite notably, it was decided that it was not of core importance to perform back-transformations on all the transformed coefficient estimates by repeating the procedure offered in equation (4.11). Statistical reliability has therefore increased without an overfitting of the data points. This is supported by the fact that the overall standard errors for the three submodels were not too dissimilar between the original and transformed specifications[61]. Moreover, in strict mathematical terms polynomial transformation should not be considered a non-linear transformation despite the fact that they alter the correlations between the IVs and the DV (Motulsky and Christopoulos 2003). Motulsky and Christopoulos (2003) also recommend that DV transformations should be avoided in non-linear regression models as it violates the Gaussian (constant distances of data points from curve) assumption. However, the Caricom data sets were all regressed without making any further transformations either to the DV or the IVs and in turn can be considered linear regressions or more accurately, General Linear Models (GLMs) with fixed effect least squares dummy variables (LSDV). In conclusion, a linear interpretation of the coefficients is not considered to be a convoluting aspect of the transformed DV regression output.

4.6.2. Diagnostic tests of individual IVs against the DV

With a best-fit curve applied to the DV for each country-pair, corresponding observations for the twelve IVs were plotted against the DV and checked for linearity, homoscedasticity and normality.

[61] Motulsky and Christopoulos (2003) contend that polynomial transformation processes can produce standard errors that are very different often reducing the sum-of-squares by a factor of nine and so reducing the reported standard error by a factor of around three. In this case the standard errors and confidence intervals would seem reasonable but would be wrong in reality. However, differences between transformed and original metric standard errors are 16%, 2% and 18% for Intra, NA and UK-Caricom markets respectively (well below the average reduction of a factor of three in all sub-samples).

The skewness and kurtosis effect of each IV sample distribution was performed for each of the three country-pair sub groupings in order to test for normality. A value of '0' indicated a normal distribution of observations in terms of its level of symmetry and height for skewness and kurtosis respectively. A positive skewness value indicates that there are too many small value frequencies and the resulting distribution skews to the right. The opposite is true for a negative skewness value. Equally, a positive kurtosis value reflects a peaked distribution indicating that frequencies are too high in some regions of the range of IV values. A negative value specifies a flat curve or an evenly distributed range of frequencies. The closer the value gets to zero the more normal is the distribution of observations in a sample. The normality decision rule considers sample size as well as the skewness and kurtosis values and is converted into a value that can be directly related to the 'z' distribution critical values of +/- 1.96 for the .05 significance level and +/- 2.58 for the .01 level. This is calculated as:

$$z_{skewness} = \frac{skewness}{\sqrt{\frac{6}{N}}} \tag{4.12}$$

$$z_{kurtosis} = \frac{kurtosis}{\sqrt{\frac{24}{N}}} \tag{4.13}$$

where *N* is the sample size. If the calculated 'z' value exceeds the desired critical value then the sample distribution can be said to violate the normality assumption required for linear regression.

Linearity can be visually inspected using standard scatterplots of the IV in question against the observed values of the DV. If the resulting linear R^2 falls below .60 while a higher R^2 can be yielded using a non-linear equation, then the regression assumption relating to linearity is said to be violated. Poorly correlated IVs showing no signs of any linear or non-linear relationship with the DV were left within the data set at this stage.

The final assumption of residual homoscedasticity of metric variables can be tested by confirming the random distribution of fitted value residuals when plotted against the fitted values of the DV. If there are signs of a distinct pattern then variance in the DV is not equally spread against variance of the IV causing predictions to be better or residuals to be smaller only at certain levels of the IV. This can lead to oversensitive or overconservative hypothesis tests and thus any possible violations relating to non-constant variance must be dealt with at this pre-model specification stage. A summary of findings for these violation tests is given in Table 4.4.

Table 4.4
Independent variable violation of linear regression assumptions

IV	Normality (n=6)	Linearity (n=24)	Homoscedasticity (n=24)
X_1	Intra-Caricom sample violates assumption at the .01 significance level with skewness 'Z' value of 4.34	2 Intra- and 1 NA-Caricom country-pair(s) showed high non-linear relationships with DV	6 Intra-, 2 NA- and 1 UK-Caricom country-pair(s) showed heteroscedasticity (9)
X_2	UK-Caricom sample violates assumption at the .01 significance level with skewness 'Z' value of 3.30	8 Intra- and 3 NA-Caricom country-pair(s) showed high non-linear relationships with DV	1 Intra- and 7 NA-Caricom country-pair(s) showed some form of heteroscedasticity (8)
X_3	Ordinal data. Test not applicable. 7 Intra-, 3 UK- and 3 NA-Caricom country-pairs maintained policy "status quo" throughout period	Ordinal data. Test not applicable. 7 Intra-, 3 UK- and 3 NA-Caricom country-pairs maintained policy "status quo" throughout period	Ordinal data. Test not applicable. 7 Intra-, 3 UK- and 3 NA-Caricom country-pairs maintained policy "status quo" throughout period
X_4	Dichotomous values. Test not applicable. Unity value for every C-P in 2001 and 2002 only	Dichotomous values. Test not applicable. Unity value for every C-P in years 2001 and 2002 only	Dichotomous values. Test not applicable. Unity value for every C-P in years 2001 and 2002 only
X_5	Intra- and NA-Caricom samples violates assumption at the .01 significance level with skewness 'Z' value of 3.94 and 4.63 respectively	1 Intra-Caricom country-pair showed high non-linear relationship with DV	2 Intra- and 1 NA-Caricom country-pair(s) showed some form of heteroscedasticity (3)
X_6	NA-Caricom sample violates assumption at .01 significance level with kurtosis 'Z' value of 3.51	1 Intra- and 1 UK-Caricom country-pair showed high non-linear relationship with DV	2 Intra- and 1 UK-Caricom country-pairs showed some form of heteroscedasticity (3)
X_7	Intra- and NA-Caricom samples violate assumption at .01 significance level with skewness 'Z' value of 2.96 and 3.43 respectively	1 Intra-, 2 NA- and 1 UK-Caricom country-pair(s) showed high non-linear relationships with DV	1 Intra-, 1 UK- and 4 NA-Caricom country-pair(s) showed some form of heteroscedasticity (6)
X_8	Intra- and NA-Caricom samples violate assumption at .01 significance level with	3 Intra- and 4 NA-Caricom country-pair(s) showed high non-linear relationships with DV	2 Intra-, 1 UK- and 5 NA-Caricom country-pair(s) showed some form of heteroscedasticity (8)

	skewness/kurtosis 'Z' values of 12.32/15.17 and 3.05 respectively		
X_9	No normality violations	1 UK-Caricom country-pair showed high non-linear relationship with DV	2 Intra- and 1 UK-Caricom country-pair(s) showed some form of heteroscedasticity (3)
X_{10}	Intra- and NA-Caricom samples violate assumption at .01 significance level with skewness/kurtosis 'Z' values of 2.83 and -10.29/8.70 respectively	1 Intra- and 4 NA-Caricom country-pair(s) showed high non-linear relationships with DV	3 Intra-, 2 UK and 5 NA-Caricom country-pair(s) showed some form of heteroscedasticity (10)
X_{11}	Intra-Caricom sample violates skewness assumption at the .01 level with 'Z' value of 3.27. NA-Caricom sample violates kurtosis assumption at .01 level with 'Z' value of -3.33	Fixed values. No possible within country-pair variation	Fixed values. No possible within country-pair variation
X_{12}	Intra-Caricom sample violates skewness assumption at the .01 level with 'Z' value of 3.00	1 Intra-, 3 NA- and 3 UK-Caricom country-pair(s) showed high non-linear relationships with DV	3 Intra-, 3 UK- and 5 NA-Caricom country-pair(s) showed some form of heteroscedasticity (11)

Notes: Change in traffic during the time-series period was of more significance than between country cross-sectional variation that does not take into account the dynamic, often cyclical process underlying the supply and demand of passenger services involving Caricom states. Moreover, between group effects could be captured by a set of fixed effect dummy variables which like X_4 cannot be tested for adherence to normality, linearity and homoscedasticity assumptions. Accordingly, tests for violations were only necessary for within group time-series variation
Independent variable rows shaded in yellow indicate the selection of regressors used in the final model specifications

4.6.3. Interplay between Independent Variables

Many of the selected IVs are not mutually exclusive. Marin (1998) found that airlines were generally more productive, for example, in liberalised markets. Airfares are also said to be inversely related to levels of cost efficiency, competition and liberalisation (See Drenser and Tretheway 1992 or Morrison et al. 1995, for example). This overlap between the various determinants of air traffic leads to cross-correlations and contributes to complications of interpretation. To check for the presence of interrelationships among the IVs in the sample, beta values are presented for three Caricom country-pair groupings in the form of an IV cross-correlation matrix.

Table 4.5
Cross-correlation matrices of three Caricom country-pair sub-groups

NA-Caricom IV correlations

	CPGDP	*GRCST*	*NOCOMP*	*LIBRANK*
CPGDP	1			
GRCST	**-0.185945**	1		
NOCOMP	**0.045879**	**0.048824**	1	
LIBRANK	**-0.029535**	**0.387285**	**0.494175**	1

UK-Caricom IV correlations

	CPGDP	*GRCST*	*QSI*	*AVYLD*	*LIBRANK*
CPGDP	1				
GRCST	**0.414865**	1			
QSI	**-0.222226**	**0.370619**	1		
AVYLD	-0.527686	**0.112198**	**-0.074184**	1	
LIBRANK	**0.215383**	0.538582	**0.46945**	**-0.093573**	1

Intra-Caricom IV correlations

	CPGDP	*DIFFINC*	*AVYLD*	*LIBRANK*
CPGDP	1			
DIFFINC	**0.100966**	1		
AVYLD	**-0.099381**	**-0.112108**	1	
LIBRANK	**0.036002**	**-0.034674**	**-0.039794**	1

An initial inspection of the remaining IVs after the first stepwise elimination process reveals that LIBRANK has a moderately positive correlation with the IV GRCST, and AVYLD returned a moderate inverse correlation with the CPGDP variable in the UK-Caricom sub-group. It follows, for example, that as real income increases, demand for air travel also increases, thus putting downward pressure on airfares. Unexpectedly, LIBRANK and NOCOMP variables were only moderately correlated in the NA-Caricom sub-group. LIBRANK also had a beta value of 0.47 with the QSI variable in the UK-Caricom sub-group. The implication in the last example is that as further air reform takes place it is moderately possible that airline quality of service will also improve.

With the exception of the abovementioned beta values, the majority of cross-correlations were insignificant with change in GDP per capita, for instance, not being highly related to the AVYLD variable in the Intra-Caricom sub-group. A more detailed review of multicollinearity considerations is given in the Variance Inflation Factor analysis covered in section 4.6.13.

4.6.4. Cross-sectional/time-series nature of the data

Although some violations were noted for some of the metric and categorical explanatory variables, it was important not to make too many adjustments in light of the fact that the dependant variable had already been transformed for the majority of the sample's country-pair observations. Moreover, it was envisaged that the backward process of independent variable elimination would highlight the same IVs that showed a higher number of regression violations in the pre-model specification stage. This is confirmed by Table 4.6, which reveals the number and ratio of violations for each of the seven IVs used in the final specifications compared with the five discarded IVs. For the same reason it was decided that any outliers should be explicitly included in the model's disturbance term given the fact that a traffic observation in time period *x* can be said to be related to preceding and subsequent traffic volume observations, and that the omission or adjustment of outliers would lead to an overfitting of the regression line and a reduction in one of only twelve yearly observations between 1995 and 2006. In this way the balance between the model's goodness of fit and its interpretability could be found. Initial testing suggested that the additive model could accommodate between four and six representative IVs.

Table 4.6
Number and ratio of linear regression violations between selected and omitted IVs

Selected/omitted IV	Normality (n=6)		Linearity (n=24)		Homoscedasticity (n=24)	
	Violations	Sample size (sub-group)	Violations	Sample size (sub-group)	Violations	Sample size (sub-group)
X_1	1	6 (All)	3	24 (All)	9	24 (All)
X_2	1	4 (UK, Intra)	8	15 (UK, Intra)	1	15 (UK, Intra)
X_3	N/A	N/A (All)	N/A	N/A (All)	N/A	N/A (All)
X_5	0	2 (UK)	0	5 (UK)	0	5 (UK)
X_6	1	2 (NA)	0	9 (NA)	0	9 (NA)
X_9	0	4 (NA, UK)	1	14 (NA, UK)	1	14 (NA, UK)
X_{12}	1	2 (Intra)	1	10 (Intra)	3	10 (Intra)
Total selecte (%)	*4*	*20 (20%)*	*13*	*77 (17%)*	*14*	*77 (18%)*
X_4	N/A	N/A (All)	N/A	N/A (All)	N/A	N/A (All)
X_7	2	6 (All)	4	24 (All)	6	24 (All)
X_8	3	6 (All)	7	24 (All)	8	24 (All)
X_{10}	3	6 (All)	5	24 (All)	10	24 (All)
X_{11}	2	6 (All)	N/A	N/A (All)	N/A	N/A (All)
Total omitted (%)	*10*	*24 (42%)*	*16*	*72 (22%)*	*24*	*72 (33%)*

An added component of the sample's historical data was that the same variables were observed across multiple time-periods giving an extra interpretive dimension to the data. Now variation can not only be analysed across multiple intervals at one point in time, but each separate interval can be focused on for variation across several time observations. For the Caricom traffic data set variation was evident between intervals (country-pairs) as well as across time indicating the presence of a number of country-pair fixed effects which when regressed simultaneously would have the effect of increasing the disturbance term. Separate regressions for each country-pair was not feasible given that only 11 degrees of freedom would permit the use of only two IVs with any statistical validity. Intuition and cross-correlation matrices of the IVs indicated that more than two representative predictors were required in order to reflect the main drivers of air traffic in the Caricom region. Consequently, the predictive power of the model could be increased by pooling 12 time-series observations across a panel of 24 country-pairs, paving the way for more generalisable results.

The 24 country-pairs naturally had to be split into three regional sub-groups given the high variance evident within the aggregate traffic data set. This variance could be reasonably controlled when broken down by region consisting of the North America group (comprising the USA and Canada), the United Kingdom group and finally the Intra-Caricom group. The heterogeneous development of trade and travel links has clearly led to more advanced passenger traffic markets for US-Caricom markets than for Intra-Caricom markets. UK-Caricom country-pairs are generally mature markets for tourism and VFR traffic reflecting well developed colonial links that have not historically been present between Intra-Caricom country-pairs. Sub-grouping all the UK- US- and Intra-Caricom markets therefore made intuitive and statistical sense. More accurately, a basecase of lower unobserved heterogeneity between country-pairs could afford more predictive power to a set of dichotomous dummy variables computed to capture those fixed effects.

Again, separate equations for each individual country-pair were considered but subsequently discarded. First, the unique liberalisation rank remained constant for the 'status quo' markets in the sample. In a static linear model the resulting time-series correlations would be meaningless, producing a coefficient error although in reality the dynamic effect of previous non-observed liberalisation may be interacting with observed values of the DV according to the magnitude and timing of reform. Second, it was important to increase the total number of degrees of freedom *(df)* to more than k^{-1} twelve time periods in order to allow for the maximum possible number of numerical, ordinal and dummy IVs.

4.6.5. Independent variable selection method

Before an appropriate method of regression could be selected the next stage was to determine the most relevant IV selection method from the following three commonly used stepwise approaches:

1. *Forward*. Step 0; the initial model always includes the regression intercept and one or more effects specified to be forced into the model. Subsequent steps consist of assessing each IVs correlation with the DV and with other IVs with the largest IV-DV correlation statistic being entered into the model controlling for low cross-correlations. Stepping terminates when partial correlations and t-values prove that little predictive value would be added to the overall model by including them.
2. *Backward.* Step 0; the initial model always includes all IV candidates to be included in the design for analysis. Subsequent steps involve eliminating IVs that have the smallest impact on the removal statistic (R^2 and F-stat). Stepping terminates when the removal of an IV results in a marked decrease in the overall predictive power of the model.
3. *Hybrid* After Step 0 and 1 have been performed either in the *forward* or the *backward* procedure, all subsequent steps use both forward and backward stepping of each IV until no further statistical value can be gained.

All three types of stepwise approach are statistically valid as long as it is assumed that a) the initial set of IVs represent a near exhaustive list of explanatory variables, b) some of the IVs have a more important explanatory effect on the DV than other candidate IVs and c) multicollinearity between the IVs is kept at a manageable level (sub 0.50) (Matlab 2008). The latter was a concern for the backward approach given that the initial input collinearity could produce unrealistic coefficients, t and p-values. However, the order of IV elimination turned out to be quite consistent for each country-pair sub-grouping giving added weight to the decision of eliminating these more insignificant variables. Moreover, the backward approach was the only method which expressly allowed for the simultaneous regression of the entire set of candidate IVs, affording higher confidence levels in the manual process of IV elimination.

Another commonly used methodology, pioneered by David Henry, for model selection is called general-to-specific modelling. Here a general model consisting of an array of possibly related variables is reduced or simplified into the most specific, contextual specification of dependent and independent variables. A comprehensive review by Campos et al. (2005) states that it was the development of computer aided algorithms that led to an increase in the popularity of this particular method for variable selection. All of these algorithms follow the same iterative procedure consisting of ascertaining a general statistical model that is congruent as the first step, followed by variable elimination satisfying the selection criteria. This new specification is then tested for congruency and the process is repeated until none of the remaining variables can be elimintated (Hoover and Perez 1999). This elimination process is analogous to the backward stepwise approach as detailed above but does not consider step one in a scientific way, i.e., the preliminary selection of variables is primarily based on researcher judgement and empirical evidence from previous studies.

It must be emphasised that leaving a possible explanatory variable out of the preliminary selection does not necessarily imply that it has poor correlation with the DV (Hair et al. 1998). In fact IVs with high cross-correlations with other IVs are frequently separated with the remaining in-sample IVs representing either the combined effect of both or the same effect in the form of two different measures on the DV. In the case of predicting levels of aggregate air traffic this is an important consideration as there are typically a high number of substitute indicators measuring a given market's propensity to fly or the quality of its supply of air services. Similarly X_1 to X_{12} is not a mutually exclusive list of explanatory factors but a representative list of common drivers of demand which in some cases act as imperfect substitutes for other candidate IVs. Total population with a propensity to fly (X_{10}), for example, can be seen as an imperfect substitute for levels of combined real GDP (X_1). But as both are in effect measures of a country-pair's prospective demand, they can both be used as imperfect alternatives within multiple regression models.

4.6.6. Appraisal of different regression options

Regressions were performed on the following 2x2 matrix of model options, with a view to selecting the most reliable and statistically significant final output:

1. Pooled Ordinary Least Squares (OLS), Actual yearly country-pair traffic
2. Least Squares Dummy Variable (LSDV), Actual yearly country-pair traffic
3. Pooled Ordinary Least Squares (OLS), Transformed yearly country-pair traffic
4. Least Squares Dummy Variable (LSDV), Transformed yearly country-pair traffic

Each of the four options was compared and simultaneously tested for overall goodness of fit (R^2), overall F and P values, multicollinearity of the IVs, IV partial T, F and P values, constant variance of the residuals against the predicted values of the DV and finally for signs of serial autocorrelation. The computed model equations along with the results from each option's reliability and significance tests are discussed below.

Initially a pooled OLS was run to test the possibility that the selected X_j fixed effect controls were comprehensive enough to capture all the relevant characteristics of each of the sampled country-pairs. IVs X_{10} total population and X_{11} great circle distance, for example, were thought to capture an unknown proportion of the between country effects. Using the backward step approach to IV model specification the following best-fit models for the three single-equation OLS regressions are given below:

$$Y_{it} = \beta_1 + \beta_2 X_{it}, \ldots, \beta_n X_{nit} \tag{4.14}$$

$$NA - Caricom_{it} = \beta_1 + \beta_2 CPGDP_{it} + \beta_3 GRCST_{it} + \beta_4 NOCOMP_{it} + \beta_5 LIBRANK_{it} + \varepsilon_{it} \tag{4.15}$$

$$UK - Caricom_{it} = \beta_1 + \beta_2 CPGDP_{it} + \beta_3 GRCST_{it} + \beta_4 QSI_{it} + \beta_5 AVYLD_{it} + \beta_6 LIBRANK + \varepsilon_{it} \tag{4.16}$$

$$Intra - Caricom_{it} = \beta_1 + \beta_2 CPGDP_{it} + \beta_3 DIFFINC_{it} + \beta_4 AVYLD_{it} + \beta_5 LIBRANK_{it} + \varepsilon_{it} \tag{4.17}$$

where *i* indexes the country-pair, *t* indexes time (twelve annual observations between 1995 and 2006), *CPGDP* denotes combined real GDP (PPP) weighted by annual directional traffic volumes, *GRCST* represents annual change in average nightly destination costs, *NOCOMP* is a route based measure of annual change to the number of effective competitors on a country-pair, *LIBRANK* is the unique classification index of 'liberalness' taking a value of between 0 for the most restrictive to 5 being the most facilitating air policy agreement, *QSI* represents the annual observations of another route based index that assumes higher values for country-pairs that exhibit higher frequencies, lower stops and larger aircraft gauges[62], *AVYLD* comprises annual change in average carrier yield with both carriers and route groups being aggregated into average country-pair estimates and *DIFFINC* measures the observed GDP per capita difference as a proxy for income disparity between the two members of a country-pair.

All predictors are regressed using their original metric. The possibility of using non-linear models were principally discarded given that firstly the DV had to be transformed in many instances into curvilinear forms in an attempt to detect any underlying trends in some of the more volatile/emerging O-D markets, and secondly interpretation and calibration of coefficients would be more straight forward and insightful when it came to informing the counterfactual framework for traffic forecasting (see research objectives 3 and 4).

To compensate for the insignificant pooled OLS results, using a standard least squares dummy variable (LSDV) regression procedure, the following three single-equation regressions were specified:

$$Y_{it} = \beta_1 + \sum_{j=2}^{k} \beta_j X_{ijt} + \sum_{i=1}^{n} \alpha_i A_i + \varepsilon_{it} \tag{4.18}$$

$$\begin{aligned} NA-Caricom_{it} &= \beta_1 + \beta_2 CPGDP_{it} + \beta_3 GRCST_{it} \\ &+ \beta_4 NOCOMP_{it} + \beta_5 LIBRANK_{it} + \sum_{i=1}^{k-1} \alpha_{i+9 Country-pair_i} + \varepsilon_{it} \end{aligned} \tag{4.19}$$

[62] The index is additive but not equally weighted with more importance being afforded to the number of frequencies on a route. The combined effect of aircraft gauge and frequency can also be thought of as a measure of change in total capacity on offer whereas number of stops is thought of purely as an indicator of the level of convenience present on a route.

$$UK - Caricom_{it} = \beta_1 + \beta_2 CPGDP_{it} + \beta_3 GRCST_{it} + \beta_4 QSI_{it} + \beta_5 AVYLD_{it} + \beta_6 LIBRANK + \sum_{i=1}^{k-1} \alpha_{i+5 Country-pair_i} + \varepsilon_{it} \tag{4.20}$$

$$Intra - Caricom_{it} = \beta_1 + \beta_2 CPGDP_{it} + \beta_3 DIFFINC_{it} + \beta_4 AVYLD_{it} + \beta_5 LIBRANK_{it} + \sum_{i=1}^{k-1} \alpha_{i+5 Country-pair_i} + \varepsilon_{it} \tag{4.21}$$

Here the unobserved fixed effect on the DV Y_i is being treated as the coefficient of the individual specific dummy variable reflected in the term $\alpha_i A_i$ (Dougherty 2007). For this process to yield any meaningful fits, one of the country-pairs in each sub-sample had to be selected as the omitted or base country-pair. In this case, the overall intercept becomes the estimated intercept for the omitted country-pair and a basis for comparison of unobserved country-pair fixed effects by comparing its value with the unique intercept value (dummy variable coefficient) for the remaining individuals kept within the sample.

Both the pooled OLS and the fixed-effect LSDV model were tested with the DV in its original metric. This process resulted in more inefficient and unstable regression outputs confirming the supposition that regressing predictors on underlying traffic trend estimates yielded more robust impact coefficients without overfitting although it is accepted that transforming a number of IVs to reduce the number of violations against the DV's original traffic figures may have produced similarly robust results.

A regression output summary for the four types of model using the backward method of IV elimination is reported below[63].

[63] The final selected stepwise output is covered in more detail in the results section (Chapter 5). Only a summary of the output is needed at this point for the purposes of methodological comparisons.

Table 4.7
Regression output: Traffic volume estimation for a selection of model options

Sub-group	Variable	Fixed effects (LSDV)				Conventional OLS			
		Transformed DV		Original DV		Transformed DV		Original DV	
		Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
NA-Caricom	INTERCEPT	-1,292,332.80	-4.78	-1,404,188.26	-5.10	-1,995,037.00	-4.13	-1,560,985.00	-3.28
Omitted country-pair: Canada-Barbados	CPGDP	76.31	4.47	66.88	3.85	32.97	**0.97**	22.96	**0.69**
	GRCST	4,071.95	2.00	4,102.16	**1.98**	-18,253.97	**-0.59**	-3,106.14	**-1.02**
	NOCOMP	182,801.56	2.38	208,579.58	2.68	440,018.00	**1.96**	321,084.00	**1.45**
	LIBRANK	249,637.12	5.85	280,602.14	6.46	916,306.00	6.25	875,213.00	6.06
	US-Bahamas	1,189,796.44	8.17	1,242,158.11	8.39				
	US-Jamaica	2,610,946.18	22.86	2,569,992.50	22.13				
	US-Dominican Republic	1,913,883.78	13.70	2,049,844.36	14.44				
	US-Barbados	-337,654.45	-2.80	-310,867.77	-2.53				
	US-Dominica	-382,457.82	-2.25	-279,944.24	**-1.62**				
	US-Guyana	-165,792.14	**-0.86**	-70,571.35	**-0.36**				
	US-St. Lucia	-373,538.84	-2.23	-277,747.18	**-1.63**				
	US-Trinidad & Tobago	240,673.48	**1.28**	275,166.76	**1.44**				
R squared		0.98		0.98		0.44		0.40	
Adjusted R squared		0.98		0.98		0.42		0.37	
Overall F-stat		322.21		315.52		20.18		16.95	
Observations		108		108		108		108	
UK-Caricom	INTERCEPT	336,327.92	3.83	464,761.56	4.32	113,087.00	**0.95**	173,768.00	**1.26**
Omitted country-pair: UK-Trinidad & Tobago	CPGDP	-17.42	**-0.55**	-25.80	**-0.66**	35.88	**0.91**	21.97	**0.48**
	GRCST	-2,398.80	-4.64	-2,835.84	-4.47	-628.43	**-1.71**	-522.81	**-1.23**
	QSI	2.77	4.14	2.06	2.51	6.52	17.47	6.43	14.86
	AVYLD	-48,809.85	-4.09	-57,129.96	-3.90	-30,510.00	**-1.71**	-39,317.00	**-1.90**
	LIBRANK	28,467.90	2.02	13,053.24	**0.76**	-8,742.56	**-0.76**	-10,750.00	**-0.80**
	UK-Bahamas	71,036.02	**1.80**	87,681.46	**1.81**				
	UK-Barbados	339,160.49	6.03	433,991.53	6.29				
	UK-St. Lucia	125,250.47	3.35	145,208.97	3.17				
	UK-Jamaica	215,034.15	8.40	232,541.95	7.41				
R squared		0.97		0.96		0.93		0.90	
Adjusted R squared		0.97		0.96		0.92		0.89	
Overall F-stat		194.53		130.69		137.99		102.69	
Observations		60		60		60		60	
Intra-Caricom	INTERCEPT	-12,766.35	**-1.41**	-12,019.64	**-1.14**	18,243.00	**0.57**	20,318.00	**0.63**
Omitted country-pair: Suriname-Trinidad&Tob	CPGDP	3,980.71	10.49	3,979.11	9.01	812.38	**1.16**	794.25	**1.12**
	DIFFINC	-2.42	-6.76	-2.50	-6.01	-1.63	-2.40	-1.66	-2.42
	AVYLD	-1,148.62	**-1.90**	-1,307.44	**-1.86**	-1,426.63	**-0.52**	-1,599.79	**-0.58**
	LIBRANK	7,734.75	4.05	8,296.77	3.74	18,737.00	6.24	18,773.00	6.21
	Bahamas-Barbados	27,227.99	4.94	28,805.40	4.49				
	Bahamas-Jamaica	37,118.72	9.95	38,097.07	8.77				
	Barbados-Guyana	53,051.12	16.03	53,539.54	13.90				
	Barbados-Jamaica	21,349.79	8.39	21,758.98	7.34				
	Barbados-St. Lucia	56,137.10	19.89	56,135.60	17.08				
	Barbados-Trinidad&Tob	81,082.63	29.69	80,874.73	25.44				
	Dominica-Trinidad&Tob	-7,585.41	-2.74	-7,371.98	-2.29				
	Guyana-Trinidad&Tob	56,856.82	23.49	57,011.86	20.23				
	Jamaica-Trinidad&Tob	2,207.50	**0.64**	2,756.80	**0.69**				
R squared		0.97		0.96		0.30		0.29	
Adjusted R squared		0.97		0.96		0.28		0.26	
Overall F-stat		262.99		194.17		12.06		12.00	
Observations		120		120		120		120	

Source: SAS output
Notes: t-statistics in bold do not reject the null hypothesis at the .05 significance level
The Dependent Variable (DV) is annual country-pair passenger traffic

Reading from right to left, the presence of significant fixed effects can be observed and is reflected by the stronger R^2 and overall F-stat values. Moreover, the DV transformations appear to have had a positive effect on the stability and reliability of the specifications with improvements in partial t-statistics being noted in the vast majority of cases whilst this transformation process has clearly not resulted in an overfitting of the regression equation. This is indicated by the fact that the DV transformations did not result in any marked improvements to the overall R^2 coefficients when compared with those shown for the original metric regressions.

It was found that, in all UK-Caricom specifications except those that included both average yield and country-pair real GDP, the real GDP coefficient had the expected positive sign in relation to traffic levels and a largely consistent magnitude of 50-100 extra passengers per million US dollar increase in combined real GDP levels. Consequently despite the expected sign and significant t-stat for the IV average yield, it had to be dropped from final sub-model to ensure that the GDP effect was both realistic and statistically significant. The dropping of average yield did not result in any dramatic changes in the effect of other IVs although it did significantly change some of the IV and country-pair fixed-effect t-statistics. This decision was supported by a moderately high inverse beta value of -0.53 between country-pair GDP and average yield as shown in Table 4.5.

The NA-Caricom best-fit model raised a number of question marks. First it is important to understand and account for the positive sign given for the IV ground costs. This suggests that as real hotel, restaurant, excursion etc prices increase by an average of one US dollar, air traffic also increases by around 4,000 passengers (controlling for other factors). As passengers travel decisions are often based on overall trip costs, it is important to investigate if reductions in average airfare over the same period may have offset average increases in ground costs. Indeed, some of the NA-Caricom markets may be more dependent on the high end, exclusive holidaymaker like Barbados and the Bahamas, for example, where increases in ground costs may indicate a differentiated product/service to the high income traveller. Two of the fixed effect intercepts were also not significant at the .05 or .10 level.

The Intra-Caricom regression showed the least LSDV improvement by transforming the DV although in most cases each IV t-statistic strengthened significantly as did the overall F-statistic. Average yield was only just insignificant at the .05 level but comfortably significant at the .10 level. As ground cost is not such an important consideration for these markets, it was deemed necessary to keep average yield within the regression specification as one of the most critical decision criteria for the Intra-Caribbean traveller. Higher differences in average income led to small but statistically significant reductions in air traffic levels. This makes intuitive sense as countries are more likely to nurture business and trading relationships when income differentials are not so marked. The overall model intercept is insignificant at the .05 level, as is the Jamaica-Trinidad & Tobago fixed-effect dummy intercept.

In accordance with the new UK-Caricom regression variate, adjusted to exclude the significant but disruptive IV *AVYLD*, overall model and residual tests had to be rerun using the updated best-fit specification for the UK-Caricom sub-group; the details of this process are discussed in the results section (Chapter 5).

4.6.7. R squared and adjusted R squared

The coefficient of determination (R^2) is defined as the percentage of total summed squares (total deviation) explained by the regression (explained deviation). The weakness of this measure in multiple regression, however, is that it is not possible for the addition of extra independent variables to decrease the numerator. The result is that a weak explanatory variable can be inputted into a specification without being reflected in the overall R^2 value. To compensate for this weakness the Adjusted R^2 looks to adjust both the numerator and the denominator by their respective degrees of freedom. If the Adjusted R^2 value is notably smaller than the original R^2 value then it is reasonable to assume that some of the IVs are weak predictors of air traffic volumes and cannot be said to be representative or analogous to other stronger explanatory variables that were left out of the analysis.

As shown in the regression output, the final set of explanatory variables can be said to be good representative predictors of traffic volumes as the adjusted R squared values (0.98, 0.96, 0.97) are almost identical to the original R^2 values (0.98, 0.96, 0.97) for the NA- UK- and Intra-Caricom sub-groups respectively. It further indicates that the estimated specifications are not overfitted to the sample, maintaining an adequate ratio of observations to independent variables in the variate.

The adjusted R^2 index (AR^2) is derived as follows: -

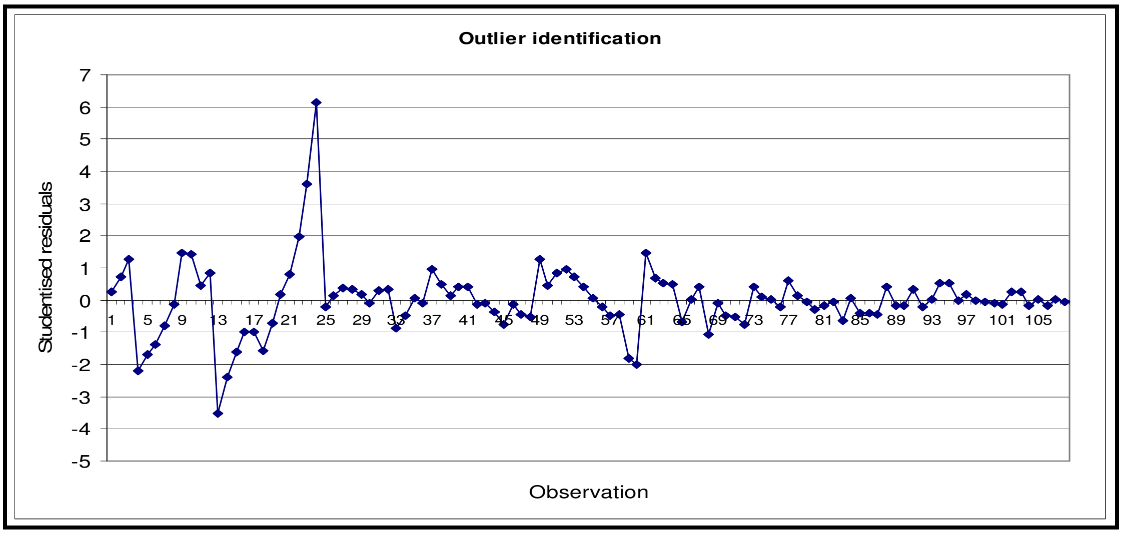
$$AR^2 = 1-(1-R^2)*\left(\frac{(n-1)}{(n-k-1)}\right) \tag{4.22}$$

where R^2 is the coefficient of determination, *n* represents the number of observations and *k* the number of IVs.

4.6.8. Outliers

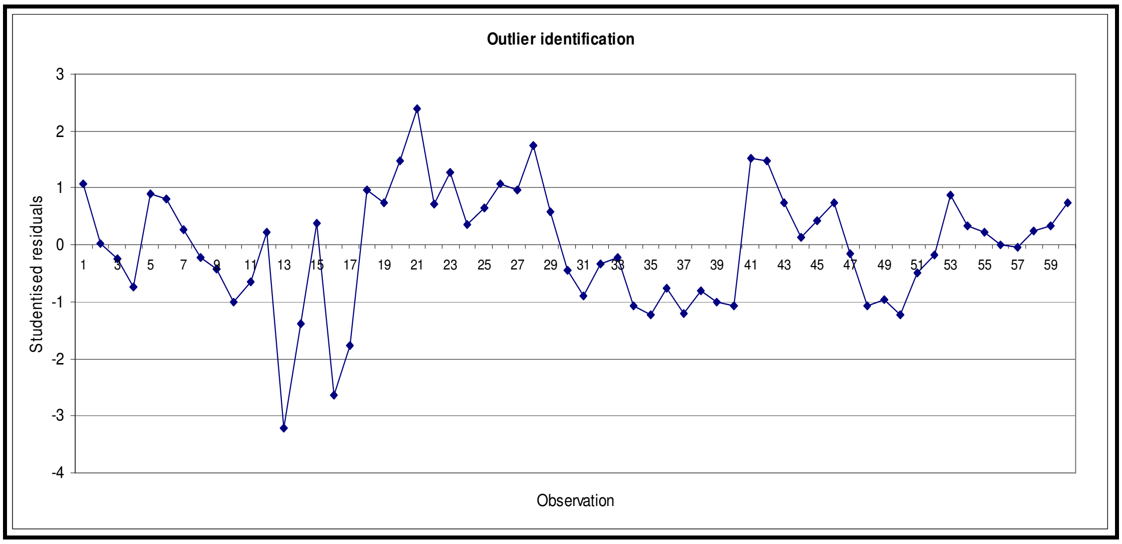
Of a total of 288 (108+60+120) observations, only 8.5% (16) can be considered outliers (in excess of studentised t-statistics of +/-2.00). No remedial action was taken in light of the fact that firstly only four data points (three on the NA-Caricom sample and one on the UK-Caricom sample), representing only 2% of the total number of observations, were significant enough to skew the overall predictions (+/-3.00 standard deviations) and secondly that the DV original curves had already been transformed and underlying trends yielded. Further action would have led to an overfitting of the model and potentially disingenuous results. Each set of sub-group observations were plotted against their studentised residuals[64] and are presented below in Figures 4.4(a), 4.4(b) and 4.4(c).

(a)



[64] 'Studentising' residuals is the procedure of weighting the residuals of each observation by their standard deviations and is helpful in highlighting outliers which do not appear to be consistent with the rest of the data. Variations in the residuals of individual IVs may be correlated. As a result it is advisable to standardise this variance (ELSA 2008).

(b)



(c)

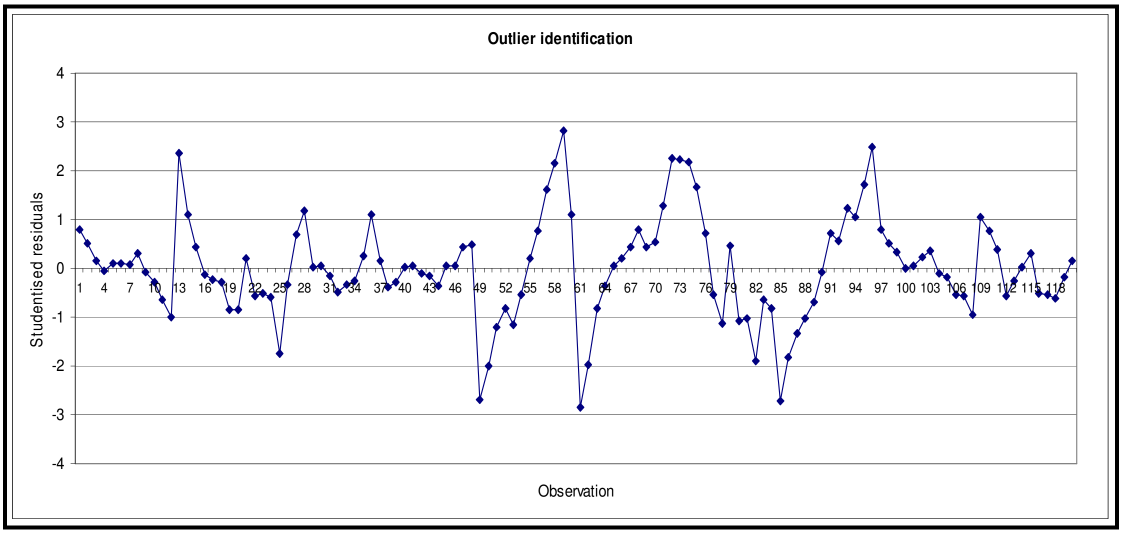


Fig. 4.4(a), (b) and (c) Plots of NA-Caricom, UK-Caricom and Intra-Caricom observation residuals

4.6.9. Linearity of the residuals

As well as testing each IV for conformity to the linearity assumption it is also a necessary step to test the best-fit variate for any violations relating to the same assumption. Unlike the IV linearity tests, a visual inspection of a scatterplot of the studentised residuals against the regression model's predicted DV values was a satisfactory method by which to detect any non-linearity in each of the three Caricom country-pair sub-groups (see Homoscedasticity scatterplots in Figures 4.6(a)-(c)).

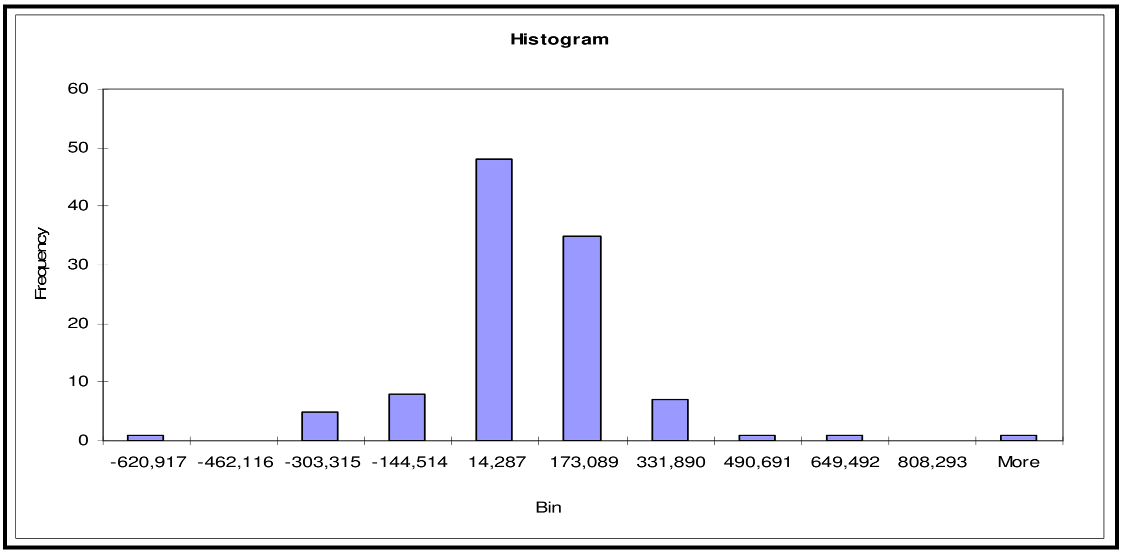
No non-linear pattern was evident in the overall NA-Caricom residual plot. Some violations were noted within the partial regression plots but for the final specification of IVs, violations were kept to a minimum level, with the added advantage of each IV remaining in its original metric paving the way for uncomplicated interpretations of individual IV effects on air traffic levels.

The same can be said for the UK- and Intra-Caricom sub-group scatterplots although of the two, the Intra-Caricom sub-group showed less of a random distribution of data points suggesting perhaps that one or two of the country-pairs within the overall sample may have revealed some curvilinear tendencies. Finally, it is important to clarify that it is of no significance that weak or very weak linear relationships are plotted between the model's residuals and the DV fitted values as long as non-linear correlations violating this assumption are minimised.

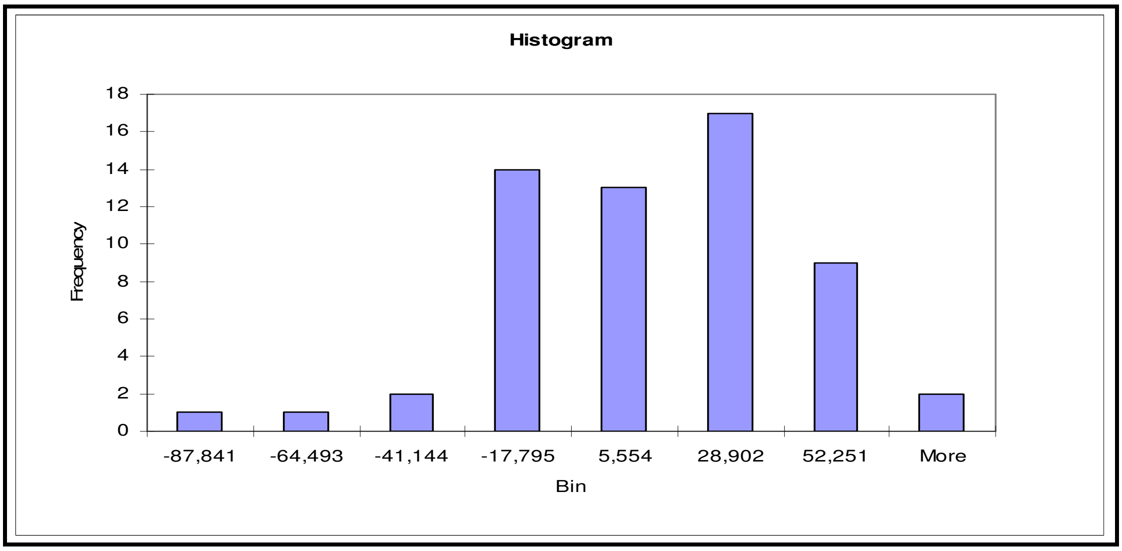
4.6.10. Normality of the residuals

An inspection of the NA-Caricom histogram of the frequency distribution of residual values shows that there were no systematic departures from the assumption of normality (Figure 4.5(a)). Smaller residuals did appear more frequently suggesting a peaked kurtosis effect which can be considered to be the direct result of the high predictive power of the model (i.e. a generally strong relationship between the specification of IVs and the DV reduced the residual value of a higher proportion of observations).

(a)



(b)



(c)

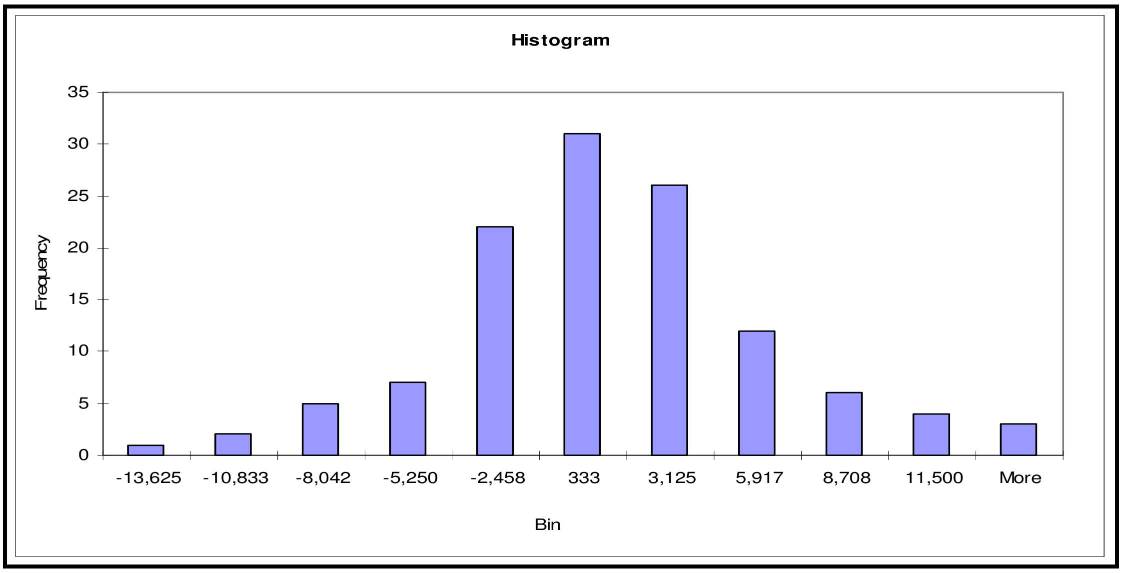


Fig. 4.5(a), (b) and (c) NA- UK- and Intra-Caricom residual frequency distributions

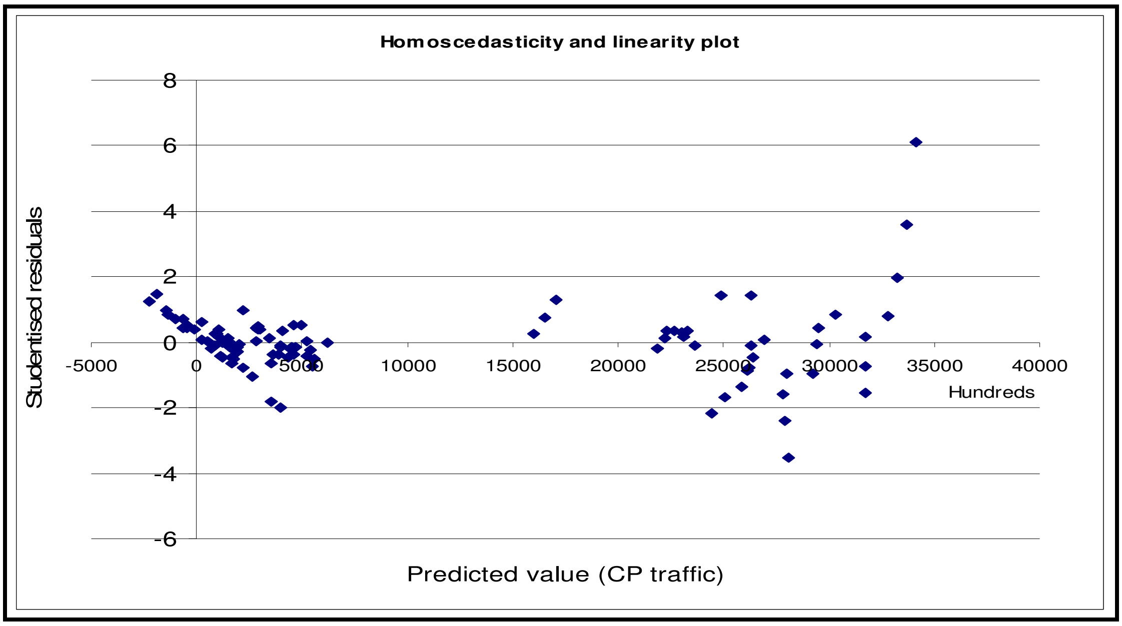
Computing kurtosis and skewness values for the distribution of NA-Caricom residuals suggests that although the null hypothesis for skewness is not rejected, the small residual peaks have resulted in a kurtosis z-value that exceeds the critical value. The non-normality null hypothesis cannot therefore be rejected. The UK-Caricom histogram indicates a slight negative skewness with more observed positive residuals but this skewness was not significant enough to accept the null hypothesis at the .05 level. A minor kurtosis effect was also noted for this sub-sample. Finally, an inspection of the Intra-Caricom histogram shows little evidence of skewness and moderate indications of a peaking kurtosis effect. No normality violations were noted for this sub-sample, however, with a sufficient spread of observations across the range of positive and negative residual values.

4.6.11. Homoscedasticity

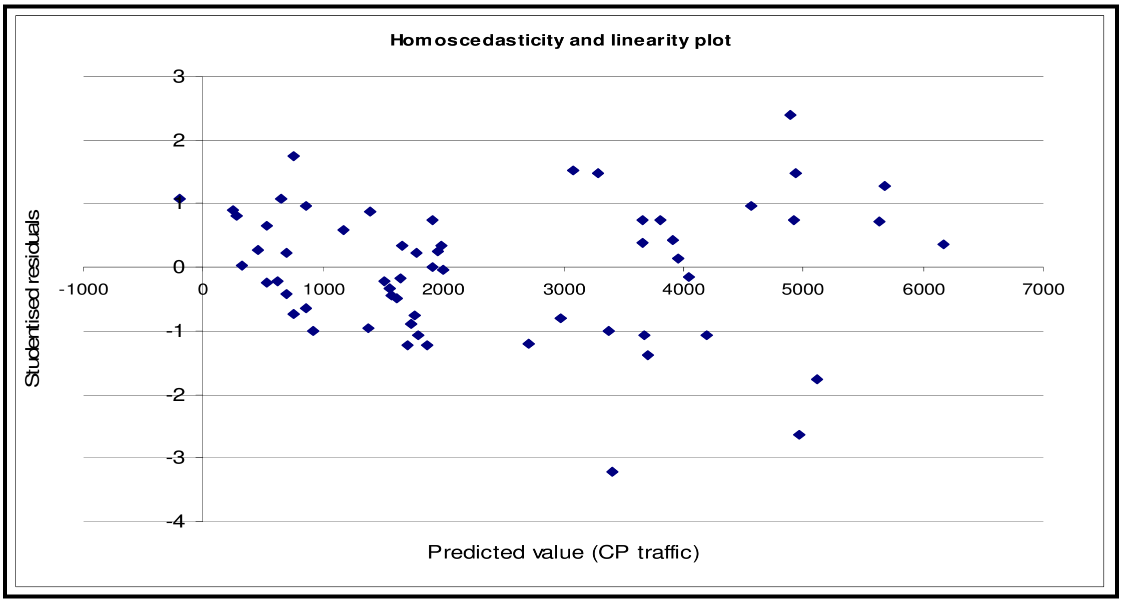
The next step was to check scatterplots of the studentised residuals against the fitted traffic values for any signs of heteroscedasticity. For the NA-Caricom sub-sample, the studentised residuals are not quite constant across all values of the DV. There is no obvious pattern of increasing or decreasing values but two clusters have emerged, one with generally larger DV traffic values and one with generally smaller DV values. This conforms to the socio-economic and air transport sector disparities between the larger country-pairs in the sample such as the Bahamas-, Jamaica- and Dominican Republic-US as compared to some of the smaller markets namely Barbados, Trinidad & Tobago and Dominica-US. The UK-Caricom sub-group yielded constant residual values across all fitted values of the DV. There is no obvious pattern of increasing or decreasing values and unlike the NA-Caricom sub-group there was a more even spread of fitted traffic values that also did not show any indication of concurrent variance with the studentised residual values.

There is evidence of a concentration of lower predicted DV traffic values in the Intra-Caricom sub-group scatterplot. Although this has not resulted in any obvious pattern of non-constant variance across the range of residual values, this finding does reflect the socio-economic and air transport sector disparities between the few larger country-pairs in the sub-sample such as Barbados-Trinidad & Tobago as compared to the more numerous smaller markets in the sample such as the Bahamas-Barbados country-pair. Despite the moderate evidence of clustering in the NA- and Intra-Caricom sub-samples, no remedial action was taken given the fact that this variance in the DV largely occurred independently from variance in the error terms of the samples' observations. The scatterplots for the three sub-samples are shown below in Figures 4.6(a), (b) and (c)).

(a)


Homoscedasticity and linearity plot
Studentised residuals
8
6
4
2
0
-2
-4
-6
-5000
0
5000
10000
15000
20000
25000
30000
35000
40000
Hundreds
Predicted value (CP traffic)

(b)


Homoscedasticity and linearity plot
Studentised residuals
3
2
1
0
-1
-2
-3
-4
-1000
0
1000
2000
3000
4000
5000
6000
7000
Predicted value (CP traffic)

(c)

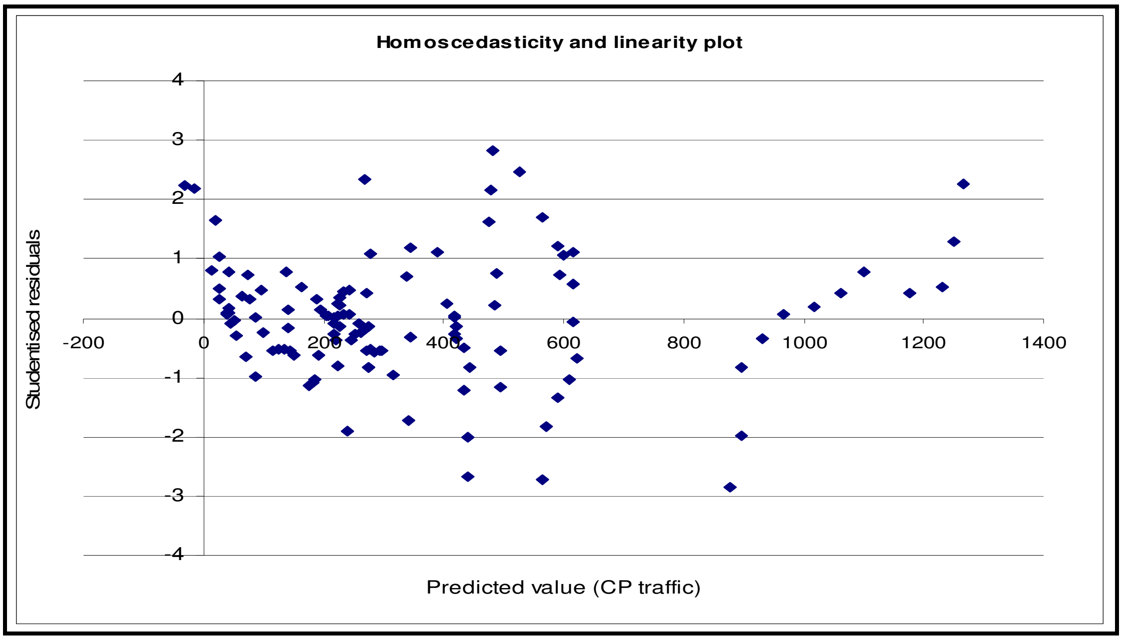


Fig. 4.6(a), (b) and (c) Scatterplots of NA-, UK- and Intra-Caricom sub-group predicted traffic values against studentised residual values

4.6.12. Autocorrelation – Panel data Durbin-Watson tests

Serial autocorrelation of a regression's error term constitutes a violation of one of the Ordinary Least Squares (OLS) regression assumptions. The overall and partial standard errors and consequently the partial t-statistics can be over or underestimated when residual values are too close together (i.e. positive serial correlation) or much different in value to one another (i.e. negative serial correlation).

If there are no time-lags specified for the dependent variable or there have been no moving average time-series transformations, a standard Durbin-Watson (d) test is commonly used to check for the presence of autocorrelation using the following test statistic:

$$d = \frac{\sum_{t=2}^{T} (e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2} \qquad (4.23)$$

where e_t is the residual associated with the observation in year t. Its resulting value always lies between 0 and 4 with the mid-point 2 indicating that there is no evidence of either positive or negative autocorrelation amongst the residuals. A general rule of thumb proposes a critical value range of between 1.0 and 3.0, below or above which there may be serious cause for remedial action to eliminate the possibility of positive (negative) serial correlation and thereby obtaining underestimated (overestimated) standard errors as well as overestimated (underestimated) t-statistics.

For a balanced fixed-effect panel data set with each observation representing an individual (country-pair) *i* at the time period (year) *t* the Durbin-Watson statistic (d_{pd}) can be adjusted to take the following form: -

$$d_{pd} = \frac{\sum_{i=1}^{N} \sum_{t=2}^{T} (e_{i,t} - e_{i,t-1})^2}{\sum_{i=1}^{N} \sum_{t=1}^{T} e_{i,t}^2} \tag{4.24}$$

where e_{it} is associated with a residual from a LSDV regression with country-pair fixed-effects built in to each sub-set. The residual values are now dependent on the number of regressors and the number of observations which are made up of the number of individuals *i* and the number of time periods *t*. Remedial action usually consists of introducing time-lags between dependent and independent variables and/or reconsidering some of the non-linear curve transformations of the dependent or independent variables to help stabilise all variables through a more appropriate use of powering, differencing, logging or deflating (refer to www.duke.edu.htm).

Computing Durbin-Watson statistics for the three Caricom country-pair sub-groups returned values of 1.01, 1.04 and 1.09 for NA-, UK- and Intra-Caricom markets respectively. This shows that although there is evidence of positive serial correlation in the error term of all three sub-groups there is not enough to indicate a fundamental structural flaw in the model (Duke University 2007). The decision therefore was not to take any further remedial action but to proceed with regression interpretations on the condition that the overall and partial standard errors may have been slightly underestimated and the partial t-statistics may have been slightly overestimated. Further, as the main output of this regression analysis is to feed IV effect coefficients into a counterfactual set of air policy scenarios, it is important to bear in mind that the presence of autocorrelation does not affect the magnitude or sign of the variate's IV coefficients.

An appraisal of the transformed and original metric DV model standard errors indicates that DV transformations have not led to any alarming underestimations of the standard error term. Reductions of only 1.6%, 17.5% and 15.6% on NA-, UK- and Intra-Caricom sub-groups were noted, suggesting that the DV transformations did not destabilise the models' variance to a concerning level and thus the transformation process did not lead to any serious underestimations of the overall standard error terms. Although it was the aim of this study to render the most reliable and statistically significant coefficients, the cyclical nature of air traffic dictates that there is an inevitable correlation between successive annual volume observations. Introducing time-lags to eliminate the presence of such a correlation may produce a marginal improvement in the model's reliability but it would come at the cost of an unrealistic disturbance term that did not take the cyclical effects of air passenger markets into consideration.

4.6.13. Variance Inflation Factor regression

A more comprehensive test for multicollinearity of a model's independent variables is termed the Variance Inflation Factor (VIF). By computing the inverse of $1\text{-}R^2$ the VIF has an opposite interpretation to the beta values presented in Table 4.5, in that the lower the VIF estimate the less collinearity is evident between the final specification of the IVs. This statistic has the added advantage of allowing for the simultaneous checking of IV multicollinearities. This is performed by regressing each IV in turn as the DV against all the other remaining IVs in the regression variate. The results for the three Caricom country-pair sub-groups are presented in Table 4.8.

All the selected IVs for the final specifications yielded values below the critical factor value of 5> indicating that the finally selected IVs were poorly predicted and explained by each other. Of the three sub-groups the Intra-Caricom market yielded the lowest VIFs followed by the NA-Caricom group and finally the UK-Caricom group.

Table 4.8
Variance Inflation Factor (VIF) derivations for three Caricom sub-samples

NA-Caricom VIF (Variance Inflation Factor)

IV	R squared	1-R squared	VIF
CPGDP	0.038	0.962	1.040
GRCST	0.205	0.795	1.258
NOCOMP	0.280	0.720	1.389
LIBRANK	0.386	0.614	1.629

UK-Caricom VIF (Variance Inflation Factor)

IV	R squared	1-R squared	VIF
CPGDP	0.355	0.645	1.551
GRCST	0.455	0.545	1.836
QSI	0.408	0.592	1.689
LIBRANK	0.393	0.607	1.646

Intra-Caricom VIF (Variance Inflation Factor)

IV	R squared	1-R squared	VIF
CPGDP	0.019	0.981	1.019
DIFFINC	0.022	0.978	1.022
AVYLD	0.022	0.978	1.022
LIBRANK	0.004	0.996	1.004

Low VIFs for the final IVs makes logical sense. In theory it would be a rare coincidence if, for instance, variation in combined national output (GDP) had a high simultaneous correlation with variation in average tourism prices, the number of airline competitors and the rank of air policy liberalness. Although individual IV beta values may frequently be higher, it is reasonable to assume that the remaining IV parameter of two air transport supply factors and one sector specific pricing factor would be a poor representation of a realistic parameter of explanatory variables accounting for more of the variation in a nation's GDP. While the UK-Caricom VIFs remain well below the critical value of 5, the comparatively higher values could be explained by the higher observed beta values between the IVs *GRCST* and *LIBRANK* (0.54) or *GRCST* and *CPGDP* (0.41). If increased air policy liberalisation leads to reduced airfares and increased traffic volumes, for example, this could put upward pressure on local hotel and restaurant prices as a small island relies on a limited portfolio of tourism capacity and infrastructure. Equally, if combined national output and therefore discretionary income increases, the same upward pressure on average tourism ground costs can result, unless the supply of extra accommodation and tourism facilities is forthcoming. The combined consequence of these moderately positive correlations could have had the effect of pushing up the overall predictive power of the independent variables when regressed against the remaining independent variables in the variates.

4.7. CHAPTER SUMMARY

In an attempt to satisfy Objective 2 of this study the most appropriate methodology comprised of three interrelated stages. An initial time-series analysis using data from a sample of 24 Caricom country-pairs, looked to capture the impact of liberalisation on recorded air traffic volumes between the years 1996-2006, by considering the role air policy plays in influencing important supply side drivers of air travel demand. This process then informed the specification of a pre-trial pilot regression analysis for three North Caribbean-US country-pairs before segmenting the main sample into three route groups and specifying a unique vector of independent variables for each of them. Best-fit regression variates were secured by adopting a backward stepwise approach to IV selection and a poly-linear general linear specification with a number of fixed-effect dummy variables introduced to account for both the observed and unobserved heterogeneity between the country-pairs in each sub-sample. This approach is useful for samples comprising both mature and growth phase air transport markets as well as country-pairs in very different stages of air policy development. A unique liberalisation index was proposed to support this policy complexity so as to facilitate clear time-series and cross-sectional comparisons between different route groups and individual country-pairs. Poor availability of current and historical data meant that a new Intra- and Extra-Caricom air policy database had to be formulated to satisfy the input requirement for the liberalisation index. The robustness of the regression models was also tested for a number of OLS violations and any necessary remedial action was taken.

5. LIBERALISATION ANALYSIS: RESULTS AND DISCUSSION

5.1. Introduction

By adhering to the experimental research approach set out in Chapter 4, firstly air policy developments are presented and discussed in Section 5.2, followed by a time-series analysis of variation in country-pair levels of liberalisation and air traffic, as well as a number of internal air transport variables and their relationship with the dependent variable and the liberalisation index (section 5.3). This leads on to a discussion of the main regression results for the three Caricom sub-samples in 5.4 and finally a summary of the chapter is offered in section 5.5.

5.2. Air policy developments

The air policy data gathering process resulted in an unprecedented database of historical air policy developments concerning the sampled Caricom member states, detailing five separate policy levers including tariffs, designation, capacity/frequency, number of access points and 5th freedom traffic rights. All data sources were cross-checked and any information given was verified by comparing policy development information provided by all relevant parties. Accounts offered by the US Department of Transportation, the Caricom Secretariat and the Jamaican Ministry of Transport & Works, for example, were cross-checked for consistency on the US-Jamaica county-pair. In the event of any discrepancies between accounts, it was deemed that the US, UK or Canadian versions were more reliable given that these developed economies typically house more consistent, balanced and audited historical records when compared to Caricom island states. It is thought that the air policy database can be built upon further to include more country-pairs and air policy levers in future studies (see Appendix G for full accounts of UK- and US-Caricom markets).

An abridged final account of all 1995-2006 air policy developments for the 24 sampled country-pairs is given below in Table 5.1. Note that a clear distinction is made between whether the underlying agreement in force is carried out on a bilateral, multilateral or extra-bilateral (extra-multilateral) basis.

Table 5.1
Evolution of Intra and Extra-Caricom air policy over the period 1995-2006

Country Pair	Official Bilat/ Multilat/ Date in Force	Policy Note	Applicable years/ Policy Control Variable	Designation	Access Points	5th Freedoms	Capacity/ Frequency	Tariffs	Liberalisation scale (0-5)
1.UK-BAH	--	Comity	1995-2006	Multiple: UK carr only (0.5)	Open: UK carr. (0.5)	No provision (0)	Permitted with BAH approval (0.5)	Double disapproval (1)	2.5
2.UK-BAR	BA-97 MoU-05	BA-97 in force	1995-2004	Multiple: Plus comm.. of int. (0.5)	Open (1)	Pre-determined points (0.5)	No 3rd/4th restrictions (0.5)	Double disapproval (1)	3.5
2.UK-BAR	BA-97 MoU-05	MoU in force	2005-2006	Multiple: Plus EU carr. (1)	Open (1)	Pre-determined points (0.5)	No 3rd/4th or 5th restrictions (1)	Double disapproval (1)	4.5
3.UK-JAM	BA-70 MoU-05	BA-70 in force	1995-2004	Multiple: UK carr only (0.5)	Restricted (0.5)	Very limited (0)	No 3rd/4th restrictions (0.5)	Dual approval (0)	1.5
3.UK-JAM	BA-70 MoU-05	MoU-05 in force	2005-2006	Multiple: Plus EU carr. (1)	Open (1)	Pre-determined points (0.5)	No 3rd/4th restrictions (0.5)	Desig. Country disapp (0.5)	3.5
4.UK-SLU	BA-89 DBA-07		1995-2006	Multiple: UK carr only (0.5)	Restricted (0.5)	Very limited (0)	Limits on Carib carrier 5ths (0.5)	Double disapproval (1)	2.5
5.UK-T&T	BA-67 DBA-07		1995-2006	Multiple: UK carr only (0.5)	Very restricted (0)	Very limited (0)	No controls (1)	Double disapproval (1)	2.5
6.BAH-BAR	--	NS	1995-2006	No provision (0)	None (0)	Indirect flights (0)	Indirect capacity (0)	No terms (0)	0
7.BAH-JAM	BA-73 --	Expired NS	Bermuda II with amend 1995-2006	Dual (0.5)	Open (1)	Limited (0)	Permitted with approval (0.5)	Dual approval (0)	2
8.BAR-GUY	MA	Comity	1995-1998	Community of interest (0.5)	2 in Guy (0.5)	Limited (0)	Open to comm. Carriers only (0.5)	Dual approval (0)	1.5
8.BAR-GUY	MA	Comity	MA in force 1998-2006	Multiple with clause (0.5)	Open (1)	Liberal between member states only (0.5)	Limits on multiple des routes (0.5)	Dual approval (0)	2.5
9.BAR-JAM	--	Comity	1995-2006	Community of interest (0.5)	Open (1)	Limited (0)	Open to comm. Carriers only (0.5)	Dual approval (0)	2
10.BAR-SLU	B-79 MA MoU-06		Bermuda II in force 1995-1998	Dual (0.5)	Open (1)	Limited (0)	Permitted with approval (0.5)	Dual approval (0)	2
10.BAR-SLU	B-79 MA MoU-06		MA in force 1998-2005	Multiple with clause (0.5)	Open (1)	Liberal between member states only (0.5)	Limits on multiple des routes (0.5)	Dual approval (0)	2.5
10. BAR-SLU	B-79 MA MoU-06		MoU in effect 2006	Multiple inc. for. Carr, (1)	Open (1)	Liberal (BA, AA local traffic) (1)	Open (1)	Single disapp (0.5)	4.5
11.BAR-T&T	B-87 MA		Bermuda I with amend 1987-1998	Single (0)	Open (1)	Pre-determined points (0.5)	No controls (1)	Single disapp. (0)	2.5
11.BAR-T&T	B-87 MA		MA in force 1998-2006	Multiple with clause (0.5)	Open (1)	Liberal between member states only (0.5)	Limits on multiple des. routes (0.5)	Dual approval (0)	2.5
12.DOM-T&T	-- MA	Comity	1995-1998	Community of interest (0.5)	POS in Tri (0.5)	Limited (0)	Open to comm. Carriers only (0.5)	Dual approval (0)	1.5
12. DOM-T&T	-- MA	Comity	MA in force 1998-2006	Multiple with clause (0.5)	POS in Tri (0.5)	Liberal between member states only (0.5)	No restrictions to comm. Carr. (0.75)	Dual approval (0)	2.25
13.GUY-T&T	-- MA	Comity	1995-1998	Community of interest (0.5)	2 in Guy (0.5)	When required (1)	Open to comm. Carriers only (0.5)	Dual approval (0)	2.5
13.GUY-T&T	-- MA	Comity	MA in force 1998-2006	Multiple with clause (0.5)	Open (1)	Liberal between member states only (0.5)	Limits on multiple des routes (0.5)	Dual approval (0)	2.5
14.JAM-T&T	--	Comity	1995-2006	Dual (0.5)	Main gat(0.5)	Restricted (0)	Controlled & comm. Carrier(0.5)	Notice and approval (0)	1.5
15.SUR-T&T	B-93 --		1995-2006	Dual (0.5)	Main gat (0.5)	Limited (0.5)	Restricted growth (0)	Double disapp. (1)	2.5
16.BGI-CAN	B-85 DBA-08		1995-2007	Dual (0.5)	Main gat (0.5)	Considered on a case-by-case basis (0.5)	Limits stemming from desig. (0.5)	Single disapp.(0.5)	2.5
16.BGI-CAN	B-85 DBA-08		2008 onwards	Multiple (1)	Open (1)	Considered on a case-by-case basis (0.5)	No controls (1)	Dual disapp. (1)	4.5
17.US-BAH	BA-73 --	Comity	Bermuda I with amend 1995-1997	Multiple with restrictions (0.5)	Pre-deter. (0)	Pre-determined points (0.5)	Subject to consult. (0.5)	Single disapp. (0)	1.5
17.US-BAH	BA-73 --	Comity	*De facto* open 1998-2006	Multiple open (1)	Open (1)	On a reciprocity basis (0.5)	No controls (1)	Double disapp (1)	4.5
18.US-DMR	BA-86 --	Comity	Traditional 1995-1999	Multiple with restrictions (0.5)	Pre-deter. /limit (0)	Limited/Restricted (0.5)	Subject to approval (0.5)	Double disapp (1)	2.5
18.US-DMR	BA-86 --	Comity	Flexible in practice	Multiple not blanket (0.5)	Pre-deter./ope	Limited/Unlimited 2 points (0.5)	No controls (1)	Double disapp (1)	3.5

Country Pair	Official Bilat/ Multilat/ Date in Force	Policy Note	Applicable years/ Policy Control Variable	Designation	Access Points	5th Freedoms	Capacity/ Frequency	Tariffs	Liberalisation scale (0-5)
			2000-2006		n (0.5)				
19.US-JAM	BA-79 --	Comity	Amended traditional 1995-2002	Multiple with restrictions (0.5)	Specific points/open (0.5)	Limited to reciprocity (0.5)	Subject to approval (0.5)	Dual approval (0)	2
19.US-JAM	BA-79 --	Comity	Unofficial part implement. of open-skies 2003-2006	Multiple with restrictions (0.5)	10 points/open (0.5)	Limited to reciprocity (0.5)	No controls (1)	Double dissapp. 15 day notice (0.5)	3
20.US-BAR	BA-82 MoU-00		Traditional 1995-1999	Multiple with restrictions (0.5)	Pre-deter/open (0.5)	Limited inter and beyond (0)	No controls (1)	Single disapp 30 days notice (0.5)	2.5
20.US-BAR	BA-82 MoU-00		Comm. Of interest 2000-2006	Extended multiple with restrictions (0.5)	Pre-deter/open (0.5)	Reciprocal exceptions (0.5)	No controls (1)	Single disapp 30 days notice (0.5)	3
21.US-DOM	BA-77		Bermuda II 1995-2006	Multiple (1)	Limited/Open (0.5)	Limited/part open (0.5)	Subject to consult (0)	Double approval (0)	2
22.US-GUY	BA-46		Acceded to UK-US accord 1995-2006	Multiple with restrictions (0.5)	Pre-deter/open (0.5)	Limited inter and beyond (0)	No controls (1)	Single disapp 30 days notice (0.5)	2.5
23.US-SLU	BA-79 MoU-05		Accession to UK-US 1995-2004	Multiple (1)	Limited/open (0.5)	Limited/Part open (0)	Subject to consult (0.5)	Double approval (0)	2
23.US-SLU	BA-79 MoU-05		MoU re: 5ths 2005-2006	Multiple (1)	Limited/open (0.5)	Limited/open (0.5)	Subject to consult (0.5)	Double approval (0)	2.5
24.US-T&T	BA-90		Amended tradition. 1995-2006	Multiple with restrictions (0.5)	Pre-deter/open (0.5)	Limited inter and beyond (0)	No controls (1)	Single disapp 30 days notice (0.5)	2.5

Sources: ICAO (2006), CARICOM Secretariat, US DOT, UK CAA, Transport Canada, Caricom State Ministries of Transport

Key:
BA - Bilateral agreement
MA - CARICOM MASA
-- No agreement
MoU - Memorandum of Understanding
DBA - Draft bilateral agreement
NS - No direct service
Comity – informal, extra-bilateral arrangement

Only one row entry is observed for country-pairs that have maintained air policy ‘status quo’ during the trial period. If two separate reforms were witnessed at two points in time, a total of three rows can be observed on those country-pairs. This occurred on the Barbados-St. Lucia pair, for example, with the 1995-1997 period governed by a Bermuda II type traditional bilateral agreement originally ratified in 1979, the 1998-2005 period by the Caricom MASA and the year 2006 by an MoU which brought about a bilateral alteration to the common multilateral agreement in force among 9 of the 15 Caricom member states. The remaining column entries provide a brief description of each of the five aforementioned air policy levers followed by an overall aggregate policy ranking. This final column, entitled Liberalisation scale, provides the sum of the parameter of ordinal policy lever rankings. Although the scale provides a useful quantitative snapshot of the degree of ‘liberalness’ for any given year, the worded case-history analysis shown here in Table 5.1 aims to pick up any specific developments that cannot be accounted for by an all embracing and simplified index. Thus, the ‘rules of the game’ can be explored on a case-by-case basis to assist and inform the descriptive time-series correlations between observed changes to levels of carrier designation and competition, for instance.

One of the common threads running through the policy data is the unbalanced approach the US and UK have taken towards the granting of access to their gateways. Invariably the granting of open access points and the right to operate intermediate or beyond 5th freedom rights has not been reciprocated in UK and US-Caricom policy agreements. It is true, of course, that for many Caricom states the granting of unlimited access points is not of any real significance given that many of the sampled states rely on only one or two gateways, but this fact does not substantiate the unreciprocal approach that both US and UK regulators have taken towards the opening up of more gateways and 5th freedom rights to Caribbean community carriers. Note for example, that even in the most liberal markets, 5th freedoms rights have been restricted for Caricom carriers. Despite a liberalisation rank of 4.5/5, the US DOT still refuses to grant intermediate and beyond rights to flag carrier Bahamasair which may want to take advantage of such rights on possible routes into Canada, Central America or the Caribbean.

Due to the variation in air policy strategy among the sampled country-pairs, it is possible to consider a wide range of effects from marginal extra-bilateral amendments to the introduction of new official bilateral or multilateral agreements that reflect ‘step changes’ to a country-pair’s air policy strategy. These fragmented effects can be tested for magnitude and consistency as well as be cross-checked with the theoretical assumptions proposed by Hickling Lewis Brod (1997)[65]. Regional or national markets with similar complexities inherent in the historical development of their air policies may be able to draw some useful insights from this framework.

Note that in 2007 the UK negotiated an amended bilateral ASA with St. Lucia and Trinidad & Tobago which was, up to the time of writing, not officially in force. In practise, however, these country-pairs have been party to further partial air reform since the beginning of 2007, which has resulted in a 2 unit shift in liberalisation on the UK-St. Lucia bilateral and a 1.5 unit shift on the UK-Trinidad & Tobago country-pair. These recent developments provide a useful first opportunity to test the strength of the

[65] Recall that the theoretical effect of a move from a restrictive to a moderate bilateral, where carriers were allowed to set prices and enter the market freely but frequency remained restricted for instance, was found to be greater than a move from a moderate to a facilitating bilateral where partial liberalisation welfare gains had already been exhausted.

regression estimations, in that predicted traffic gains can be contrasted with actual gains (losses) over the period of no further air reform. As no further policy shifts have been made on the aforementioned country-pairs, however, it will be difficult to draw conclusions with any confidence regarding the strength of the liberalisation model estimates. If 2007 growth figures already exceed the model estimates then it can be concluded that the estimates are conservative. If growth figures are positive and the model's liberalisation coefficient is also positive then this gives a first indication of a robust model as long as the actual growth figures remain below the threshold stipulated by the cumulative gain estimates of the model.

5.3. Time-series analysis

5.3.1 Liberalisation and traffic volumes

Firstly, a top level picture of the explanatory variable of interest and its relationship with air traffic (number of yearly passengers) was obtained by breaking down the route group sub-samples into three liberalisation categories; high, medium and low. For the 24 sampled country-pairs a number of descriptive statistics were computed for each of these categories and the results of which are presented in Table 5.2.

Table 5.2
Descriptive statistics for route group sub-samples broken down into three policy categories

CP Group	Lib Category	Mean	SD	Min	Max	Count
NA-Caricom	High (>3.34)	3,268,670	480,112	2,556,232	4,382,838	17
	Medium (1.68-3.34)	695,550	906,980	4,124	2,743,075	76
	Low (0-1.67)	507,682	917,871	47,163	2,417,174	15
UK-Caricom	High (>3.34)	480,420	117,093	253,659	627,185	12
	Medium (1.68-3.34)	133,277	83,743	15,127	399,996	38
	Low (0-1.67)	347,858	61,304	231,722	405,530	10
Intra-Caricom	High (>3.34)	65,502	N/A	65,502	65,502	1
	Medium (1.68-3.34)	41,847	31,450	8,118	137,152	87
	Low (0-1.67)	15,988	11,305	3,631	40,459	32
Totals	High (>3.34)	2,046,598	1,469,077	65,502	4,382,838	30
	Medium (1.68-3.34)	306,303	635,522	4,124	2,743,075	201
	Low (0-1.67)	203,604	509,797	3,631	2,417,174	57

Comparing the aggregate statistics (totals) with the dissected results broken down into three intuitive country-pair groupings provides evidence that the impact of a relaxation of air policy is generally limited by the presence of non-supply related variables such as country-pair population levels, historical and commercial links, income levels and disparities, market tourism intensity and so on. It is these factors which determine the magnitude of demand on US-Caricom markets when compared to Intra-Caricom markets. This is reflected by the fact that for a given level of liberalisation, air traffic levels are invariably lower on Intra-Caricom markets than on NA-Caricom markets. With the exception of the NA-Caricom group, the disseminated means provide a more reliable measure of central location than the aggregate mean with sample variability (SD) being sizeably lower than the mean for all categories of liberalisation. Variability was greater on the NA-Caricom sub-group because of the presence of the US-Bahamas –Jamaica and –Dominican Republic markets which all yielded higher air traffic volumes for a given level of liberalisation when compared to the southern and eastern Caricom states also present in the same sub-group.

The most important observation of the results in Table 5.2 is therefore that, within a given set of socio-demographic and consumer preference constraints, traffic levels are shown to increase as the level of liberalisation also increases both for the aggregate and dissected results. The exception to this appears on the UK-Caricom market with mean average traffic levels on restricted markets being notably higher than on partially liberalised markets. Further analysis of each UK-Caricom county-pair shows that the restricted UK-Jamaica market between 1995 and 2004 did not appear to tame traffic growth during the same period perhaps indicating that the sustained control of designation, capacity, pricing and frequency has not resulted in a negative market response driven in part by the large Jamaican Diaspora residing in the UK. Necessary (inelastic) VFR journeys to and from Jamaica plus the stable and consistent presence of respective flag carriers British Airways and Air Jamaica may have dampened the possible negative effects of the moderately restrictive air policy evident in the country-pair during the period.

When looking at a comparison of average growth rates between markets that experienced air reform and those that did not during the observation period, a slightly different picture emerges. Figures 5.1(a) to (c) present average indexed and absolute traffic trends for the three country-pair sub-groups.

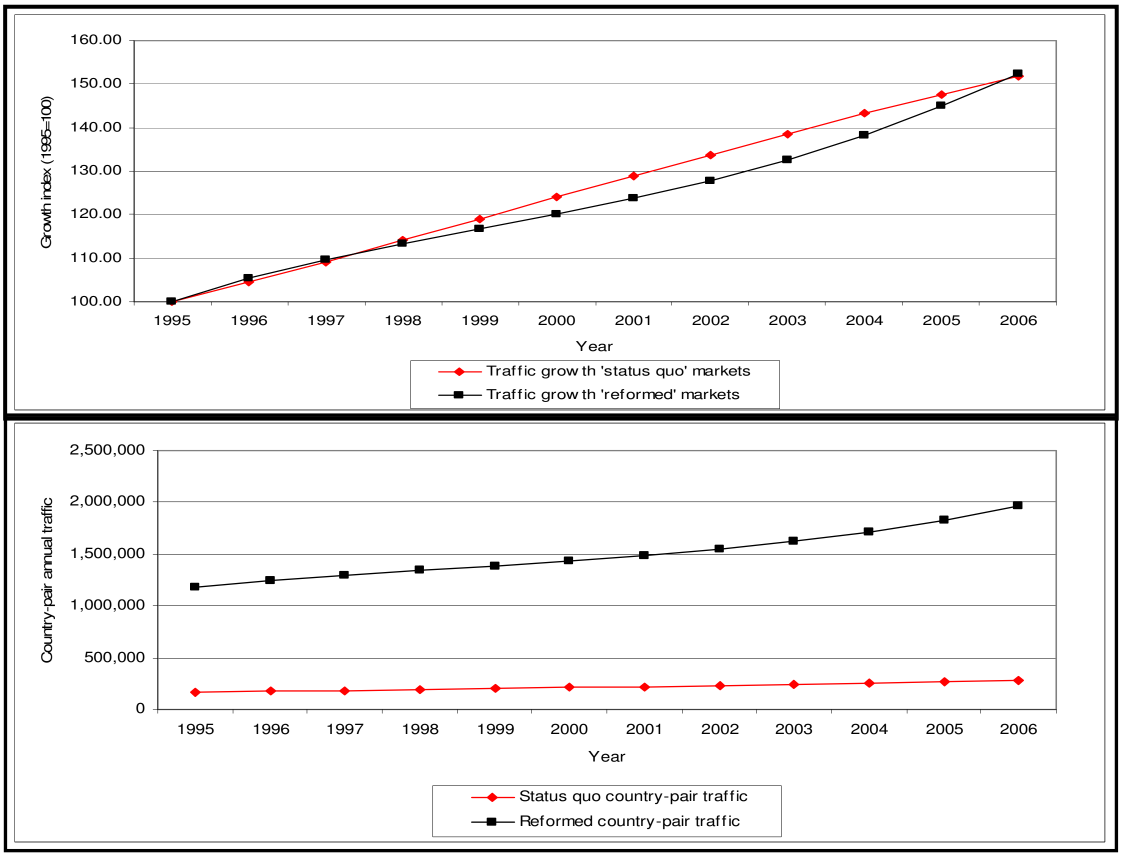


Fig. 5.1(a) North America-Caricom country-pair traffic growth 1995-2006

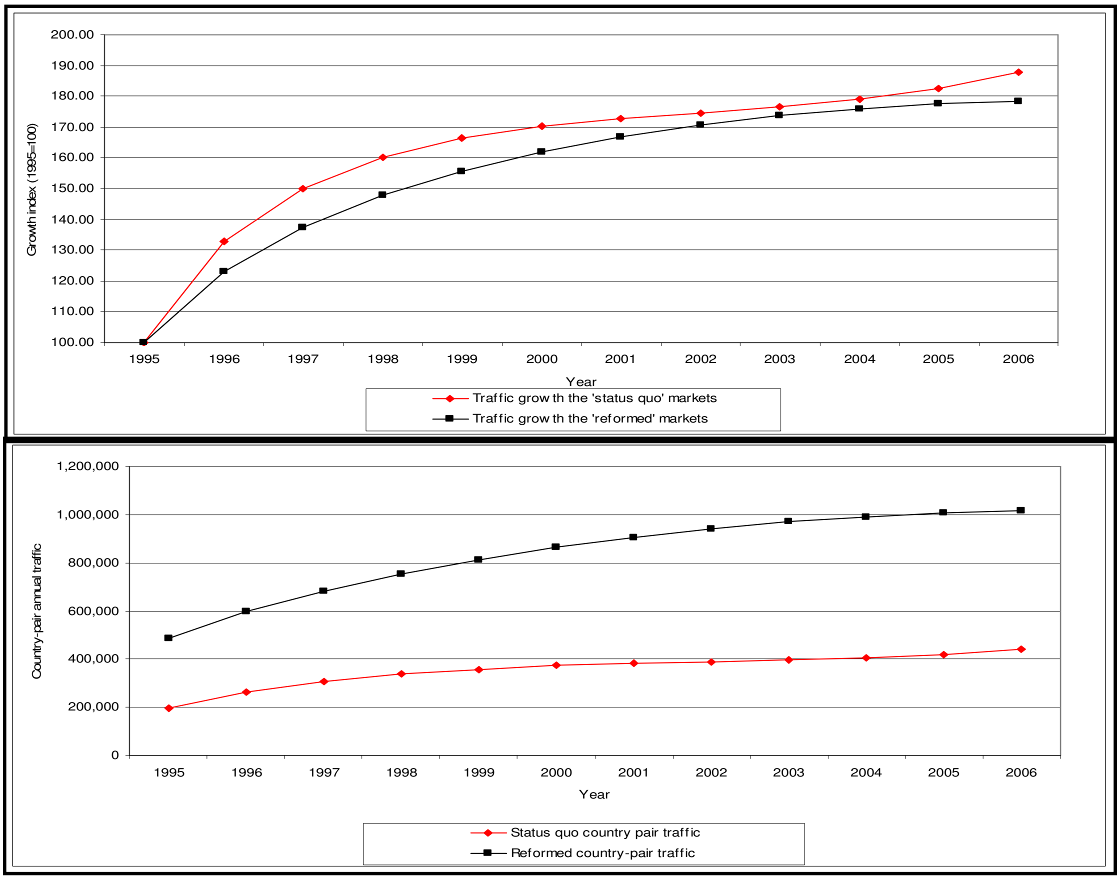


Fig. 5.1(b) UK-Caricom country-pair traffic growth 1995-2006

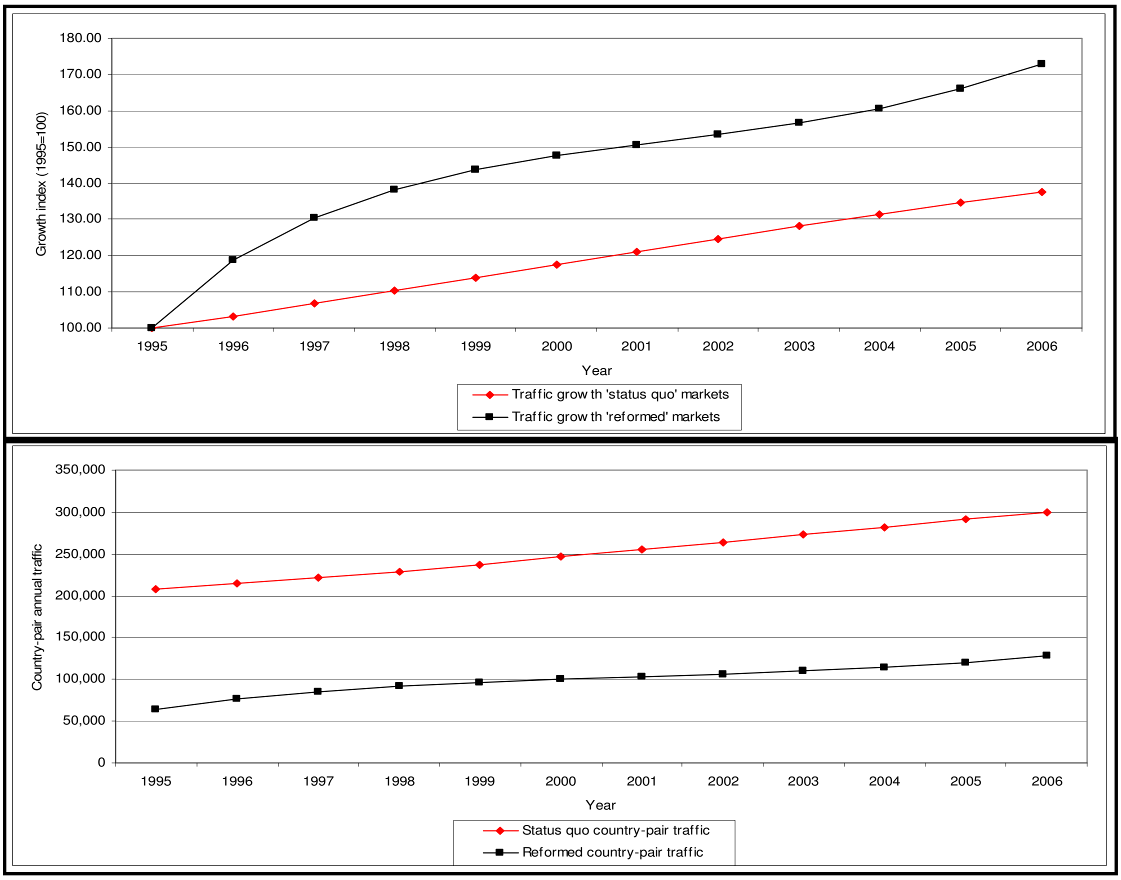


Fig. 5.1(c) Intra-Caricom country-pair traffic growth 1995-2006

For the NA- and UK-Caricom sub-groups, reform occurred more frequently on country-pairs that had higher absolute traffic levels during the observation period but lower growth rates. Clearly, greater initial growth rates are to be made on markets with little or no historical O-D traffic irrespective of whether air reform took place or not. Annual growth on a thin market from 5,000 to 10,000, for example, would yield a 100% growth rate whereas a greater absolute increase from say 1,250,000 passengers to 1,500,000 would only yield a 20% growth rate. It can be argued, therefore, that smaller markets have been able to experience initial growth without the need for air reform in the short term. More important, however, is what Figures 5.1(a) to (c) do *not* show. The fact that the 'status quo' markets have displayed higher growth rates than the reformed markets does not provide evidence that (a) traffic growth stagnates under reformed markets and (b) higher growth rates in percentage terms for 'status quo' markets indicate that lower cumulated traffic gains are to be made when certain policy restrictions are removed. The logarithmic shape of the 'status quo' growth curves provides further evidence that as absolute levels increase, growth rates level off. The inverse of the same argument holds for the Intra-Caricom markets given the fact that it was the 'status quo' country-pairs that were more developed in terms of absolute traffic levels leading to higher but declining growth rates for the smaller, reformed markets.

Another possible explanation of variance could be the extent to which air policy was controlled or relaxed as a result of earlier developments which took place outside the observational period. *Ceteris paribus,* a country-pair which maintained its air policy 'status quo' index of 2.5, for example, may be expected to have a more positive effect on traffic growth rates than for a restricted country-pair that maintained a more modest index of 1. This hypothesis can be tested by evaluating how strong the liberalisation index is as a predictor of traffic growth rates regardless of whether reform took place or not. This is performed using a single factor ANOVA test for both the aggregate and sub-group country-pair data. Country-pairs with very low traffic volumes over the observation period were left out of the sample given their disproportionate growth (reduction) rates when compared to mature markets with higher and more stable absolute traffic volumes. The results are presented below in Table 5.3.

Table 5.3

ANOVA variance output to show strength of liberalisation index as a predictor of traffic growth rates

Anova: Single Factor NA-Caricom

SUMMARY

Lib index	Count	Sum	Average	Variance
1 to 1.99	14	24.55	1.75	120.34
2 to 2.99	48	163.99	3.42	51.99
3 to 3.99	18	92.72	5.15	5.16
4 to 5	8	36.97	4.62	0.27

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	101.00	3	33.67	0.69	0.56	2.71
Within Groups	4097.48	84	48.78			
Total	4198.48	87				

Anova: Single Factor UK-Caricom

SUMMARY

Groups	Count	Sum	Average	Variance
1 to 1.99	9	58.81	6.53	31.14
2 to 2.99	24	147.04	6.13	63.32
3 to 3.99	9	90.09	10.01	63.81
4 to 5	2	6.75	3.38	0.05

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	127.40	3	42.47	0.77	0.52	2.84
Within Groups	2216.01	40	55.40			
Total	2343.40	43				

Anova: Single Factor Intra-Caricom

SUMMARY

Groups	Count	Sum	Average	Variance
1 to 1.99	12	50.49	4.21	5.42
2 to 2.99	81	295.46	3.65	24.00
3 to 3.99	5	81.05	16.21	66.23
4 to 5	1	5.07	5.07	#DIV/0!

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	744.00	3	248.00	10.50	0.00	2.70
Within Groups	2244.32	95	23.62			
Total	2988.31	98				

Anova: Single Factor Total sample

SUMMARY

Groups	Count	Sum	Average	Variance
1 to 1.99	35	117.16	3.35	69.82
2 to 2.99	153	606.48	3.96	39.17
3 to 3.99	32	263.86	8.25	44.54
4 to 5	11	48.79	4.44	0.49

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	539.41	3	179.80	4.20	0.01	2.64
Within Groups	9713.71	227	42.79			
Total	10253.12	230				

Despite the largely higher traffic growth means for less restricted markets there is not enough statistical evidence in the NA- and UK-Caricom sub-groups to suggest that the null hypothesis, stating the mean scores for the four liberalisation classifications are equal, can be rejected. This resulted in F distribution values of 0.69 and 0.77 respectively which were comfortably below their given critical F values. Consistent with the Intra-Caricom growth index shown in Figure 5.1(c), even when there has been no reform, higher between country-pair liberalisation values generally leads to higher average traffic growth figures confirmed by an F value of 10.50, well above the given critical value of 2.70[66]. Conclusions must be drawn with caution, however, given the small number of unrestricted air policy observations and the resulting high variance around the mean. The same reasoning cannot be offered for

[66] Twelve (12) year cumulative traffic growth for non-reformed Intra-Caricom markets was at 38% between 1995 and 2006. This works out at an average of approximately 90,000 extra passengers per annum. On reformed Intra-Caricom markets, their lower average liberalisation rating over the entire observation period led to a more modest average of approximately 64,000 extra passengers per annum despite having a higher cumulative growth rate of 73%.

the more modest 4 to 5 liberalisation band. Despite the small number of observations present in this classification the low variance suggests viable mean values. This finding is consistent with Hickling Lewis Brod's (1997) diminishing gains theory where a move from a restrictive to a moderate air service agreement enables air carriers to take advantage of suppressed demand compared with a move from a moderate to facilitating agreement (where only marginal gains can be expected within a maturing market). The Civil Aviation Authority also observed similar experiences on the UK-India market after the previously restrictive bilateral was partially liberalised to unlock a predictable response of latent new carrier entry and an overdue expansion of services on a number of inviting new city-pairs (Civil Aviation Authority 2006[67]).

In addition to this, depending on the ability of carriers to react to regulatory changes, the benefit of reform is assumed to be realised unevenly across subsequent time periods of air policy 'status quo'. The shape and significance of this relationship can be tested using the sample's time-series observations. In the absence of further historical data, it can be assumed that both reform and air service supply changes have a similar relationship in the non-observed time periods leading up to 1995. If an inverse u-shape relationship is observed, for instance, this would suggest that reform benefit gradually reaches a peak and then slows down again until such time as further reform takes place. If this is not the case then some other relationship may be prevalent among the sampled country-pairs or some other combination of drivers is explaining the magnitude and timing of carrier responses.

As described in the methodology section, the liberalisation scale was devised using three ordinal level rankings and five individual policy levers. If all policy levers were classified as restrictive an overall liberalisation index of "0" was employed. In turn the other extreme of complete air policy facilitation would yield a maximum ranking of "5" reflecting a facilitating index of "1" for each relaxed policy lever. The number of sampled country-pairs witnessing some degree of air policy liberalisation in the period 1995-2006 totalled 11. This signifies that 13 country-pairs in the sample either failed to update or revise air policy at all or the resulting overall liberalisation ranking showed no net increase as a result of regulatory changes governing an air

[67] For a more detailed description of the UK-India case refer to Appendix H.

transport market. When testing the hypothesis of an increase in country-pair air traffic growth as a result of air policy reform, the normal distribution can be used to approximate the binomial of discrete values as long as the number of observations in a sample is larger than 10 (Lind et al. 2005). Given that only country-pairs with at least some air policy development could be included in the sample, the number of observations (11) was only just above this threshold resulting in a tenuous z-value at the .05 significance level on the following experimental data (Table 5.4):

Table 5.4
Average country-pair traffic growth levels before and after partial liberalisation

Country-pair	Before		After		Sign (difference in traffic growth)	Year of policy change
	Lib rank	Average traffic growth	Lib Rank	Average traffic growth		
US-Bahamas	1.50	-35,777	4.50	161,541	+	1998
US-Dominican Republic	2.50	177,830	3.50	199,596	+	2000
US-Jamaica	2.00	32,821	3.25	180,607	+	2003, 2006
US-Barbados	2.50	-3,979	3.00	10,836	+	2000
US-Dominica	2.00	3,517	2.50	10,844	+	2006
US-Guyana	1.50	745	1.50	745	0	N/A
US-St. Lucia	2.00	697	2.50	54,707	+	2005
US-Trinidad & Tobago	2.50	29,468	2.50	29,468	0	N/A
Canada-Barbados	2.50	-213	2.50	-213	0	N/A
UK-Bahamas	2.50	5,098	2.50	5,098	0	N/A
UK-Barbados	3.50	32,634	4.50	36,501	+	2005
UK-Jamaica	1.50	18,896	3.00	2,115	-	2005
UK-St. Lucia	2.50	5,526	2.50	5,526	0	N/A
UK-Trinidad & Tobago	2.50	7,744	2.50	7,744	0	N/A
Bahamas-Barbados	0.00	-119	0.00	-119	0	N/A
Bahamas-Jamaica	2.00	-1,063	2.00	-1,063	0	N/A
Barbados-Guyana	1.50	4,537	2.50	1,616	-	1999
Barbados-Jamaica	2.00	750	2.00	750	0	N/A
Barbados-St. Lucia	2.00	1,582	3.00	3,380	+	1999, 2006
Barbados-T&T	2.50	4,911	2.50	4,911	0	N/A
Dominica-T&T	1.50	871	2.25	900	+	1999
Guyana-T&T	2.50	1,776	2.50	1,776	0	N/A
Jamaica-T&T	1.50	727	1.50	727	0	N/A
Suriname-T&T	2.50	528	2.50	528	0	N/A

Nine of the eleven country-pairs that showed an increase in air policy between 1995 and 2006 displayed increases in after-liberalisation traffic growth (positive signs). Testing this finding against a normal distribution requires the following sign test equation:

$$z = \frac{(X - .50) - \mu}{\sigma} = \frac{(X - .50) - .50n}{.50\sqrt{n}} \tag{5.1}$$

Inputting the sample values into eq. 5.2 gives:

$$z = \frac{(X - .50) - \mu}{\sigma} = \frac{(9 - .50) - .50(11)}{.50\sqrt{11}} \tag{5.2}$$

$$z = 1.82$$

Therefore the null hypothesis that there is no increase in traffic as a result of Caricom air policy reform cannot be rejected at the .05 significance level (+/- 1.96) but can be rejected at the .10 significance level (+/- 1.64).

With more than 80% of the eleven observed country-pairs showing a mean average increase in traffic growth after liberalisation took place, it is possible that the sample size may not have been large enough to ensure the necessary normal distribution on which the z-value is based. Consequently a sign test was performed using the binomial probability distribution which does not require normality of a sample distribution and can also be a reliable predictor on small sample sizes. With random effects the probability of a "success" is assumed to be .50. Thus, the alternate hypothesis that air policy reform did have a notable effect on traffic growth can be demonstrated if the given sample of observations indicate non-random effects leading to a >.50 probability of a "success". The following Table (5.5) and Figure (5.2) present the binomial probability of a given number of successes when n = 11 and π = .50.

Table 5.5
Binomial probability distribution for n = 11, π = .50

Number of successes	Probability of success	Cumulative probability
0	0.000	1.000
1	0.005	1.000
2	0.027	0.995
3	0.081	0.968
4	0.161	0.887
5	0.226	0.726
6	0.226	0.500
7	0.161	0.274
8	0.081	0.113
9	0.027	0.032
10	0.005	0.005
11	0.000	0.000

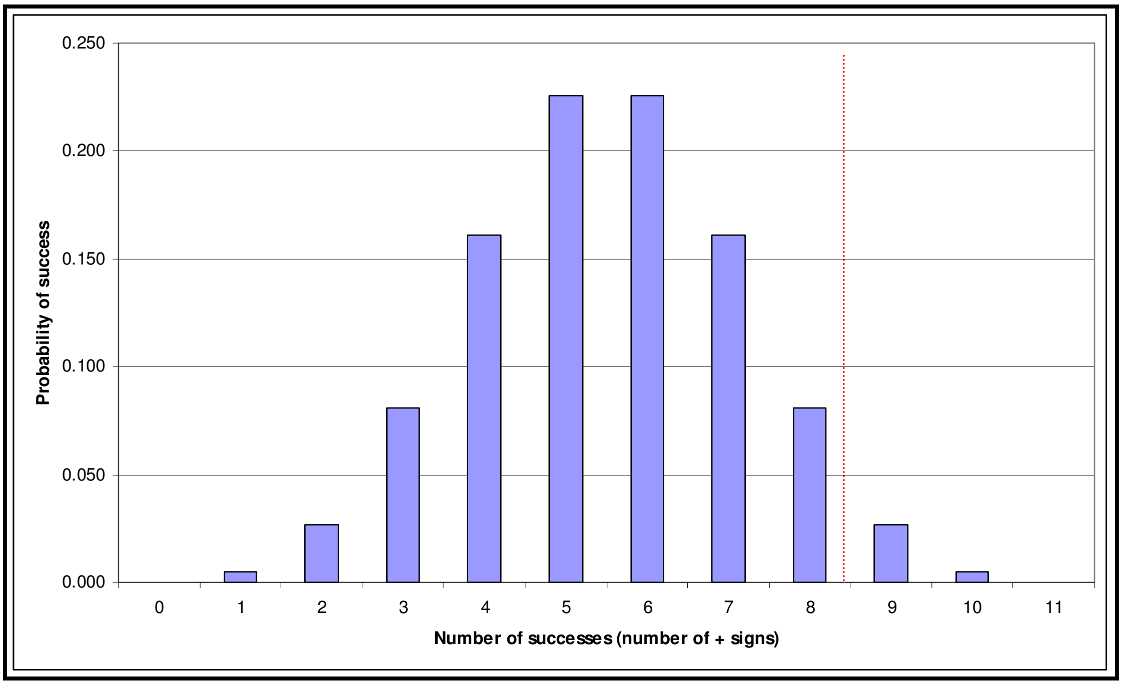


Fig. 5.2 Region of rejection, n = 11, π = .50

As can be seen by the cumulative probability column in Table 5.5, at the .05 level of significance the decision is to reject the null hypothesis that there has been no increase in traffic growth as a result of air policy reform in the region. This is also reflected in Figure 5.2 which shows that the outcomes of 9, 10 or 11 “successes” are located in the region of rejection at the .05 significance level (0.032+0.005+0.000 = 0.037 <.05). It is probable that the small sample size of country-pairs did yield an unreliable z-value and it is more likely reform did positively effect post-liberalisation average traffic growth at the .05 significance level and not at the .10 level.

Of the three country-pair sub-groups, the most policy development has occurred on North America-Caricom markets, with the majority of country-pairs preferring to negotiate on an extra-bilateral basis as opposed to opting for the route of official reform, either on a bilateral open-skies basis or on a multilateral Caricom-US, -Canada basis. Nevertheless, ad-hoc extra-bilateral negotiations appear to have had a positive facilitating impact on levels of air traffic, either by helping to reverse negative growth trends, or by supplementing growth rates that were already positive before reform took place. A dampening effect is evident on markets that have seen no air policy development or on markets where reform took place only recently, showing perhaps that the full benefits of air reform are not realised uniformly across subsequent periods of no further air reform. Finally, some markets like UK-Trinidad & Tobago experienced healthy traffic growth rates despite the fact there was no air traffic development during the same time-series period. This finding suggests that a number of other variables are driving traffic levels on any given country-pair which may dampen or overwhelm the impact of a change in air policy. This is linked to the observation that largely positive pre-liberalisation traffic growth figures were recorded, with only 5 of the 24 sampled country-pairs showing pre-reform or 'status quo' negative means[68].

It is also of interest to review the statistical magnitude of the before and after changes in traffic as compared to markets that maintained their air policy 'status quo' during the observational period. The results for the three sample sub-groups can be found in Table 5.6 and the statistical significance of these results are tested by applying the Wilkoxon signed rank test, typically used on categorical data that cannot follow the necessary normal distribution for a t-test. The individual country-pair rankings and workings are subsequently given in Table 5.7.

[68] The impact magnitude of other traffic determinants is estimated as part of the country-pair traffic regression models (section 5.4).

Table 5.6
Average annual country-pair traffic growth under conditions of air policy 'status quo' and partial liberalisation

Country-pair sub-group	Measure of location	Status quo period	After lib period	% Traffic growth
Intra-Caricom (n=10)	Mean average growth	1,449	1,965	35.63
	Standard deviation traffic growth	1,903	1,276	-
UK-Caricom (n=5)	Mean average growth	13,980	19,308	38.12
	Standard deviation traffic growth	11,847	24,315	-
NA-Caricom (n=9)	Mean average growth	22,790	103,022	352.05
	Standard deviation traffic growth	61,445	87,292	-
Total (n=24)	Mean average growth	12,062	60,240	399.41
	Standard deviation traffic growth	37,866	79,508	-

Table 5.7
Traffic growth (reduction) ratings for before and after partial air reform

Before lib score	After lib score	Difference in score	Absolute difference	Rank	Signed rank R+	Signed rank R-
-35,777	161,541	197,318	197,318	11	11	*
177,830	199,596	21,766	21,766	8	8	*
32,821	180,607	147,786	147,786	10	10	*
-3,979	10,836	14,815	14,815	6	6	*
3,517	10,844	7,327	7,327	5	5	*
745	745	0	0	*	*	*
697	54,707	54,010	54,010	9	9	*
29,468	29,468	0	0	*	*	*
-213	-213	0	0	*	*	*
5,098	5,098	0	0	*	*	*
32,634	36,501	3,867	3,867	4	4	*
18,896	2,115	-16,781	16,781	7	*	7
5,526	5,526	0	0	*	*	*
7,744	7,744	0	0	*	*	*
-119	-119	0	0	*	*	*
-1,063	-1,063	0	0	*	*	*
4,537	1,616	-2,921	2,921	3	*	3
750	750	0	0	*	*	*
1,582	3,380	1,798	1,798	2	2	*
4,911	4,911	0	0	*	*	*
871	900	29	29	1	1	*
1,776	1,776	0	0	*	*	*
727	727	0	0	*	*	*
528	528	0	0	*	*	*
Total					56	10

Using the Wilcoxon non-parametric T-value distribution, the critical value when n=11 and the significance level is .05 is 13. As R- is the smaller value of the two rank sums, it acts as the test statistic T. The decision rule is to reject the null hypothesis that there is no difference in passenger growth rankings between markets that have and have not experienced an increase on the liberalisation scale if the value of the test statistic t is lower than the critical value. As the R- sum is equal to 10 the decision is to reject the null hypothesis and accept the alternate hypothesis that an increase in air policy liberalisation is linked to the higher average traffic growth rates observed in

Table 5.6. This can be seen as a first attempt to isolate the effects of liberalisation from other internal and external factors influencing traffic volumes involving Caricom states. Consistently higher average traffic growth after partial air reform takes place, suggests that the more typical demand and supply side effects usually lead to more modest growth rates in the absence of further air policy reform.

In general, the magnitude of post reform traffic growth is greater on US-Caricom country-pairs than on UK and Intra-Caricom country-pairs. In some cases bilateral liberalisation of capacity and designation controls coincided with US domestic carrier retrenchment before and after 11th September 2001. As a result, extra capacity was made available with medium haul aircraft by carriers wishing to expand international capacity on routes with less direct competition than that experienced on some of the US domestic routes they replaced. This convenient sequence of events infrequently occurs on many of the sampled country-pairs, however, showing that carrier responses to air policy reform is dynamic and unpredictable rather than static and predictable. This may have been a contributory factor to the more modest post-liberalisation growth rates on UK- and Intra-Caricom markets as shown in Table 5.6.

Finally, the measure of traffic growth dispersion was found to be large among the majority of country-pairs. This suggests that the fixed between country-pair effects, even within the three 'homogenous' sub-groups, are significant in determining the extent to which the removal of supply controls can stimulate a positive response in the market.

5.3.2. Liberalisation and other determinants

5.3.2.1. Competition

Although competition is frequently coupled with liberalisation as one of its major objectives (Hansjochen 2001), for a variety of reasons increased competition at the route level is not always significantly nor statically correlated with air policy reform. In fact, if we look at the possible barriers to competition (See for example, Schnell in Forsyth et al. 2005), it becomes clear that the use of a measure of competition as a proxy for a market's air policy status can be problematic. Of the twenty-two (22) entry barriers cited by a sample of EU, US, Canadian and Australasian carriers, only half can be said to be directly or indirectly related to the economic relaxation of air policy levers. Decision criteria relating to the cost of market research, possible levels of product differentiation, incumbent carrier advertising intensity and the lack of access to valuable airport slots can clearly moderate the effect of even the most liberal air policy frameworks. By extension, if two separate indicators are used, one for air policy status and one for levels of competition, an overall disturbance term can account for any low liberalisation-competition correlations endogenously within the parameters of a regression model.

A number of distorting factors have been found which are specific to the Caricom country-pair sample and are in many cases backed up by the findings of Schnell (2005) and Gannon (2005, both in Forsyth et al. 2005). Some lie within the auspices of air service agreements while others are considered to be unrelated to air policy and more associated with individual firm behaviour and the strategic network priorities for air service providers:

1. Incumbent carriers often react to the removal of carrier designation barriers by dumping extra capacity onto those routes to which the policy reform applies in an attempt to obtain fares which fall below the marginal costs of any potential new entrants. This prevents direct competition at least in the short-term and often results in time-lags like those witnessed on the US-Bahamas market (Figure 5.3). Incumbent carrier capacity increases in response to a more liberal policy framework can result in an increase in traffic volumes, however, and this growth has to be indirectly accredited to the removal of entry barriers.

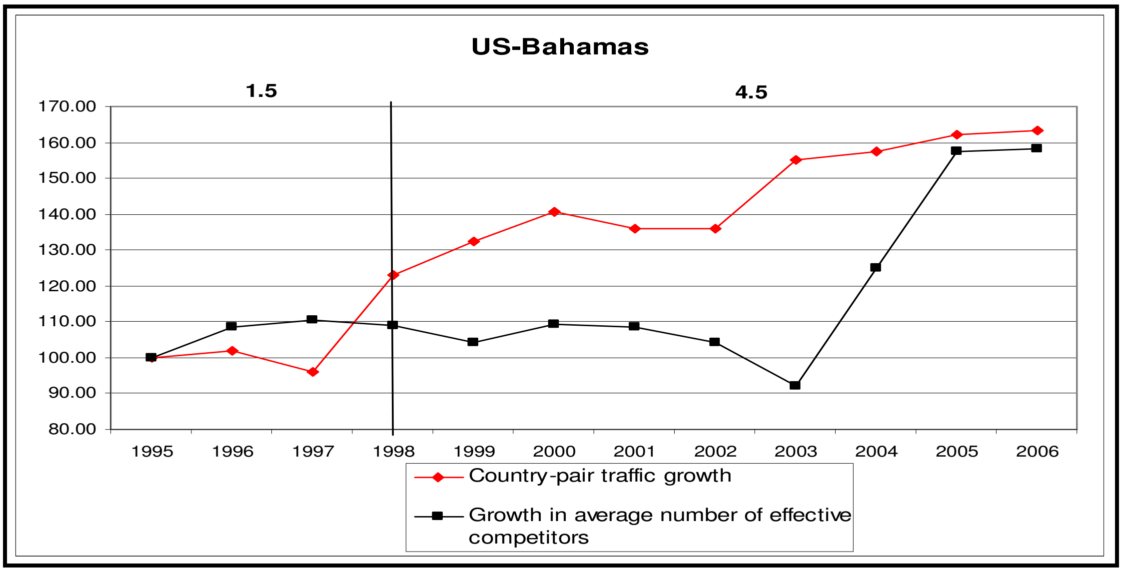


Fig. 5.3 US-Bahamas comparison of trends in traffic volumes and levels of effective competition

2. The behaviour of new entrants is unpredictable and often based on a manager's perception of entry opportunities. Extended designation rights frequently lead to entry as was the case on the US-Barbados market when reform in the year 2000 acted as the catalyst for the entry of US and Delta airlines in competition with incumbents BWIA and American on the BGI-NYC city-pair. There was a decoupling of levels of competition through the period 2003-2006, however, as Delta and US airline services were scaled down or withdrawn suggesting perhaps that the incumbents American and BWIA enjoyed first mover advantages as well as hub airport scale advantages thereby preventing sustainable competition on that route despite the higher liberalisation ranking (Figure 5.4).

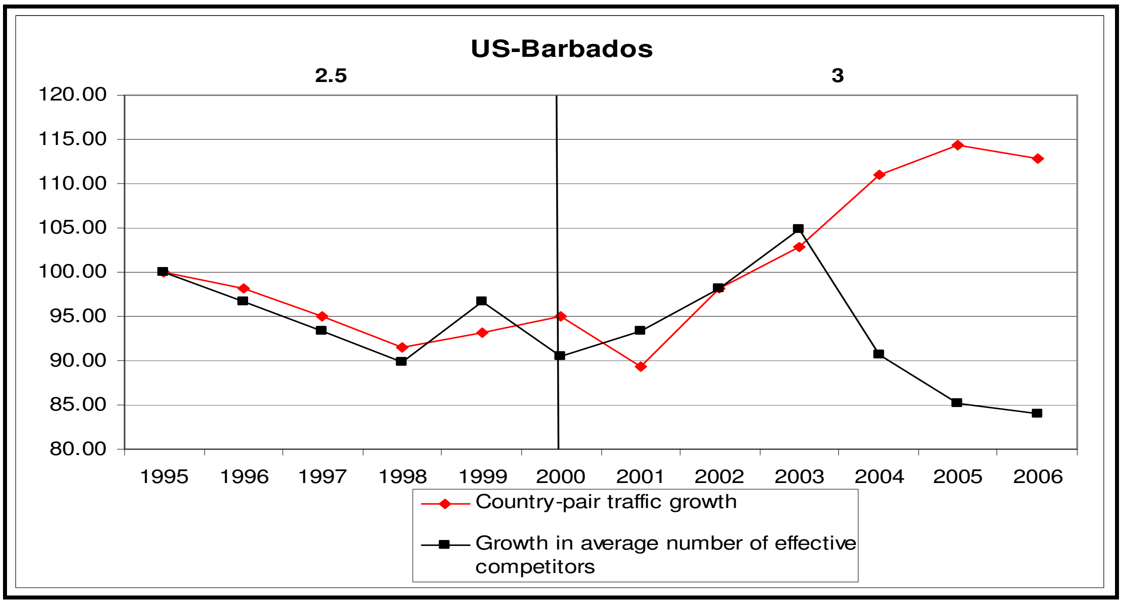


Fig. 5.4 US-Barbados comparison of trends in traffic volumes and levels of effective competition

3. Incumbents sometimes build strong brands and enjoy well established Frequent Flyer Programmes (FFPs) making entry an unattractive proposition. This barrier is completely detached from a country-pair's air policy framework and could have had a marked effect on the correlation between liberalisation and levels of competition on the Barbados-St. Lucia market, for example. Although both Barbados and St. Lucia signed up to the 1998 Caricom multilateral agreement, effectively opening up nine Caricom markets to unlimited 5th freedom rights, entry was clearly discouraged due to incumbent carrier LIAT's historical dominance in this market and their resulting brand presence. Despite the entry of Caribbean Star in direct competition with LIAT, incumbents BWIA and Air Jamaica, despite being able to take advantage of blanket community 5th freedoms, decided to withdraw service leading to a reduction in the

effective number of competitors through the period. The 2006 part removal of pricing and foreign carrier controls on a bilateral basis may help to mitigate some of these incumbent effects (Figure 5.5).

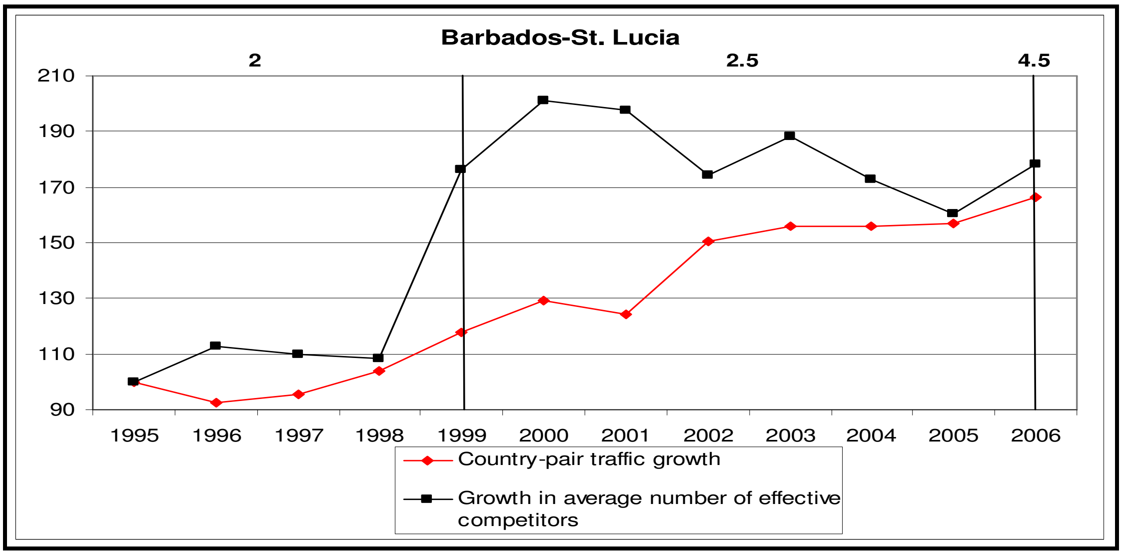


Fig. 5.5 Barbados-St. Lucia comparison of trends in traffic volumes and levels of competition

4. The reaction of an incumbent may be to compete more aggressively with the new entrant on other routes either to prevent entry or to induce a quick service withdrawal by the new entrant. This type of tacit behaviour is difficult to trace empirically but it is assumed nevertheless to be a valid tactical option, especially for the more financially stable foreign carriers like American Airlines, which can firstly increase its share of total Caricom capacity at short notice and secondly, exercise the option of cross-subsidising short-term competitive route losses with profits from other non-competitive routes.

5. The market itself may be too thin, predictably lending itself to natural monopoly or duopoly operations. For example, although the US-Dominica market did not see an air policy change throughout the observation period, it was estimated to be a moderately liberal market with a liberalisation ranking of 2. For the majority of the period, only one carrier (AA) operated US-Dominica services with ATR-72 turboprop aircraft. This supply of air services remained constant despite the fact that traffic grew suggesting higher load factors, frequencies, or a combination of both. But the market was clearly not even large enough to support dual operation with community carriers LIAT, Caribbean Star, Air Jamaica or BWIA showing no interest in using the dual designation rights available to them on that market (Figure 5.6). In 2004 Caribbean

Sun did enter the market with a considerable market share, but the following year this share was reduced and subsequently withdrawn again at the end of 2006 due to poor load factors as well as the successive demise of Caribbean Star/Sun and its incorporation into the LIAT entity.

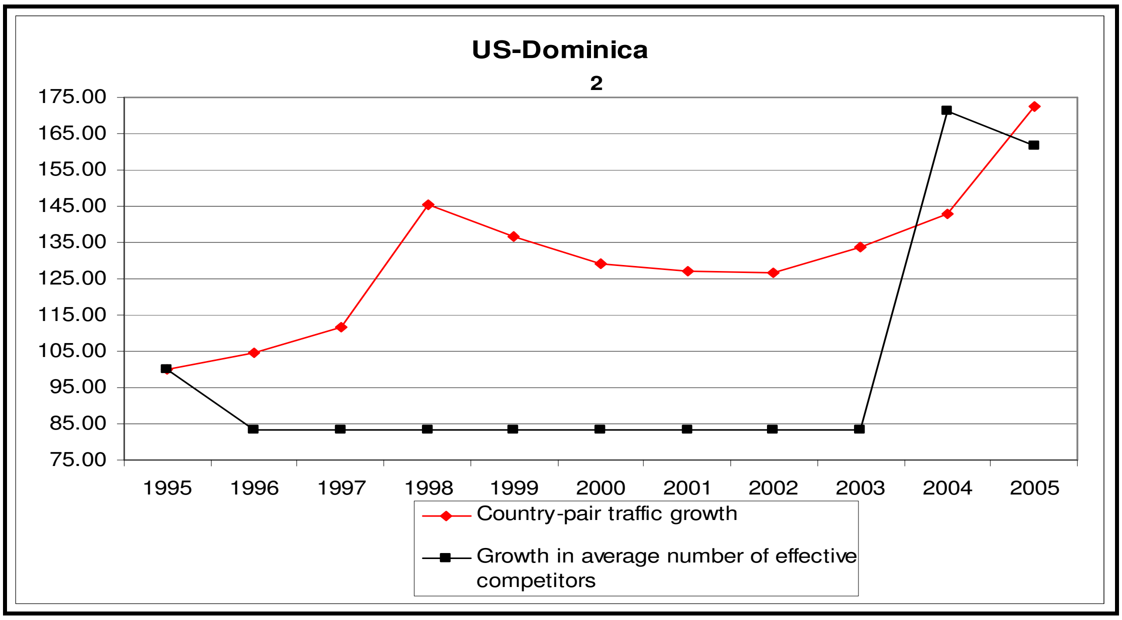


Fig. 5.6 US-Dominica comparison of trends in traffic volumes and levels of effective competition

5.3.2.2. Airline productivity

By using partial or total productivity measures it is possible to obtain an overview of the possible effect of liberalisation on airline performance. In theory, the positive impact of a more competitive environment on the efficient use of factor inputs may be moderated to a greater or lesser degree by the origin country and organisational structure of the air carriers providing services on the effected country-pair(s). Nationalised carriers, for example, often lack the necessary incentives to drive down costs and improve efficiency. Strong representation from labour unions and government pressure regarding carrier route networks can also hinder a movement towards improved airline performance. In spite of this, a recent study by Barbot et al. (2008) found a greater homogeneity in TFP scores among carriers from the same region. The North America example is offered with a TFP index standard deviation of only 22.5, probably reflecting more competitive conditions and a similar legal framework within that region. The TFP scores were more heterogeneous for carriers from other regions, however, with the Europe group, for instance, revealing a standard deviation of 43.5.

A similar regional analysis can be performed for the three Caricom regional sub-groups on the basis that total carrier productivity is said to be influenced by an entire network of routes. It can be assumed, therefore, that foreign carriers who operate into the region principally operate in more liberal environments whereas local Caricom carriers generally carry out their activities in more restricted markets. Although UK-Caricom markets were observed to be largely restrictive during the observation period, it is reasonable to assume that the effect of this would be proportional to each carrier's capacity share on these routes. For British Airways and Virgin Atlantic, for example, Caricom routes make up a small fraction of their entire networks, whereas a greater proportion of BWIA and Air Jamaica capacity would be exposed to the same changes. The inverse of this would hold for NA-Caricom markets where more air policy development took place during the period. Restrictions on Intra-Caricom markets would have a marked impact on local carriers given their high share of total network capacity offered in these markets.

A multiple labour related partial productivity index[69] is used as a proxy for TPF in accordance with the findings of Windle et al. (1992). Means and standard deviations of change in this index between 1995 and 2006 are segmented into a matrix of local and foreign carriers operating in each of the three regional sub-groups and are presented in Table 5.8.

Table 5.8
Average growth in partial airline productivity index (1995-2006)

Regional sub-group	Index mean growth local (%)	Index mean growth foreign (%)	Aggregate mean growth regional sub-group (%)	SD local carriers (%)	SD foreign carriers (%)	Aggregate SD regional sub-group (%)
NA-Caricom	32.21	132.65	110.40	17.97	130.45	48.45
UK-Caricom	37.27	114.45	111.75	20.65	143.20	34.52
Intra-Caricom	31.72	126.22	56.83	16.46	262.92	40.23
Agg. mean/SD	33.73	97.79	92.99	2.12	73.08	7.00

Note: Percentages represent the cumulative twelve year change in carrier productivity between the years 1995 and 2006

The first observation is that, due to total network effects, there is a higher level of variation between the productivity growths of foreign carriers compared to local carriers than between different route groups. Local carrier mean estimates are also

[69] This index includes a financial measure (revenue per employee) and a measure of output (Revenue Tonne Kilometres (RTK) per employee).

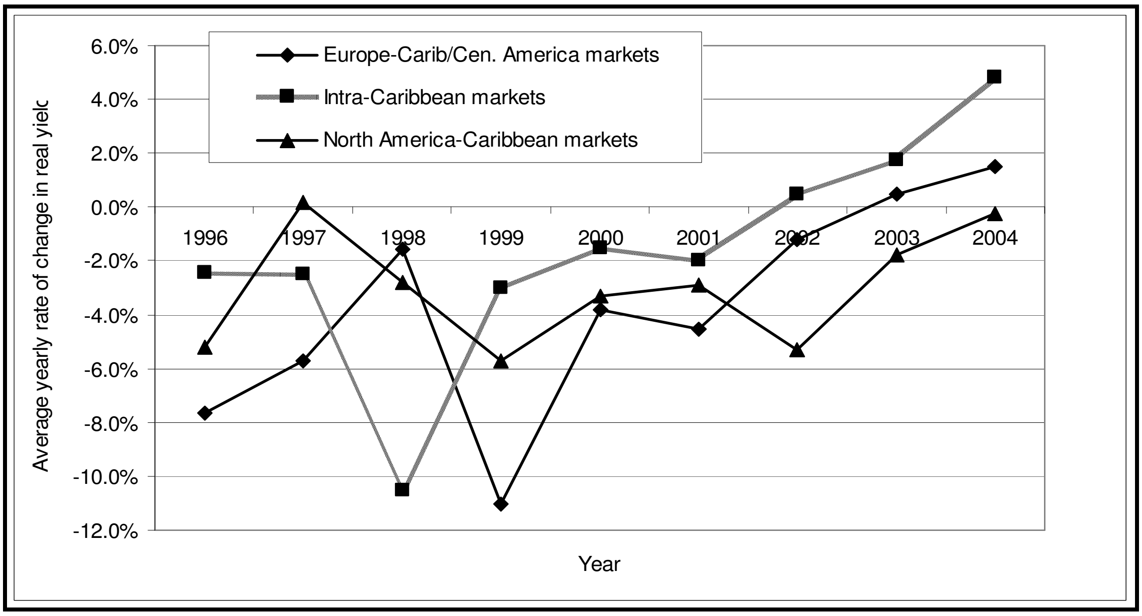
found to be more reliable than foreign carrier mean estimates given the vastly differing route networks of carriers such as British Airways, Continental and American Airlines, in contrast to local Caricom carriers who offer a more homogenous product in terms of network coverage. Despite the between carrier variation, it is still possible to observe more significant growth figures in the productivity index on foreign carrier intensive route groups. Conversely, the Intra-Caricom route group revealed a mean productivity index growth of only 56.83, half of that recorded for the NA- and UK-Caricom route groups. Thus, it appears to be no coincidence that the route group with the highest incidence of restricted markets was also the route group with the highest proportion of local carrier services. The introduction of British Airways and American Eagle services on the Barbados-St. Lucia, –Trinidad & Tobago markets have served to increase the variation around this mean figure, however, with a standard deviation estimate of 40.23. The market share of these carriers is still not high enough to have a positive impact on the Intra-Caricom productivity index growth figure and by extension one could draw from this the inference that, as foreign carrier market share increases in local markets, so too will the aggregate carrier productivity index on this route group.

It is important to recall the limitations of the use of partial productivity measures as well as the direct application of total network developments as an indicator of changes in productivity for specific route groups. There could be homogenous constraints in particular regions which prevent carriers from fully implementing productivity enhancements. Moreover, factor prices tend to vary quite considerably between regions with foreign carriers, for instance, having greater access to capital and scale economy opportunities in areas such as aircraft leasing, fuel costs and labour costs. It is a useful first attempt, however, at an empirical assessment in the Caricom region, given the clarity of the deregulation-foreign carrier-route group relationships evident in the partial productivity results.

5.3.2.3. Airfares

It is also possible to observe the possible impact of air policy reform on airfares by following annual developments in average yields on the NA-, UK and Intra-Caricom route groups. Average yield data was provided by ICAO Air Transport Bureau (2006) and represents the average change in real fares covering all routes, all air carriers and all fare classes for each respective route group. It is already known from a policy perspective which route groups have experienced a greater level of reform, and thus the general theory of significant downward pressure on fares in deregulated markets can be tested for Caricom markets (See findings of Morrison et al. 1995, for example).

The following Figure (Figure 5.7) details the annual percentage change in levels of average real yield for the three sampled route groups between the years 1996 and 2004. Rates of change are preferred to absolute levels of change given the fact that absolute unit fare differences relating to average sector distance and average aircraft size can be controlled for and underlying growth patterns obtained.



Source: ICAO Air Transport Bureau (2006)

Fig. 5.7. Average percentage change in real yields for selected Intra-Caribbean, North America-Caribbean, and Europe Caribbean markets 1996-2004

Aside from one dip in airfares in the year 1998, it can be observed that Intra-Caricom airfares have experienced a lower rate of decline than Europe- and NA-Caricom markets. Although the route groups are not exactly comparable, given that the air policy and ICAO real yield samples featured different yet overlapping markets, it gives an insight into the suppressed effects of more restricted markets especially in the global context of sharply declining yields during the same observation period. In fact, from 2002 to 2004 average real yields on Intra-Caricom routes actually increased and this trend showed no signs of reversal. Average yield decreases also stagnated on

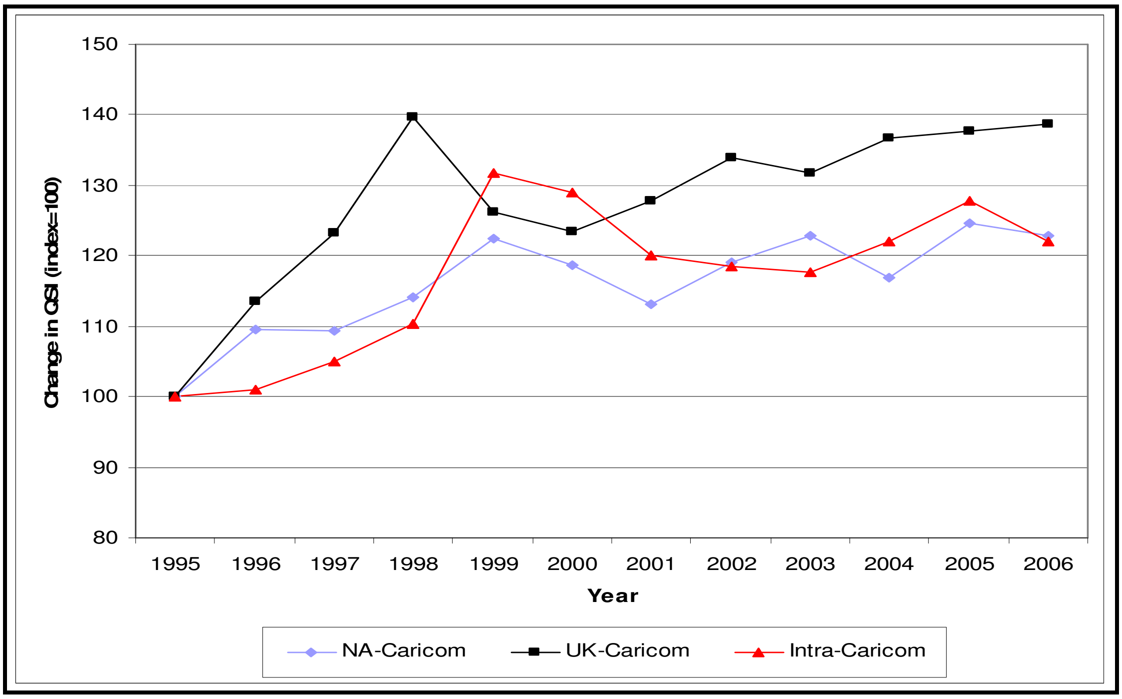
NA- and Europe-Caricom markets as producers started to cut back capacity in the wake of September 11th. But as can be seen in Figure 5.7, this trend was already levelling off by the end of 2004 at the same time as Intra-Caricom yields were increasing by approximately 4.5%. Perhaps the local carrier inefficiencies revealed in the productivity analysis points towards higher unit costs on these markets, which were then passed on to the consumer in the form of fare hikes in the 2002 to 2004 period. It is also possible that the high incidence of restricted markets in this sample may have facilitated these local carrier inefficiencies and fare increases to a certain extent. Equally, the ratification of the Caricom MASA in 1998 by some of the southern and eastern Caribbean states may have been a contributory factor in the fare decreases experienced that year on the Intra-Caribbean route group.

The general volatility of change in the average yield data points to the presence of a number of disturbance factors, however. Despite the fact that six of the nine sampled NA-Caricom country pairs experienced an increase on the scale of air policy liberalisation, 2003 and 2004 were years in which real yields actually increased. Although some of the bilateral agreements were relatively liberal, network effects, overcapacity and financial problems led to restructuring by US carriers and some notable bankruptcies. This would have clearly affected fare levels even when the liberalisation scale did not remain constant. That is, external effects beyond the direct control of Caricom markets may have overwhelmed the partial liberalisation effects during this period.

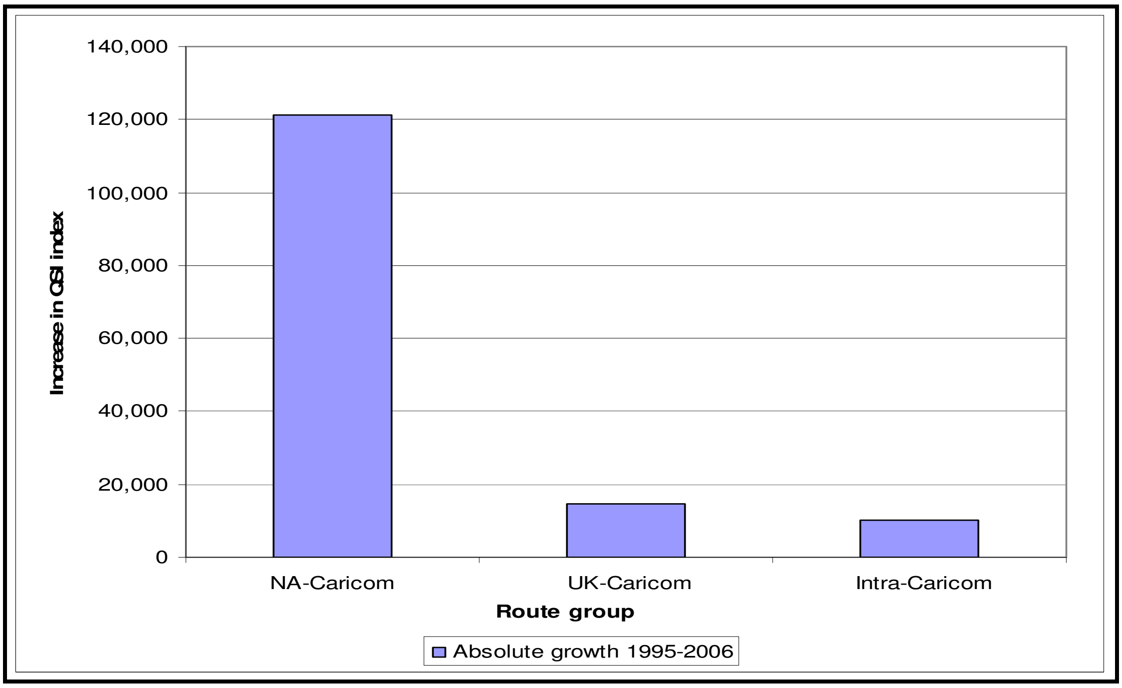
5.3.2.4. Service levels and capacity offered

Time-series results relating to service levels are offered using the Quality of Service Index (QSI) for each of the sampled country-pairs, which incorporates a capacity component (change in the total number of seats offered), a connectivity component (number of stops) and an aircraft component as a proxy for on board service (equipment type). Once again each country-pair is assessed within its respective route group with the most liberal generally being the NA-Caricom market and the most restrictive being the Intra-Caricom market. Figure 5.8(a) reveals the average change in QSI for the three route groups between 1995 and 2006 while Figure 5.8(b) depicts the absolute change in the QSI Index over the twelve year period 1995-2006.

(a)



(b)



Source : OAG data

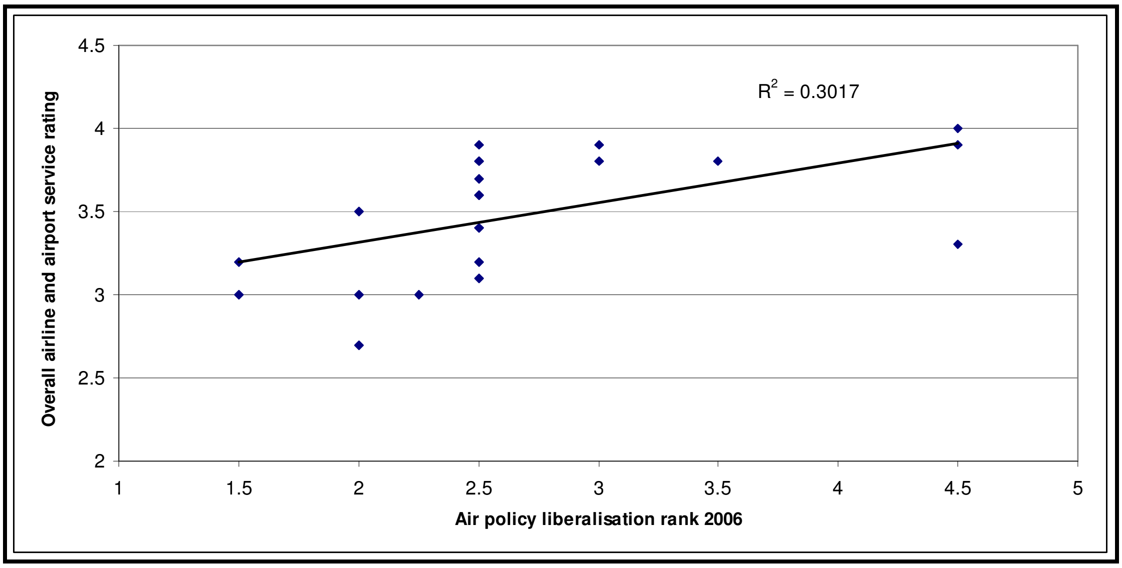
Fig. 5.8(a) and (b). Indexed and absolute change in QSI levels on NA- UK- and Intra-Caricom markets 1995-2006

Overall passenger service levels to, from and within the region have improved during the observed period. This applies at all levels of liberalisation. The route group that experienced the greatest percentage growth in the QSI index was the UK-Caricom sub-group, which despite being generally more restrictive than the NA-

Caricom route group, was able to benefit from a higher incidence of direct or one stop services on larger aircraft with the higher comfort levels associated with long haul travel. Also, the introduction of extra capacity from BMI, Virgin Atlantic, First Choice, Thomas Cook and Excel airways, effectively increased carrier choice, quantity of seats offered and the number of frequencies.

Smaller aircraft gauges combined with a higher level of stopping services may have served as a moderating force on NA- and Intra-Caricom routes, although it must be added that the vast difference in absolute service levels between the NA-Caricom route group and the remaining route-groups means that it is not possible to make direct percentage comparisons with any certainty. In 1995, average QSI on NA-Caricom markets were estimated to be 515,963 mainly due to the superior capacity and frequency levels as compared to UK-Caricom (35,350) and Intra-Caricom (48,044) markets. The contrasting starting point among route groups is not reflected in the Figure 5.8(a) comparative index, but if cumulative change is compared in absolute terms, it is clear that improvements have been most significant on NA-Caricom markets. With the introduction of Delta and US Airways services in 2004 to St. Lucia and Universal (2002) Delta (2006) and Continental (2003) services to Trinidad & Tobago, for example, the QSI index jumped 67% and 31% respectively on those two markets. A similar effect can be seen from the introduction of LCC services on US-Jamaica, Dominican Republic and Bahamas markets, although the high QSI starting point on these markets has led to lower levels of change in percentage terms. This is because incumbent carriers Air Jamaica and American Airlines on the US-Jamaica market, for example, already boasted a competitive service offering.

The second component of the service assessment relates to customer satisfaction levels revealed in the 2006 Caricom passenger survey. Figure 5.9 plots the correlation of the 2006 liberalisation rank on the x-axis against the average of overall airline and airport service rankings on the y-axis. It can be seen that there is a tentative positive statistical relationship between the ‘status quo’ of air policy liberalness and levels of customer satisfaction with both airlines and airports operating under the auspices of the respective air service agreements. Three main factors can be cited to explain the variation in results between the country-pairs in the sample. First, there is a high level of variation in satisfaction levels among moderately liberal country-pairs. Of the country-pairs with a 2006 liberalisation rank of 2.5, an upper and lower satisfaction limit of 3.1 and 3.9 were recorded respectively. Upon further analysis it appears that leisure intensive UK-markets with a moderate liberalisation rank recorded greater average satisfaction levels than for the equivalent policy status on Intra-Caricom markets. Higher service levels provided by UK carriers may have contributed to this variation. Secondly, the St. Lucia-Barbados market is effectively an outlier with a 2006 policy ranking of 4.5 and satisfaction levels of only 3.3. As reform on this market occurred in 2006, perhaps travellers were yet to benefit from the expected improvement in service levels associated with reformed markets. If this pair is removed from the sample, the R^2 coefficient increases to 0.47. Third, the passenger survey was not repeated across multiple time periods for any member state in the sample. Thus, the all important time-series effects of liberalisation on service levels were not captured by the analysis. Finally, passenger ratings were based on comparisons between expected service levels and the actual level of service received. If a market has enjoyed a high level of service over an extended period of time, traveller expectations may increase for a given airfare or consumer surplus. A simple Likert scale ranking could not pick up these between country differences in traveller expectation levels.



Notes: The air policy indicator uses an ordinal scale with 0 representing the most restrictive ASA and 5 the most facilitating ASA. Customer satisfaction was also based on an ordinal ranking, with 1 indicating a very poor average of overall airline and airport service levels and 5 representing an excellent rating

Fig. 5.9 Correlation between level of liberalisation and air passenger satisfaction

5.4. Regression analysis results

Based on the model selection and validation work, this section presents the results of the most appropriate or best-fit regression model generated to predict and explain Caricom country-pair traffic variability for the period 1995-2006. In lieu of the final adjustments made to the UK-Caricom estimation, an updated summary of the chosen validation tests are also provided along with a discussion of the reliability, sign and relative magnitude of each of the model's IV coefficient estimates. Note that the following final equations also present partial F and P statistics, standard errors, as well as the T statistics already revealed previously in Table 4.7 to enable a fuller evaluation of the statistical significance and reliability of each explanatory variable.

Model I: Regression coefficient estimates for NA-Caricom markets 1995-2006

$$\text{Traffic volume NA-Caricom}_{it} = ά_i + 76.305(CPGDP_{it}) + 4071.95(GRCST_{it}) + 182801.56(NOCOMP_{it}) + 249637.12(LIBRANK_{it}) + \varepsilon_{it}$$

i = individual country-pair

t = observation time period (annual)

ε = error term

$ά_i$ = overall intercept and fixed-effect country-pair dummy variable intercept

IV/fixed-effect intercepts	*T-value*	*F-value*	*P-value*	*StanErr*
Overall intercept (+Canada-Barbados)	-4.78*	290.07	0.001	270,631
CPGDP	4.47*	19.95	0.001	17
GRCST	2.00**	3.99	0.049	2,039
NOCOMP	2.38**	5.68	0.019	76,690
LIBRANK	5.85*	34.17	0.001	42,704
US-Bahamas	8.17*	-	0.001	145,569
US-Jamaica	22.86*	-	0.001	114,233
US-Dominican Republic	13.70*	-	0.001	139,662
US-Barbados	-2.80*	-	0.006	120,650
US-Dominica	-2.25**	-	0.027	170,026
US-Guyana	-0.86ns	-	0.390	191,914
US-St. Lucia	-2.23**	-	0.028	167,396
US-Trinidad & Tobago	1.28ns	-	0.205	188,545

R^2	= 0.98
R^2 adj.	= 0.98
Overall F	= 322.21
Durbin-Watson panel test	= 1.01
Restest: Outliers	= 3/108 +/-2.00 standard deviations (2.8%)
Restest: Heteroscedasticity	= Constant increases and decreases within two clusters
Restest: Normality	= Peaked kurtosis due to high number of small residuals
Restest: Linearity	= No non-linear correlations
Average VIF (multicollinearity)	= 1.329

* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level
ns Not significant

Overall, results are largely consistent with what one would expect to observe in the three subsample models. Within all three, combined real GDP had a powerful, positive and highly significant effect on traffic levels. That is, if all other determinants remain constant a US$1 billion increase in real GDP levels results in an estimated traffic increase of 76, 73 and 3,981 passengers on NA-, UK- and Intra-Caricom markets respectively. The discrepancy between Intra- and NA/UK-Caricom markets in terms of magnitude stems from the fact that in percentage terms a billion dollar change in combined GDP levels represents a jump of up to 50% on some Intra-Caricom markets, whilst on NA/UK-Caricom markets the same increase in absolute terms only represents a marginal increase in percentage terms due to the large relative national output levels of the US and UK in comparison to Caricom states. What is clear, however, is that, as expected, air traffic has been quite responsive to changes in combined GDP levels over the observed period, perhaps slightly less so on some of the maturing US/UK-Caricom markets, where income growth does not result in as much traffic growth as it previously did when markets were in their exponential growth stages.

Using a common bundle of average daily tourism costs, it has come as no surprise that on the more leisure intensive UK and NA-Caricom markets, traffic responded strongly and significantly to a US$1 dollar change in ground costs. With the highest ratio of holidaymakers, the UK-Caricom model revealed an estimated traffic decrease of 3,093 passengers for every US$1 dollar increase in average hotel, restaurant and excursion costs (etc.). This estimate is highly significant at the 1% level as expected.

An inverse relationship was revealed in the NA-Caricom estimation. For the same dollar increase in ground costs, traffic is said to increase by 4,072 passengers with a moderate statistical performance at the 5% level. Although well within the critical value offered for IV elimination, of the four final IVs used in the NA-Caricom sub-sample, the IV ground cost cross-correlated most with the other IVs in the sample, although it is unlikely that this had a negative effect on the reliability of this partial estimate. A more likely explanation can be offered by looking at a combination of factors. First, the Caricom countries featured in the NA-Caricom sub-group are imperfect substitutes as tourist destinations with the Dominican Republic, for example, appealing to the more traditional mass market holiday maker while St. Lucia prides itself on offering a more exclusive type of holiday with typically higher prices as a result[70]. Second, travellers base their pricing decisions not only on their hotel and other ground costs but also on the price of flights (i.e. total trip costs). Incorporating a hedonic price adjustment before statistical testing may have accounted for imperfect substitutes in relation to the quality of tourism product being offered but not for total trip costs (refer to section 4.4.4.4. for more detail).

Although discarded for the final specification, average yield data for the same NA-Caricom country-pairs show the most significant decreases over the observation period of any of the three subgroups. This may have given travellers more price flexibility when it came to organising other travel arrangements, especially if this meant that total trip costs either decreased or remained constant.

Despite the ambiguity of the ground cost variable's signs, its good statistical performance along with its high magnitude in influencing traffic levels justified its inclusion in the NA-Caricom sub-model. With O-D leisure travel making up only a small minority of travellers on Intra-Caricom country-pairs, the IV ground cost was not included in the final specification for this subsample. The stepwise approach to IV elimination also confirmed this hypothesis with Intra-Caricom ground cost variation making an insignificant and small impact on traffic volumes.

Model II: Regression coefficient estimates for UK-Caricom markets 1995-2006

$$\text{Traffic volume UK-Caricom}_{it} = \acute{\alpha}_i + 72.999(CPGDP_{it}) - 3092.622(GRCST_{it}) + 3.498(QSI_{it}) + 22208.473(LIBRANK_{it}) + \varepsilon_{it}$$

i = individual country-pair

t = observation time period (annual)

ε = error term

$\acute{\alpha}_i$ = overall intercept and fixed-effect country-pair dummy variable intercept

IV/fixed-effect intercepts	*T-value*	*F-value*	*P-value*	*StanErr*
Overall intercept (+UK-Trinidad & Tobago)	0.63ns	13.60	0.532	53,792
CPGDP	2.74*	7.51	0.008	26
GRCST	-5.53*	30.64	0.001	559
QSI	4.74*	22.44	0.001	0.74
LIBRANK	2.02**	4.25	0.085	11,843

70 As revealed in the St. Lucia passenger survey, St. Lucia is becoming a popular destination for weddings, for example. This type of vacation as a one-off cost can be considered as a high value service where increases in average ground costs may actually attract further incoming tourists.

UK-Bahamas	1.69***	-	0.097	45,111
UK-Barbados	5.29*	-	0.001	64,349
UK-St. Lucia	2.73*	-	0.009	42,619
UK-Jamaica	6.99*	-	0.001	29,092

R^2	= 0.96
R^2 adj.	= 0.96
Overall F	= 165.76
Durbin-Watson panel test	= 1.04
Restest: Outliers	= 3/60 +/-2.00 standard deviations (5%)
Restest: Heteroscedasticity	= Constant variance of residuals against fitted Y values
Restest: Normality	= Slight negative skewness
Restest: Linearity	= No non-linear correlations
Average VIF (multicollinearity)	= 1.681

* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level
ns Not significant

As an inexact and indirect supply variable, it was necessary to support the liberalisation rank IV with at least one other endogenous supply variable affecting the observed changes to traffic levels between 1995 and 2006. Of the three main supply side variables for which time-series data was collected, one has been included in each of the three submodels using the backward stepwise approach to IV elimination. Model instability was observed in specifications with more that one cross-correlating supply factor. Thus, although each one has a theoretical relationship with air traffic in its own right, the explanatory power of the variate was not compromised by the omission of two of the three supply variables in each subgroup. Indeed, the elimination of these IVs tended to increase the statistical performance of the equations.

As described in the time-series analysis, there are sometimes a number of real or perceived barriers preventing further competition in moderately to highly liberalised markets. This justified the inclusion of a competition variable in the NA-Caricom subgroup alongside the liberalisation variable in order to isolate any exogenous barriers from those associated purely with air policy reform. Predatory behaviour as seen on the US-Bahamas market or the presence of natural monopoly markets like US-Dominica causes a decoupling of change to liberalisation and competition levels and has contributed to the modest but positive beta value of 0.49 between these two IVs on NA-Caricom country-pairs (see Table 4.5, Chapter 4).

Traffic volumes reportedly increase 182,802 passengers for every extra effective competitor entering a market (see Model I). The strength, positive sign and significance (at the 5% level) of this relationship conforms to economic theory. The air traffic response to changes in competition as reported here may seem on the elastic side, but this can be explained by the functional form of the competition indicator used. Carrier entry resulting in a small market share does not equal one extra competitor on the inverse HHI index. As unequal market shares have been typically observed on the case-study markets, more actual entry is typically needed to increase the index by one unit to compensate for this imbalance.

As expected, increases in Quality of Service (QSI) has a positive and significant (at the 1% level) effect on UK-Caricom traffic levels. As the computed QSI index increases by one unit, traffic is estimated to increase by 3.5 passengers. The index's calculation is multiplicative so a one unit increase in aircraft gauge, for example, leads to a much higher increase in the overall QSI. As a result, even modest improvement in frequencies, the number of stops, or the type of aircraft can lead to quite significant increases in passenger numbers as was evident on the sample's UK-Caricom markets.

The average yield variable is not quite significant at the 5% level in the Intra-Caricom subgroup. Its coefficient, however, does reveal the likely sign and a plausible magnitude, in accordance with economic theory. For every US cent increase in yield air traffic is estimated to decrease by 1,148 passengers, which is a possible outcome if average yield is converted into an average airfare. For example, a one cent increase in yield roughly converts into an average fare increase of US$12.41 on the Trinidad-Jamaica market and in some periods, when real yield was decreasing in UK- and NA-Caricom markets, it was increasing by as much as US50 cents on average on some Intra-Caricom markets (e.g. Barbados-St. Lucia in 2006). This partial effect has to be taken, of course, within its context of variation to the other explanatory variables in the final specification in order to determine the overall DV traffic volume response. The removal of average yield in Model II, the UK-Caricom specification led to a reduction in cross-correlations, more realistic partial real GDP effects and minor adjustments to the overall statistical performance of the variate (compare Model II above with Table 4.7 in chapter 4).

Model III: Regression coefficient estimates for Intra-Caricom markets 1995-2006

$$\text{Traffic volume Intra-Caricom}_{it} = ά_i + 3980.71(\text{CPGDP}_{it}) – 2.42(\text{DIFFINC}_{it}) – 1148.62(\text{AVYLD}_{it}) + 7734.75(\text{LIBRANK}_{it}) + \varepsilon_{it}$$

i = individual country-pair

t = observation time period (annual)

ε = error term

$ά_i$ = overall intercept and fixed-effect country-pair dummy variable intercept

IV/fixed-effect intercepts	*T-value*	*F-value*	*P-value*	*StanErr*
Overall intercept (+Suriname-Trinidad & Tobago)	-1.41ns	264.11	0.162	9,061
CPGDP	10.49*	110.13	0.001	379
DIFFINC	-6.76*	45.64	0.001	0.36
AVYLD	-1.90***	3.62	0.060	604
LIBRANK	4.05*	16.44	0.001	1,908
Bahamas-Barbados	4.94*	-	0.001	5,516
Bahamas-Jamaica	9.95*	-	0.001	3,730
Barbados-Guyana	16.03*	-	0.001	3,310
Barbados-Jamaica	8.39*	-	0.001	2,545
Barbados-St. Lucia	19.89*	-	0.001	2,823
Barbados- Trinidad & Tobago	29.69*	-	0.001	2,731
Dominica- Trinidad & Tobago	-2.74*	-	0.007	2,770
Guyana- Trinidad & Tobago	23.49*	-	0.001	2,421
Jamaica-Trinidad & Tobago	0.64ns	-	0.524	3,456

R^2	= 0.97
R^2 adj.	= 0.97
Overall F	= 262.99
Durbin-Watson panel test	= 1.09
Restest: Outliers	= 10/120 +/-2.00 standard deviations (8.3%)
Restest: Heteroscedasticity	= Constant increases and decreases but with more low fitted values of Y
Restest: Normality	= Slight peaked kurtosis
Restest: Linearity	= Some country-pairs within overall sample may show non-linear tendencies
Average VIF (multicollinearity)	= 1.017

* Significant at the 1% level
** Significant at the 5% level
*** Significant at the 10% level
ns Not significant

Moving on to the variable of primary interest, by and large the three subgroup coefficients do not contradict the case-history findings. As predicted, the highest and most significant impact is reported for the NA-Caricom country-pairs. In absolute terms, the effect of a one unit increase in the liberalisation rank was to increase traffic levels by an estimated 249,637 passengers, compared to 22,208 passengers on UK-Caricom markets and 7,735 passengers on Intra-Caricom markets. The difference in magnitude is not so pronounced if thought of in percentage growth terms, but still conforms to the idea that greater observed levels of reform and higher pre- and post-liberalisation 'status quo' differentials would lead to a more accentuated effect on traffic volumes. As the effect of air policy reform on traffic levels was found not to be static, the fact that three of the six NA-Caricom country-pairs experienced policy reform before the year 2001, allowed more of the effect of a change in liberalisation to be captured by the data in the sample. On those markets where change occurred in 2005 or 2006, as was the case on the UK-Barbados market, for example, the full effect of this change could not be captured by the observed time-period. This could have had a moderating effect on the revealed UK-Caricom LIBRANK coefficient.

Evidence of reform on Intra-Caricom markets was sparse, although in 1999 marginal gains were made after the introduction of the Caricom MASA on three of the sampled country-pairs, and further bilateral reform on the Barbados-St. Lucia market was also recorded in 2006. The overall pre-liberalisation status on these markets was either restricted or moderate, suggesting that the latent gains to be made from reform may have outweighed the fact that on the remaining seven country-pairs no air policy gains were recorded during the observed period. Clearly, if each country-pair assumed a separate single equation, the relative effect of liberalisation on the observed change in traffic levels would have been zero. As it stands, however, the simultaneous fixed-effect regression resulted in a dampened liberalisation effect due to inclusion of the seven 'zero-effect' country-pairs in the Intra-Caricom sample. Given that between 2000 and 2003, for example, Intra-Caricom air movements increased from 454,000 to 629,000 (World Bank Study 2006) without the assistance, in many cases, of a liberal air transport framework, it is considered reasonable to have a conservative approximation of the impact reform can have on markets that are often thin and suited to natural monopoly/duopoly market structures.

While there were marked differences between the reported coefficients, it is important to note for the following macroeconomic analysis, that the positive signs and reliable statistical performance of the coefficients indicate that, *ceteris paribus*, it is unlikely that reform would result in any net losses to the number of visitors and consequently to the amount of visitor expenditure entering the region.

One of the additional benefits of the LIBRANK variable is that it takes into account the before liberalisation policy status of each of the sampled country-pairs along with changes to all the other independent variables during the same pre-liberalisation periods. The natural consequence of this is that the additional traffic volume estimates resulting from any counterfactual air policy alterations can be thought of as additional volumes net of those that would have occurred if the LIBRANK value had not been altered. Unlike the Booz Allen Hamilton (2007) study, this meant that it was not necessary to apply Airbus'/Boeing's or any other global air transport institution's future traffic estimates as a basecase (assuming no further air policy reform). In fact, basecase traffic growth in the 'status quo' scenario is inherently available within the study's sample reducing the uncertainty involved in the practise of extrapolation and the loaning of data from industry sources.

The liberalisation and other IV coefficients for the three subsamples can be applied to any of the country-pairs that make up each subsample. More precisely, each model is attempting to account for three (3) dimensions of effect; the dynamic time-series effects of IV changes within each country-pair, the cross-sectional effect of different IV values across country-pairs, and an unobserved, out-of-sample between country-pair effect which either moderates or drives traffic growth in different markets. It is this final effect which allows for the inclusion of the same simultaneously estimated IV coefficients for any individual country-pair in the sample. The unique dummy variable coefficient for each country-pair represents a best-fit alteration of the overall intercept value (also the omitted country-pair dummy estimate), which in turn permits a direct application of the time-series, cross-sectional IV effects into a unique set of country-pair equations with their only difference being the dummy variable coefficient value, which replaces the overall intercept value to capture the unobserved country-pair effects. The application of these best-fit intercept values generally result in reliable traffic estimates although in some cases the differences in absolute market sizes have resulted in exaggerated estimates for the smaller country-pairs in the samples. The LSDV process automatically finds a dummy variable coefficient for each country-pair that minimises this disturbance term. Of the 24 country-pairs in the sample, only 4 were insignificant at the 10% level and 6 at the 5% level. Therefore approximately 25% of the fixed-effect coefficients should be applied into the counterfactual analysis and interpreted with caution.

5.5. CHAPTER SUMMARY

It was found both in the descriptive and causal analyses that further liberalisation stimulated air traffic to varying degrees of intensity between the years of 1995-2006. 13 of the 24 sampled country-pairs maintained air policy 'status quo' during the observation period. These pairs acted as a within sample control group, which, when estimated simultaneously with the remaining 11 reformed country-pairs, still yielded positive and statistically significant liberalisation impact estimates. These estimates could then be inputted into the counterfactual analysis (Chapter 6) to obtain approximations of possible bilateral and multilateral gains if reform was to occur on the 13 currently restricted country-pairs. The prudence and reliability of this simultaneous approach is supported by the use of a set of country-pair fixed effect dummy variables. These produced unique intercept values for each market, thereby controlling for any unobserved socio-demographic and air network variations that would alter the partial traffic effects of the aggregate liberalisation estimates.

6.1. COUNTERFACTUAL SCENARIO ANALYSIS

6.1.1. Introduction

The validated, best-fit liberalisation coefficients from Chapter 5 now become the primary inputs for the predictive stage of the analysis. These estimated effects have been isolated from the other Caricom traffic effects to produce a set of traffic gain (loss) approximations that can be directly attributable to air policy developments.

Incorporating the estimated GDP and employment basecase effects from the socio-economic impact study along with the regression databank of historical country-pair socio-economic and air network developments, the counterfactual effect of reform can be assessed in terms of its internal (producer and consumer) and external (GDP and wider employment contribution) impact on the economy. These gain estimates can then be aggregated and added to the regional basecase to yield a regional or segmented measurement either into route groups (North America-, UK- and Intra-Caricom) or into individual country-pairs. The following flow chart (Figure 6.1) will help to clarify the process involved in estimating open market volume effects on consumer/producer surplus, GDP, employment and business investment/ productivity.

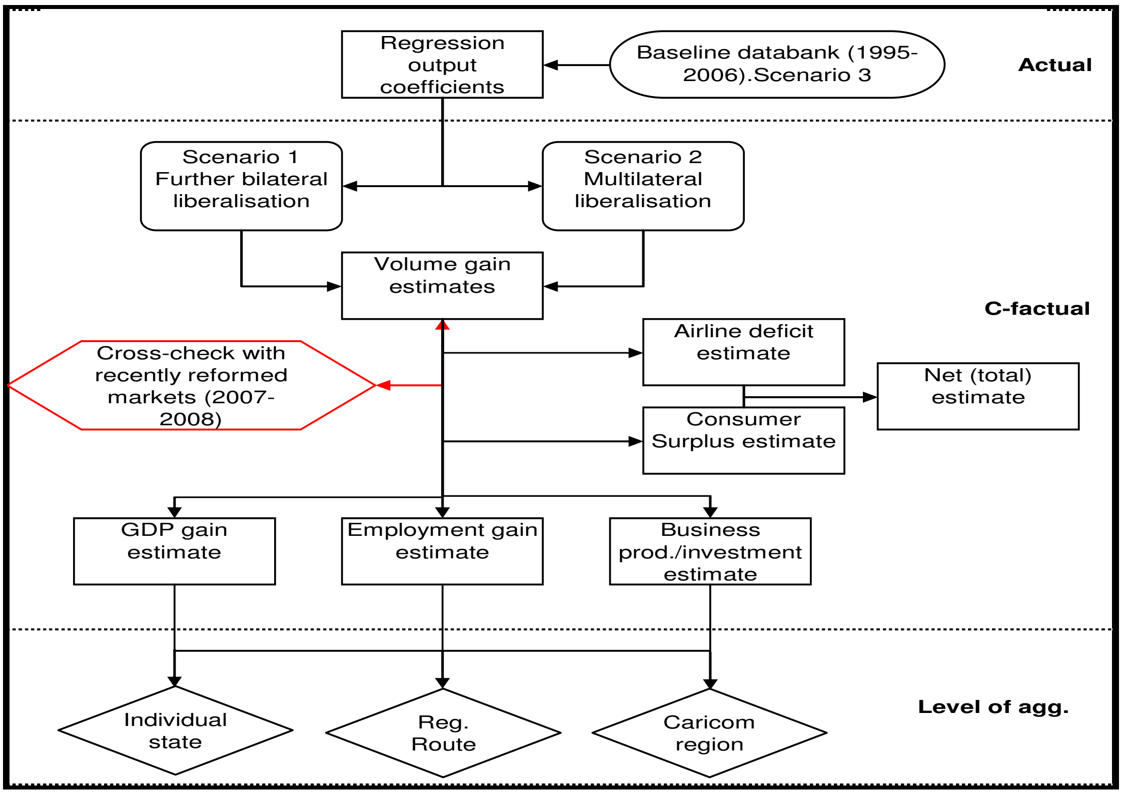


Fig. 6.1 Scenario analysis flow chart

Each of the gain estimates will be computed for two principal scenarios which will then be compared to the basecase scenario (i.e. no change from the actual observed data). These are:

Scenario 1: Further bilateral reform (using fixed-effect intercept values)
Scenario 2: Multilateral reform + unanimous ratification (using simultaneous effects)
Scenario 3: Basecase impact (using base datasets)

In Scenario 1, individual pair estimates can be aggregated to work out total Caricom effects. In Scenario 2, the three regional route group estimates can also be aggregated to yield Caricom estimates and disaggregated to approximate individual member state effects using averaging methods.

Up to the time of writing three of the sampled country-pairs made concerted efforts towards the opening up their air transport markets in the non-observed time periods of 2007 and 2008. This provided a good opportunity to cross-check the volume gain estimates produced by the regression analysis with real volume gains or losses which may have been linked to Caricom air policy reform. This cross-checking process can be represented graphically and results tested statistically using an appropriate hypothesis test. In the absence of a post-trial data set encompassing other determinants of air traffic, any variance evident between the predicted and actual changes to traffic will be accounted for inferentially.

6.1.2. Research plan - Volume analysis

Given the partial, step-by-step approach that has generally been taken towards air policy liberalisation, further bilateral reform is assumed to change by only one unit to begin with on each of the sampled country-pairs. On pairs where reform already took place during the observed period, the pre-reform liberalisation rank is taken as the assumed ‘status quo’ and calibrated accordingly using this pre-liberalisation value. This scenario can be considered conservative but in keeping with the real life options available to policy makers in the region. Equally, in the multilateral reform scenario, it is assumed that for unanimous ratification to take place among member states, the counterfactual ranking has to be as, or more liberal than the most relaxed bilateral/multilateral agreement currently in force today. Thus, the multilateral ranking was adjusted to 5, the maximum or most facilitating air policy status, to ensure

Bahamian and Jamaica participation during US-Caricom policy negotiations, for example.

Each total gain estimate, whether through further bilateral or multilateral liberalisation, had to be calibrated in order to arrive at an annual estimate. If, for example, a unit increase in air policy liberalness was observed in 1999 and there were no further changes on that market during the observation period, the total gain had to be allocated either uniformly or by some other method, to the remaining years of air policy 'status quo' (2000-2006). Although the effects of liberalisation can vary across time periods and markets, the direction and total magnitude of impact is the issue of critical importance for this study. Thus, it is arbitrarily assumed that total liberalisation effects are distributed evenly across subsequent years, although in reality there would typically be a significant variation around this mean estimate reflecting any homogenous time-lags or disturbance factors specific to each market, as well the actual time period in which the air policy change took place.

As the base year for the macroeconomic impact assessment, all 2006 original traffic observations were also taken as the baseline traffic volumes. Apportioned average gain estimates representing only one year were then inputted and the estimated change in volumes was revealed for each individual country-pair. On 'status quo' country-pairs this volume differential represented a gain in the counterfactual scenario, and on reformed markets it represented a traffic loss prediction. In the multilateral scenario, NA-, UK- and Intra-Caricom market basecase traffic volumes were totalled, averaged and then added to the average gain estimates resulting from simultaneous reform across all markets to reveal adjusted traffic volumes. Each respective sub-group could also be disaggregated to estimate how simultaneous reform would affect each country-pair individually. This could then be compared to the bilateral approach to reform. As the simultaneous approach requires a greater level of liberalisation, however, it is expected that the multilateral case would produce more immediate benefits than the step-by-step approach stipulated in the bilateral scenario.

It is important to note that adjusted traffic estimates in scenario 1 and 2 do not represent accurate forecasts of traffic growth in time periods after 2006, but rather an isolated estimate of the partial effect of liberalisation on that traffic growth. In many markets, gains associated with reform efforts would have to be added to gains (losses) owing to changes in other endogenous or exogenous drivers like GDP, levels of trade, tourism ground capacity improvements and so on.

6.1.3. Research plan – Consumer/Producer gain estimates

In general, the market's responsiveness to a change in airfare is dependent upon the level of necessity with which a particular journey or trip is made. For example, a traveller that has to make a journey at a certain time, on a certain date and on a certain city-pair is often forced to be unresponsive to a change in price, whereas an increased flexibility in a traveller's travel plans typically implies a much higher level of responsiveness to a change in airfare. The price/demand relationship is said to be an inverse one and is reflected by a downward sloping demand curve when quantity (Q) is plotted on the x-axis and price on the y-axis. Thus, as airfare increases, demand is said to decrease. If this occurs at a constant rate, the demand curve becomes a straight line and elasticity of demand takes on a negative unity value (-1.0). Non-constant demand responses can either be elastic (above -1.0) or inelastic (below -1.0). The basecase scenario for Caricom markets is considered to be a mean average of a range of market elasticities whose values are dependent on the market segmentation on every individual country-pair. In line with the general theory, it is assumed that extra volume induced surplus estimations using unity values will underestimate leisure/VFR intensive UK- and US/Canada-Caricom markets and overestimate some business intensive Intra-Caricom markets (Doganis 2003). Using market segmentation data from the Caricom passenger survey and E/D immigration cards, it is proposed that each market's surplus estimates should be derived using both the basecase elasticity along with high (-1.5) and low (-0.5) estimates in accordance with each market's segment breakdown.

When the demand curve is a straight line consumer surplus (CS) is the area of a triangle and given by:

$$CS = \frac{1}{2} Q_{mkt} (P_{\max} - P_{mkt}) \tag{6.1}$$

where P_{mkt} is the equilibrium price, Q_{mtk} is the total quantity purchased at the equilibrium price and P_{max} is the price at which the quantity purchased drops to 0.

Thus when price elasticity of demand is assumed to be -1.0, constant and small changes in supply can be converted into an estimate of change to consumer surplus by applying the rule of one half:

$$\nabla CS = \frac{1}{2}(Q_1 + Q_0)(P_0 - P_1) \tag{6.2}$$

Q_0 and Q_1 are the before and after quantities demanded after a change in supply, P_0 and P_1 are the prices before and after a change in supply.

In the case of a consumer surplus gain, the new estimate can be split into two segments; gains due to price decreases for existing customers and gains due to the creation of new traffic lying on areas of the demand curve that were previously priced out of the market. This second segment can be given by:

$$CS_{new} = \frac{1}{2}(Q_1 - Q_0)(P_0 - P_1) \tag{6.3}$$

To obtain an estimate of price reductions for existing customers, the partial gain due to the creation of new travellers needs to be subtracted from the total gain estimation given by equation 6.2.

In the non-constant response scenario, integral calculus can be used to obtain surplus estimates of the area to the left of a non-linear demand curve. Changes in supply with -0.5 and -1.5 elasticity values can result in a change in consumer surplus of the following function:

$$CS = \int_{Pmkt}^{P\max} D(P)dP \text{ where } D(P_{max}) = 0 \tag{6.4}$$

In order to approximate the reduction in price associated with the estimated traffic volume gains, a constant value *"k"* had to be determined, which is composed of the following form (Brattle report 2002):

$$k = \frac{Q(P)}{P^{-\varepsilon}} \tag{6.5}$$

where P is the price, Q is the quantity and ε is the elasticity of demand.

Once the value of k is known, the new estimated price (P_2) at the new quantity (Q_2) can be given by:

$$P_2(Q_2) = \frac{k}{Q_2} \tag{6.6}$$

P_2 then becomes P_1 in the constant elasticity estimation of consumer surplus (equation 6.2) and P in the non-constant elasticity equation for consumer surplus (equation 6.4), thereby yielding surplus estimates for a given reduction in price caused by a given increase in aggregate traffic volumes.

The predicted increases in traffic volumes along with the associated reductions in airfare will generally lead to a reduction in aggregate airline revenues. Depending on the country-pair in question, both local and foreign carriers are likely to have large sections of their producer surpluses recaptured by the consumer, despite the marginal gains made in terms of the creation of completely new passengers previously priced out of the market. This estimated loss in revenues needs to be balanced against a backdrop of improved cost efficiencies as more productive firms replace or incorporate the least efficient ones in a liberalised market for air transport[71]. Therefore, a net producer gain can only be secured if the estimated cost reductions outweigh the revenue reductions predicted within the consumer surplus section[72].

There are said to be two main areas of air policy that can have a significant direct impact on airline efficiency levels: 1. clauses relating to ownership and control rights and 2. those relating to the ability of carriers to compete freely in terms of tariffs, capacity, frequency and access rights. The relaxation of the former can lead to mergers, acquisitions and other forms of restructuring focused on cost synergies, whilst the latter usually results in the more efficient firms winning market share

[71] Reed (1999), for example, found that there was a 40% reduction in unit costs in the post-deregulation period in the United States between 1974 and 1994, largely owing to the adaptation of new airline structures, new pricing practises and better network configurations.

[72] It is assumed for the purposes of this study that the increased traffic densities and levels of airline competition associated with further air reform is passed on to the consumer in the form of lower airfares.

against the less efficient firms, thereby pressuring incumbent firms to drive costs down further.

For the sake of realism the Caricom multilateral agreement with a unique liberalisation rank of 5 is assumed to include the right of any community air carrier to acquire a controlling stake in the airlines of other community states. On the other hand, it is unlikely that a liberal multilateral agreement with the US, Canada and the UK would result in similar concessions being afforded in terms of ownership and control rights. Hence, cost reduction estimates are intuitively more conservative for liberal Extra-Caribbean country-pairs given that access to this type of efficiency gain is unlikely in the foreseeable future.

Due to the lack of airline cost data on a route level basis, it was not possible to estimate producer gains (losses) for any individual airline before/after the introduction of further liberalisation on different country-pair markets. System wide cost data were available, however, from individual air carriers along with ICAO financial data. Average unit cost figures from 1995-2006 were used as a basis from which to estimate gains. The two labour productivity measures used for the regression analysis were also considered to be reasonable indicators of time-series changes in firm efficiency levels before and after air reform. The advantage of this data is that it can be broken down by air carrier as well as route group and used to estimate counterfactual gains/reductions in unit labour costs as a representative of one of the main controllable costs for air carriers[73]. General economic theory stipulates that the relaxation of economic policy constraints lead to improvements in unit labour productivity due in part to the threat of entry, actual entry and an ability to freely optimise supply issues relating to capacity and frequency, bringing about improved aircraft utilisation, airport passenger costs per passenger kilometre (mile) produced and so forth (Doganis 2003).

In short, the inputs for the counterfactual producer estimates will firstly be the volume and airfare data from the consumer surplus section, secondly the airline labour productivity data obtained from ICAO and individual airline annual reports for the

[73] After interviews and discussions with industry experts, the Brattle Report (2002) concluded that the controllable costs are those which show the most variability between carriers, namely flight and cabin crew costs, passenger service costs, ticketing, sales and promotion costs and general/admin costs.

1995-2006 panel data sets, and thirdly system wide unit costs for the major players in each country-pair markets for the period 1995-2006. Again this data is sourced from IATA, ICAO and a number of local carrier annual reports. The output will be an estimate of the counterfactual producer gains (losses) above or below the 2006 base estimates. This evaluation process will be applied to the bilateral and multilateral scenarios for each level of aggregation and will involve the following steps:

1. System wide airline operating costs (unit costs) will be averaged for every country-pair and include both local and foreign carrier figures for the years 1995-2006 inclusive.
2. The two unit labour productivity measures for each carrier and each route group will be averaged for the years 1995-2006 inclusive.
3. Evidence of deregulation induced average cost reductions and improvements in productivity will be cross-checked with non-reformed market efficiency developments (i.e. by contrasting reformed market evidence of efficiency gains with evidence from a control group of 'status quo' markets).
4. A weighted[74] average efficiency differential between pre and post reform time periods will be reversed to arrive at a counterfactual estimate and inputted as the 2006 baseline efficiency gain (loss) estimate.
5. Finally, average producer efficiency gain (loss) estimates are solved against the percentage net revenue loss (gain) predictions from the consumer surplus analysis. If airline efficiency gain estimates outweigh predicted revenue losses, the producer is considered to make an overall gain. An overall loss is made if the situation is reversed.

The bilateral scenario incorporates individual country-pair efficiency estimates while the multilateral scenario represents a simple aggregation of the country-pairs that make up each route group. The Intra-Caricom multilateral efficiency scenario will be multiplied by a factor of 1.5, however, to take ownership and control and deep alliance synergy opportunities for local carriers into account.

[74] Network productivity and unit cost values are averaged over the sum of the airlines operating on each country-pair and each time-period. If a carrier entered or exited the market, the overall average was adjusted accordingly. Carrier values were then weighted by country-pair market share before a final yearly average was determined.

As mentioned above, the net ratio between consumer and producer gains can be obtained through a direct comparison of the percentage change in efficiency and consumer surplus above or below the 2006 baseline. The final output of this process will give an indication of whether the predicted traffic growth estimates in the suggested counterfactual scenarios will lead to an overall increase or decrease in welfare, and if so to what extent. If the balance between producer and consumer welfare is found to be relatively stable then the macroeconomic impact of increased traffic volumes can be considered to be sustainable. If, on the other hand, there is evidence that consumer surpluses arising from more competitive markets lead to an unstable supply of air services, then the estimated change in macroeconomic impact may be unsustainable. A summary of the procedure used for estimating these national level changes to employment, GDP and business productivity now follows.

6.1.4. Research plan – Macroeconomic benefits

Using 2006 as a baseline it is possible to make a proportional estimate of additional GDP and employment across the selected Caricom member states. If x amount of traffic volume produced y amount of FTE jobs and z \$US dollars of expenditure, then it can be assumed that a change in x would produce a proportional change in y and z. This method is more tenuous when forecasting into the future, but the counterfactual approach adopted in this study automatically controls for the other selected influences both on air traffic volumes and its corresponding macroeconomic impact. For triangulation purposes, the baseline proportions are contrasted with those offered by other studies. Two alternative multipliers are also offered to include and exclude catalytic impacts from the estimation.

Although it is tempting to concentrate fully on the tangible impacts of the air transport sector, it is also useful to predict the impact of lower fares and higher consumer surpluses on business mobility and investment using the comments made by high level Managers from a range of sectors in the Caricom region captured in the Caricom business survey. The percentage of respondents citing high transport costs or high fares as one of the main hindrance factors preventing productivity gains from cross-border investment is combined with the 2006 business passenger fare data captured in the Caricom passenger survey to arrive at the baseline 'status quo' situation. A baseline airfare to transport cost complaint ratio is then computed and recalculated using the new scenario 1 and scenario 2 average fare estimates as inputs for a revised estimate of cross-border investment activity. This is compared to the baseline level of investment to reveal the additional investment that would take place in the presence of lower average fares. This analysis can also be segmented in order to give an indication of the sectors which feel the pinch of inflated airfares most intensely, and equally the sectors that stand to gain the most from liberalisation will be pointed out. As the consumer surplus estimates were compiled from the regression models' volume gain estimates, it is possible to trace back the effect of a unit change in bilateral or multilateral liberalisation on baseline investment levels in the business community.

A reminder must be made about the nature of the traffic data given the fact that it effects the distribution of gains among the sampled member states. The extra volume can be either direct Origin-Destination passengers or in-transit passengers with a different final destination. The former is counted twice, once as a disembarking passenger and once as an embarking passenger; the latter is counted once as an in-transit passenger only. Passengers making connections on to medium/long haul flights with a stop-over are included as two separate trips, one Intra-Caricom, and one UK-, NA-Caricom. In-transit passengers were included in the Caribbean Tourism Organisation data only as true Origin-Destination and hence double counting was avoided. A separate entry was found for the majority of regional airport passenger spreadsheets and subsequently only stop-over passengers were included as separate journeys. Passengers from North America or Europe with multiple Caricom destinations by air were each counted as separate long-haul Origin-Destination trips with a passenger's place of residence being picked up by the Caricom passenger survey, the Caribbean Tourism Organisation tourism reports and by the respective airport E/D cards. Thus, it is assumed that the volume gain estimates are largely reflective of the distribution of additional output gains among the sampled countries[75].

[75] Although extra multi-destination passengers caused by an improved Caricom multilateral agreement, for example, would be captured by the country-pair coefficients, a complete itinerary of each passenger's destinations and connections cannot be predicted by the model. This is due to the nature of the original US DOT, UK CAA, E/D card and CTO traffic data which treats every journey as an exclusive event (i.e. unrelated to any other O/D journey).

6.2. RESULTS AND DISCUSSION

6.2.1. Introduction

With a best-fit regression model explaining Caricom traffic volumes between 1995 and 2006, it is possible to counterfactually estimate and substantiate the possible effects of further bilateral (scenario 1) and multilateral (scenario 2) reform whilst holding all other predictors of air traffic constant. Due to recent efforts to introduce more liberal air policy on the Canada-Barbados market in 2008 and the UK-St. Lucia and UK-Trinidad & Tobago markets in 2007, the possible effects of bilateral liberalisation can be cross-checked against any early evidence of real volume gains as a result of actual reform taking place in the region. Until further reform occurs on these markets, however, it would be hard to draw any sound conclusions as to the accuracy of the model coefficients beyond what is revealed by the statistical indicators in the regression variates. In other words it will be difficult to determine the longevity of recent reform effects after only 1-2 years.

6.2.2. Traffic volumes

Figures 6.2 to 6.7 illustrate the Scenario 1 results for a selection of the 24 individual country-pairs (A complete set of time-series charts can be found in Appendix I) while Table 6.1 reveals the estimated effects of further multilateral reform for the 3 regional sub-groups under the assumption that these new integrated agreements take precedence over the preceding, more restrictive, bilateral agreements.

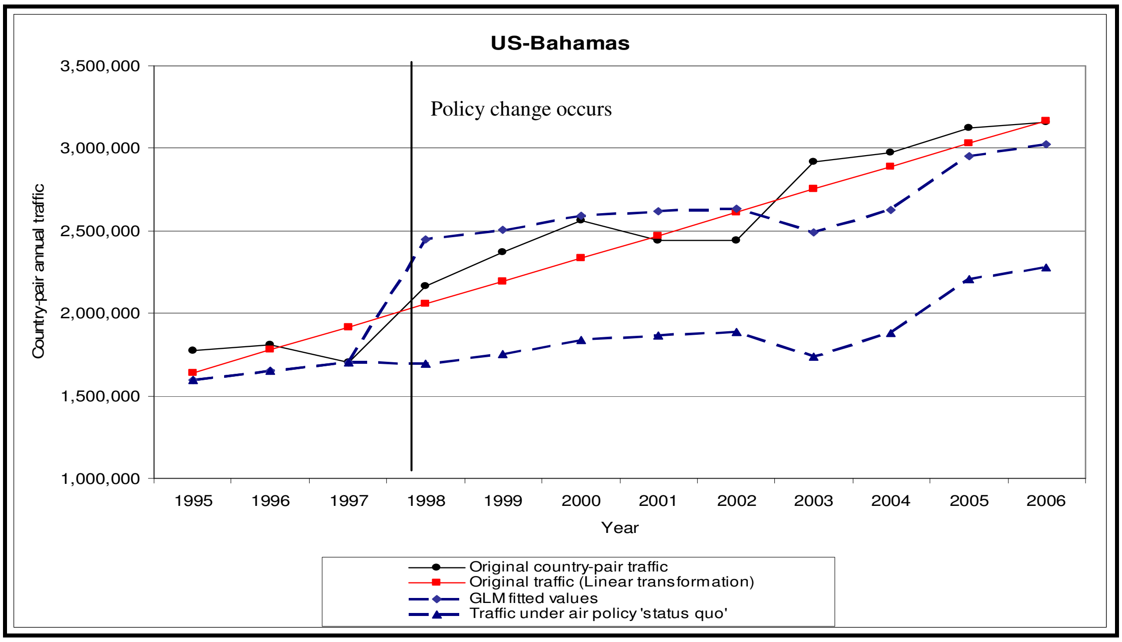


Fig. 6.2 Predicted 'status quo' against actual reform (3 unit change) – US-Bahamas

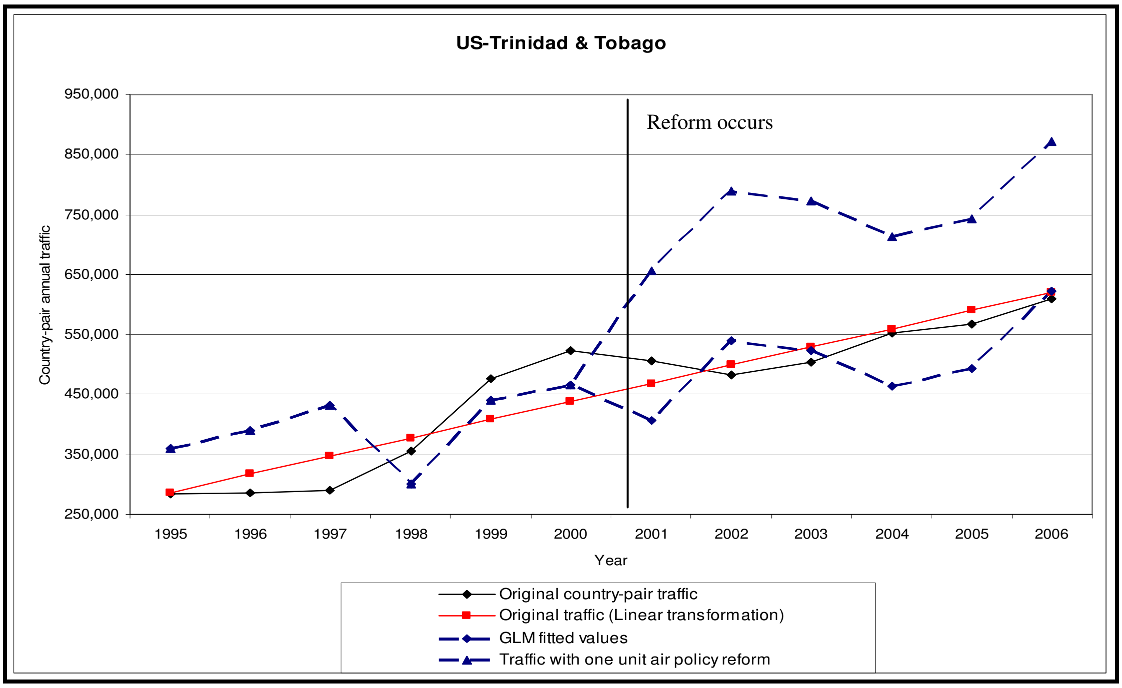


Fig. 6.3 Predicted reform (one unit change) against actual 'status quo' – US-T&T

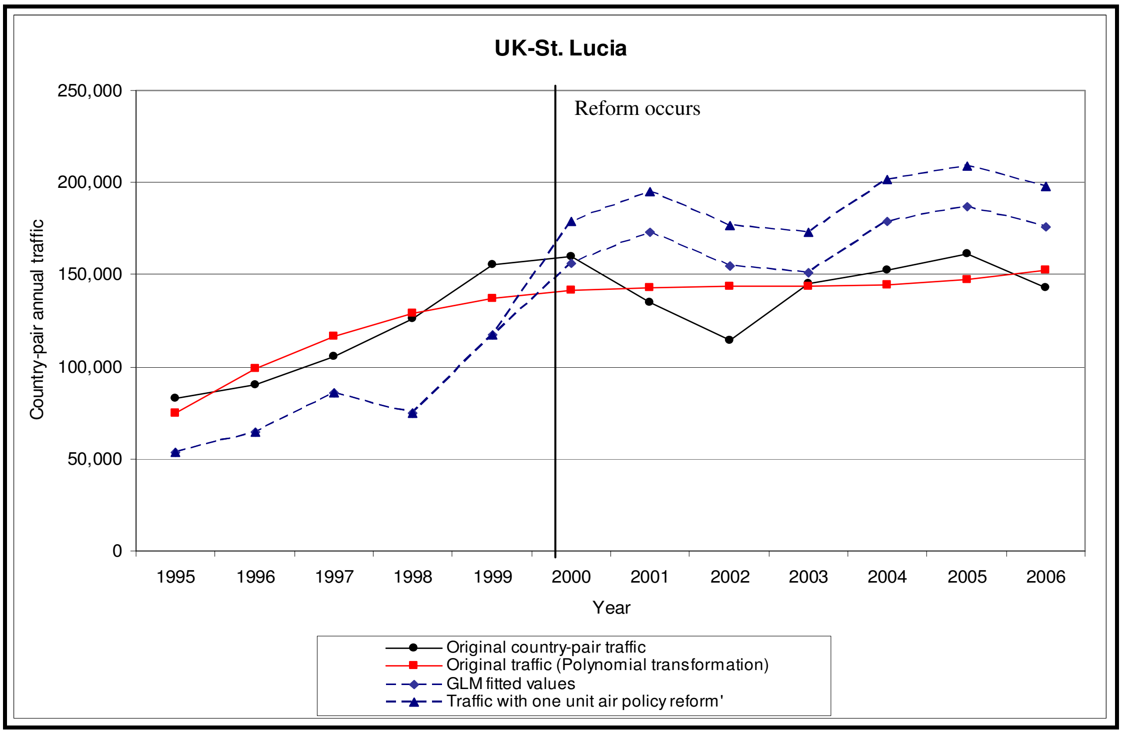


Fig 6.4 Predicted reform (one unit change) against actual 'status quo' – UK-St. Lucia

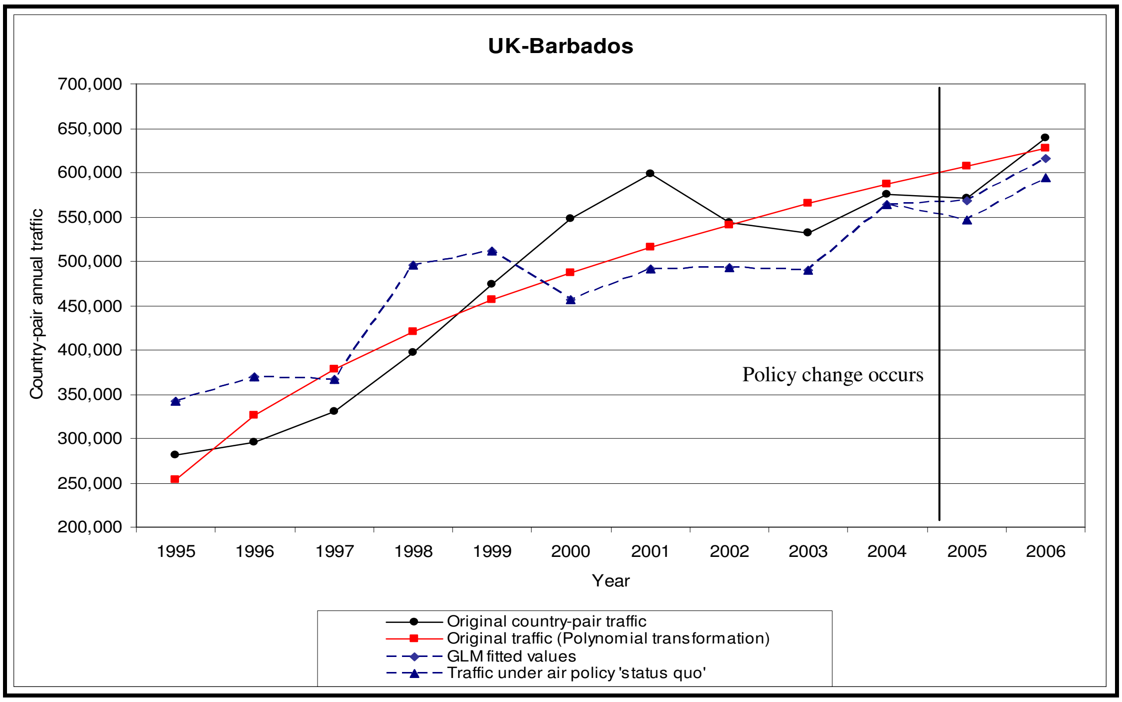


Fig. 6.5 Predicted 'status quo' against actual reform (one unit change) – UK-Barbados

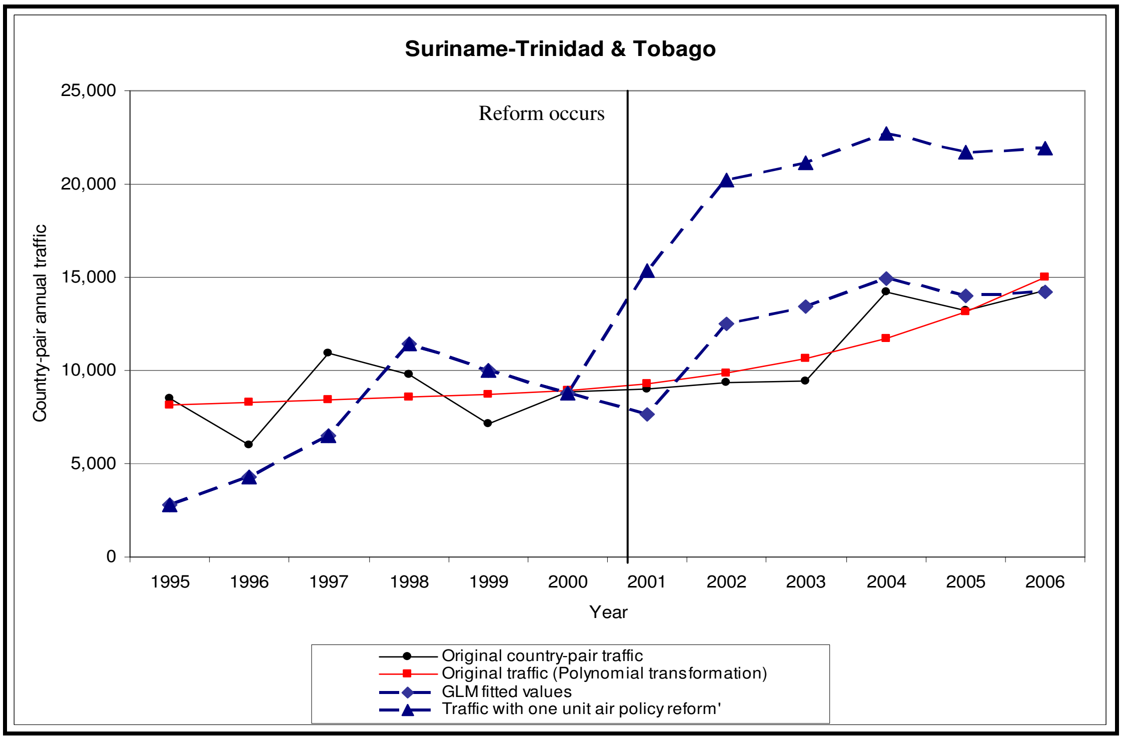


Fig. 6.6 Predicted reform (one unit change) against actual 'status quo' – Suriname-T&T

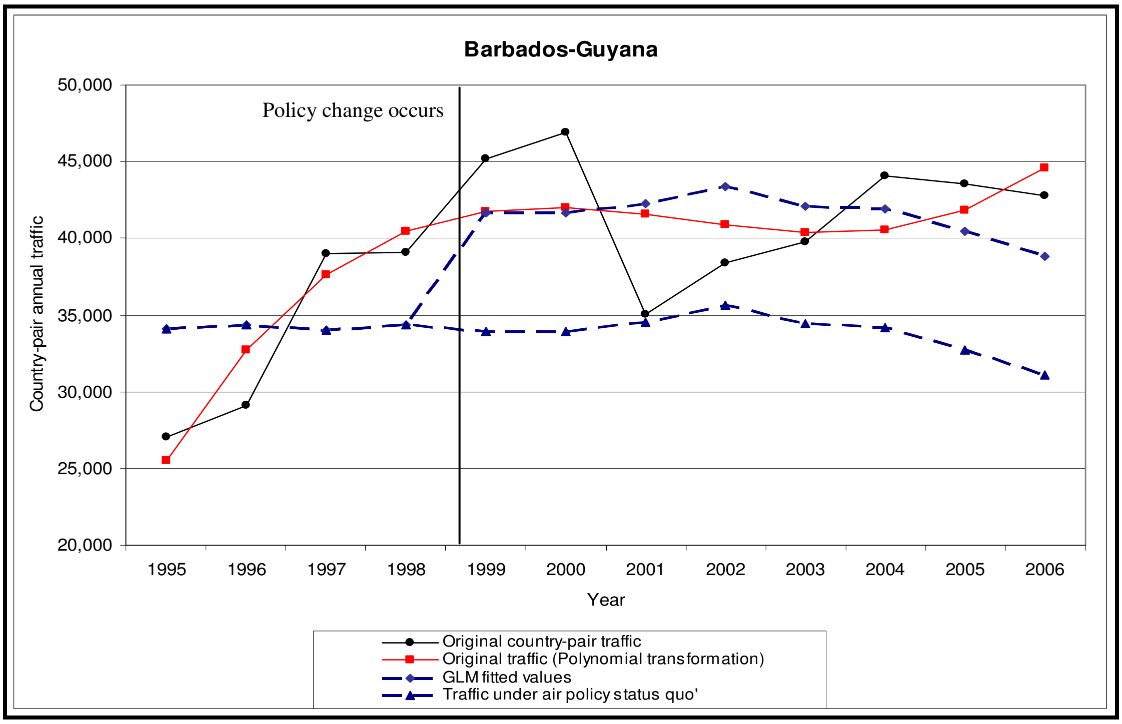


Fig. 6.7 Predicted 'status quo' against actual reform (one unit change) – Barbados-Guyana

Table 6.1
Possible effects of multilateral air reform for three Caricom region sub-groups

Route group	Summed traffic volumes (2006)	Average traffic volumes (2006)	Average reformed volume	% growth
NA-Caricom (n=9)	12,103,242	1,344,805	1,899,554	41.25
UK-Caricom (n=5)	1,453,407	290,681	335,098	15.28
Intra-Caricom (n=10)	417,202	41,720	63,184	51.45
Total Caricom (3 sub-groups)	13,973,851	1,677,206	2,297,836	37.00

Note: The number of possible Caricom country-pairs is much higher than the sample size offered. Of the selected seven representative states, however, approximately 91% of the total number of airport passengers is included in the selected country-pair data

For each of the three sub-groups, two liberalisation effect line charts are provided, one representing the counterfactual effect of no policy reform on markets that did experience some form of liberalisation during the observation period and the other representing the effect of a one unit increase in the unique liberalisation rank on markets where air policy controls were constant throughout the same period.

Each chart denotes four trends. The solid black line represents the 12 year development of original traffic flows, and the solid red line their suggested transformations. The dotted blue lines represent the regressions' predicted values with the triangle data points revealing the counterfactual effect of a policy adjustment on the fitted traffic values. As can be seen, a significant effect can be observed on US-Bahamas and –Trinidad & Tobago markets where the counterfactual bilateral scenarios have caused a decoupling of the fitted values followed by a constant difference between the two curves, reflecting the fact that only one counterfactual adjustment was made on those markets. Where reform occurs late in the observation period, and there has already been evidence of large traffic volumes and healthy growth rates, the counterfactual adjustment has not had such a sizeable effect. This is illustrated in the UK-Barbados chart in Figure 6.5. In absolute terms, bilateral scenario gains are most significant on the US-Caricom markets followed by UK-Caricom and finally Intra-Caricom markets, although, as a proportion of total traffic levels, some Intra-Caricom predictions are worthy of note. Whilst controlling for other determinants, it was predicted on the Barbados-Guyana market that traffic would have stagnated if it had not been for the ratification of and adherence to the Caricom MASA in 1998 (Figure 6.7). Conversely, if the Suriname and Trinidadian governments decided to reform their bilateral air policy by one unit it is estimated that traffic levels would have increased nearly 60%. In absolute terms this represents a traffic increase of approximately 6,500 passengers per annum.

The largest aggregate gains, however, are revealed in the multilateral scenarios. A significant, positive and reliable liberalisation coefficient along with a large and previously suppressed increase in liberalisation on a concurrent basis resulted in the largest effects for NA-Caricom markets. On average, more modest gains were noted for UK- and Intra-Caricom markets although for Intra-Caricom markets, this was not the case in percentage terms with average traffic levels estimated to grow 51% above 2006 levels in the event of a fully liberal, all-encompassing Caricom MASA (Table 6.1). A fully liberal scenario in this study was represented by a liberalisation index of 5; this counterfactual value was subtracted from the actual 2006 index to obtain the predicted increase in the index for each country-pair in each sub-sample. The overall sub-group intercept values along with their corresponding liberalisation coefficient values were then multiplied by the index increases in every country-pair to extract an overall traffic gain estimate for each pair, which could then totalled and adjusted to obtain an annual gain estimate for each sub-sample. In the case of NA-Caricom sub-sample this was equal to 550,000 extra passengers per annum above average 2006 baseline levels. This process was repeated for the other two sub-samples although the performance of the change in reform was more modest (in absolute terms).

The reliability of the liberalisation coefficients can also be tested by cross-checking counterfactual gain estimates against real traffic gains on three markets that have recently experienced further air policy deregulation. In 2008, Canadian and Barbadian regulators made a concerted effort to open up the previously restricted market in terms of carrier designation, Canadian access points and pricing controls. The official bilateral introduction of multiple designation, open access to Canadian gateways for Caricom carriers, the granting of 5th freedom rights to more carriers and a dual disapproval tariff policy led to an increase in the liberalisation index of 2 from 2.5 to 4.5. Accordingly, counterfactual predictions were set up with the same policy conditions as those experienced in reality and an average yearly traffic gain estimate was derived. Available traffic data for the first quarter of 2008 were then obtained from Transport Statistics Canada (2008) and compared with the regression estimate.

As reform has only just occurred in this market, it is difficult to draw any conclusions from the comparison apart from the fact that the counterfactual estimates should not overly contradict the post-trial observations. This same process was repeated for the UK-St. Lucia–Trinidad and Tobago markets that saw extra-bilateral reforms, effectively increasing the liberalisation rank from 2.5 to 4.5 and 2.5 to 4 respectively. Both sets of negotiations took place in 2007 although neither had been officially ratified or put into force up until the time of writing. In a similar fashion to the Canada-Barbados market, a revised counterfactual scenario was run for these two country-pairs and average annual gains were compared with their actual post-trial traffic observations. The results of this process are revealed below in Table 6.2.

Table 6.2
Predicted versus actual traffic gains on a number of recently reformed markets

Country-pair/Year	Actual LIBRANK increase	2007 Predicted traffic gain	2007 Actual traffic gain	2007 Error	2008* Predicted traffic gain	2008* Actual traffic gain	2008* Error
Canada-Barbados	2	98,025	11,180	86,845	98,025	13,130	84,895
UK-St. Lucia	2	22,208	8,861	13,347	22,208	16,736	5,472
UK-Trinidad & Tobago	1.5	16,656	-50,339	66,995	16,656	-19,063	35,719

Source: UK CAA, CTO and Transport Statistics Canada for actual 2007 and Jan-Apr 2008 traffic figures
Notes: 2008 traffic volume data was only available until April 2008. Percentage change in Q1 was assumed to represent entire year performance
The total predicted reform benefit has been equally divided between 2007 and 2008 although in reality it is likely that the distribution and longevity of benefit would be different

It appears that the more open market on the UK-Trinidad & Tobago country-pair may have initially had a reverse effect or possibly coincided with a decision by ailing flag carrier Caribbean Airlines to pull out of the London route. Although the new extra-bilateral agreement permitted Caribbean Airlines to sell seats on British Airways flights, the overall effect was that scheduled traffic in 2007 reduced from 161,000 to 102,000 passengers. Charter traffic marginally improved, mainly owing to increased frequencies into Trinidad's sister island Tobago, resulting in an aggregate reduction of around 50,000 passengers in 2007. Early indications on the UK-St. Lucia and Canada-Barbados markets, however, are that further reform is having a positive impact on aggregate traffic levels although not as marked as the predicted regression coefficients have proposed.

It must be reiterated that the effects of all the post-trial reforms were still in their infancy at the time of writing and thus comparisons could not be made with any certainty. What it does provide, however, is an early indication of the reliability both of the direction and magnitude of the liberalisation coefficients. It would be useful, of course, to repeat this process again in 2009 and 2010, where, in the absence of other extraneous disturbances, the bulk of these recent reform effects might be witnessed. Also, the total gain predictions have been arbitrarily allocated across two time periods whereas in reality this predicted effect can last much longer depending on when the regulatory framework is further liberalised, as well as when other external events take place.

6.2.3. Consumer surplus

The traffic gain estimates using the best-fit regression coefficients for the bilateral and multilateral reform scenarios also become the main inputs of a consumer/producer surplus assessment. The counterfactual volume gains are calibrated by using 2006 passenger survey airfare and traffic statistics data as the basecase supply scenario, with the effect of the new predicted traffic volumes on passengers and airlines being of primary interest.

Table 6.3(a)
Counterfactual scenario 1 – bilateral reform (1 unit increase in librank on current restricted markets)

Market	2006 Average fare (pax survey)	2006 Allocated traffic volume (actual)	Average reformed volume (average annual gain)	Calculated "k" factor	Post reform average fare ($US)	Total gain in consumer surplus ($US)	Gain owing to new travellers ($US)	Gain owing to price reductions for existing pax	Likely arc elasticity of demand	Likely CS gain estimate ($US)
US-Dominica	556	47,376	84,822	26,341,056	311	16,224,324	4,595,652	11,628,672	1.5	24,336,486
US-Guyana	702	73,936	115,542	51,903,072	449	23,948,703	5,258,709	18,689,993	0.5	18,712,677
US-Trinidad & Tobago	601	608,810	650,416	365,894,810	563	24,205,436	799,770	23,405,666	0.5	12,929,816
Canada-Barbados	590	134,704	176,310	79,475,360	451	21,651,150	2,896,390	18,754,761	1.5	32,476,725
UK-Bahamas	1,037	78,887	82,060	81,805,819	997	3,226,786	63,615	3,163,172	1.5	4,840,179
UK-St.Lucia	965	143,281	146,454	138,266,165	944	3,028,776	33,169	2,995,606	1.5	4,543,164
UK-Trinidad & Tobago	1,043	198,114	201,287	206,632,902	1,027	3,283,355	26,084	3,257,270	0.5	1,667,971
Bahamas-Barbados	730	3,564	6,313	2,601,720	412	1,569,845	436,925	1,132,921	0.5	1,390,353
Bahamas-Jamaica	525	24,758	26,047	12,997,950	499	659,980	16,745	643,236	0.5	347,171
Barbados-Jamaica	540	26,701	27,990	14,418,540	515	680,032	16,028	664,005	0.5	356,431
Barbados-Trinidad &Tobago	218	130,032	131,579	28,346,976	215	335,263	1,983	333,281	0.5	169,626
Guyana-Trinidad & Tobago	193	64,002	65,549	12,352,386	188	295,048	3,523	291,525	1.5	442,572
Jamaica-Trinidad & Tobago	665	27,050	28,597	17,988,250	629	1,000,929	27,826	973,103	0.5	529,086
Suriname-Trinidad & Tobago	368	14,274	15,563	5,252,832	338	454,708	19,644	435,064	1.5	682,062

Table 6.3(b)
Counterfactual scenario 1 – bilateral reform (maintenance of 'status quo' on current reformed markets)

Market	2006 Average fare (pax survey)	2006 Allocated traffic volume (actual)	Average status quo volume (average annual loss)	Calculated "k" factor	No reform average fare	Total loss in consumer surplus ($US)	Loss owing to lost travellers ($US)	Loss owing to price increases for existing pax	Likely arc elasticity of demand	Likely CS loss estimate ($US)
US-Bahamas	376	3,158,602	3,075,390	1,187,634,352	386	-31,710,994	-423,282	-31,287,712	1.5	-46,313,372
US-Dominican Republic	240	4,285,384	4,249,721	1,028,492,160	242	-8,595,033	-35,913	-8,559,120	1.5	-12,785,258
US-Barbados	739	447,054	429,223	330,372,906	770	-13,450,814	-273,705	-13,177,109	1.5	-19,371,481
US-Jamaica	476	3,058,044	2,966,431	1,455,628,944	491	-44,281,163	-673,375	-43,607,788	1.5	-64,431,879
US-St. Lucia	645	289,332	247,726	186,619,140	753	-29,089,435	-2,253,565	-26,835,870	1.5	-37,359,552
UK-Barbados	982	639,179	628,075	627,673,778	999	-11,000,517	-96,389	-10,904,128	1.5	-16,214,120
UK-Jamaica	951	393,946	377,289	374,642,646	993	-16,190,486	-349,679	-15,840,807	1.5	-23,258,869
Barbados-Guyana	246	42,744	41,639	10,515,024	253	-275,437	-3,607	-271,830	0.5	-134,158
Barbados-St. Lucia	237	65,987	63,504	15,638,919	246	-599,976	-11,505	-588,471	1.5	-866,099
Dominica-Trinidad & Tobago	254	18,090	17,123	4,594,860	268	-252,553	-6,935	-245,618	1.5	-358,580

Table 6.3(c)
Counterfactual scenario 2 – multilateral reform (simultaneous reform with librank of 5 on all markets)

Market	2006 Average fare (pax survey)	2006 Total allocated traffic volume (actual)	2006 Average allocated traffic volume (actual)	Average reformed volume (average annual gain)	Calculated "k" factor	Post reform average fare	Total gain in consumer surplus ($US)	Gain owing to new travellers ($US)	Gain owing to price reductions for existing pax	Likely arc elasticity of demand	Likely CS gain estimate ($US)
NA-Caricom	547	12,103,242	1,344,805	1,899,554	735,906,998	387	259,243,342	44,327,723	214,915,619	1.5	388,865,014
UK-Caricom	996	1,453,407	290,681	335,098	289,402,402	864	41,290,748	2,930,758	38,359,990	1.5	61,936,122
Intra-Caricom	398	417,202	41,720	63,184	16,587,952	263	7,084,530	1,449,529	5,635,001	0.5	5,364,666

Notes: Total gain estimates assume a constant elasticity of 1.0
Additional traffic growth due to liberalisation represents an average yearly figure computed by dividing the predicted gain from liberalisation by the subsequent observation time periods to which the reform applies
Bidirectional fares are covered by the 2006 survey although there were sometimes uneven numbers of respondents at each end of the O-D market

The overall Caricom passenger survey results indicated an aggregate consumer surplus of around US$145 per passenger in the base year of 2006. This estimate masks a high variation when broken down by sector distance, type of carrier (foreign, local or combination) and place of residence (Caricom country or foreign country). On Intra-Caricom routes, for example, a large minority of respondents cited that they place a lower value on their ticket than the price they paid for it. This was especially the case where the respondents were local residents and travelling on local carriers. Basecase consumer surplus on Intra-regional routes was thus moderated to a value of only US$82, approximately 20% in excess of the average fare paid (US$398). Assuming simultaneous ratification of a more liberal Caricom MASA, average price is estimated to decrease to US$263 (Table 6.3(c)) with constant elasticity of demand and US$295 in the more likely case of an inelastic response to the revealed change in traffic volumes. This results in a consumer surplus gain over the base value ($82) of US$22.4 and US$17.8 per passenger airfare respectively. In absolute terms this represents a gain of US$7.1 million and US$5.6 million over a basecase surplus of US$17.1[76] million respectively, or a 41.5% and a 32.7% gain over 2006 levels.

Two other types of observation can be read from the consumer surplus results. First, the extra volumes attributable to a new Caricom MASA will create price reductions for existing passengers, which in fact makes up the majority (80%) share of the total gain estimate. This is logical given the fact that new passengers typically stimulate the introduction of further competition and capacity in a market which in turn encourages price reductions for those who were previously willing to pay more. The second observation relates to the bilateral gain estimates. Naturally, if individual Caricom country-pairs decide to negotiate separately, more modest gains will be made on those markets that take a more gradual approach to air policy reform. In line with historical evidence, a modest unit increase of 1 on the liberalisation scale was assumed to represent the most accurate approach to air policy reform. This is reflected in the lower airfare reductions estimated in Table 6.3(a) and the lower airfare increases shown in Table 6.3(b). The largest gains appear to be made on emerging and previously restricted markets where absolute gains have a more pronounced effect in terms of rates of change, and where quick service level gains can be made on small markets (where the introduction of a direct service or a second air carrier can result in a more significant rate of change in traffic volumes than on mature and partially liberalised markets).

[76] Calculated by: Absolute consumer surplus gain estimate/Total before sub-group traffic volumes(/2, as airfares are bidirectional).

On NA-Caricom markets, the maintain 'status quo' scenario of no reform produced the most pronounced effects in terms of consumer surplus. US-Jamaica observed policy reform saw a move on the liberalisation scale from 2 in 2003 to 3.5 in 2006. The timing of this reform plus the fact that the no reform scenario resulted in a LIBRANK reduction of 1.5 (greater than the 1 unit increase stipulated for the other bilateral scenario), helps to explain the high consumer surplus difference when compared to counterfactually reformed markets. Total gains in the multilateral reform scenario were more significant than the sum of bilateral gains, however, suggesting that the quickest win, in terms of traffic volumes and fare cuts, would be to negotiate a new Caricom-US/Canada multilateral agreement which takes precedence over the bilateral agreements that are currently in force. Change in total consumer surplus is US$120 million greater in the multilateral scenario. If, hypothetically speaking, all NA-Caricom bilaterals took on a LIBRANK of 5, it is estimated that this would not result in an equal surplus estimate as that given by the multilateral scenario. In the multilateral scenario it is probable that there would be greater fare reductions in line with the higher quantity and quality of connections available between the islands and the greater use of sub-regional hubs leading to greater airline efficiency. Due to economies of scale and network advantages, it is therefore envisaged that this would result in greater consumer surplus values in the multilateral scenario, especially if improvements in carrier efficiencies are passed on to the consumer through the pricing mechanism.

On UK-Caricom markets, smaller volumes in general combined with more modest liberalisation coefficients resulted in smaller airfare reductions and subsequent consumer surplus gains than those seen on NA-Caricom markets. Assuming an elasticity of demand of 1.5 on the leisure markets makes a notable difference to the gain estimates, but the airfare reductions are effectively limited in magnitude by the fact that historical predictions placed more evidence on the partial contribution of other traffic determinants, including changes in income, interest rates, disposable income, exchange rates and destination price competitiveness. Having said that, using the conservative total gain estimate of US$41 million, consumer surplus as a percentage of the average fare paid jumps from 16.9% (US$170/US$996) in 2006 to 29.7% (US$256/US$864) in the multilateral counterfactual scenario. On bilateral markets estimates range from modest gains as shown by the UK-Trinidad & Tobago market (16.3% to 19.7%) to quite significant losses as predicted on the UK-Jamaica market (17.8% to 8.5%), again applying unity elasticity values. In keeping with the findings from the other regional sub-groups, however, multilateral gains were generally more pronounced than those predicted for bilateral policy changes and particularly so if the more likely high elasticities were applied instead of the unity values.

6.2.4. Producer gains (losses)

Morrison et al. (2005) discovered on US domestic markets that low-cost carriers tended to enhance traveller welfare more than legacy carriers did. Yet, at the same time, in the year 2000, it was found that those carriers who contributed most to consumer welfare were generally rewarded with higher profits, indicating perhaps that policy makers should do little to intervene in this competitive process. This represented a snapshot in time, however, and the effects of deregulation, as mentioned previously, are not static, and vary from market to market and from network to network. Although comparisons of airline efficiency are difficult due to carrier network differentials, it is not the aim of this study to compare the efficiency of individual carriers but to estimate the overall effect on producers of a given level of liberalisation in terms of productivity and unit costs and whether, in percentage terms, gains in carrier efficiency can be expected to outweigh the loss of producer surpluses resulting from the downward pressure on yields in markets with higher predicted post-liberalisation traffic volumes. For a more thorough analysis of airline cost and productivity effects in deregulated markets, refer to the earlier work of Encaoua (1991) or the later work of Oum et al. (2005) who both explore Total Factor Productivity (TFP) to try and isolate real competitive improvements in efficiency from those caused by differences relating to factor prices or scale economies.

Network data regarding air carrier annual unit operating costs, as well as route group data on total revenue and route tonne kilometres per employee, were gathered for every year between 1995 and 2006. Total change over the period as well as an average annual change estimate was computed for every Caricom country-pair using network data for every carrier serving a particular market. If, during the period, an airline either entered or exited the market, an adjusted average was computed to reflect the new ‘status quo’ average unit cost and productivity levels. Annual network productivity and cost levels were finally weighted by each carrier's country-pair market share in an attempt to relate network values with individual country-pair effects. Also, by averaging across the network values of all carriers operating on a country-pair, it is assumed to pick up the partial effects of operating in country-pairs at different stages of air policy liberalisation. The results of this process are presented below in Table 6.4.

Table 6.4
Average and twelve year change in airline unit costs and partial productivity index

Country-pair	Total change in real productivity index (95-06)	Total change in unit costs (95-06) US cents	Average percentage change productivity index	Average percentage change real unit costs	Total average change in airline efficiency (%)
US-Bahamas	+171	-14	+10.2	-1.8	+12
US-Dom Rep	+149	+2	+5.8	+0.4	+5.4
US-Jamaica	+109	0	+5	+0.1	+4.9
US-Barbados	+154	+2	+6.9	+0.4	+6.5
US-St. Lucia	+129	0	+5.8	+0.5	+5.3
Mean NA-Car (R)	*+142*	*-2*	*+6.3*	*-0.1*	*+6.8*
Canada-Barbados	+70	+1	+3.3	+0.6	+2.7
US-Dominica	+65	+2	+8.8	+0.6	+8.2
US-Guyana	-136	+8	-5.9	+1.8	-7.7
US-T&T	+121	+6	+5.5	+1.3	+4.2
MeaNA-Car (SQ)	*+30*	*+4*	*+2.9*	*+1.1*	*+1.8*
NA-Car (Diff)	*+112*	*-6*	*+3.4*	*-1.2*	*+5*
UK-Barbados	+166	+1	+7	+0.4	+6.6
UK-Jamaica	+260	-1	+10	-0.1	+10.1
Mean UK-Car (R)	*+213*	*0*	*+8.5*	*+0.2*	*+8.4*
UK-Bahamas	+123	-14	+5	-2.6	+7.6
UK-St. Lucia	+122	+29	+5.1	+6.1	-1
UK-T&T	+144	+2	+5.9	+0.5	+5.4
MeaUK-Car (SQ)	*+130*	*+6*	*+5.3*	*+1.3*	*+4*
UK-Car (Diff)	*+83*	*-6*	*+3.2*	*-1.1*	*+4.3*
Barbados-Guyana	+46	+4	+7.8	+0.8	+7.0
Barbados-St. Luc	+98	-4	+9	-0.1	+9.1
Dominica-T&T	+21	+1	+3	+0.5	+2.5
Mean Int-Car (R)	*+55*	*0*	*+6.6*	*+0.4*	*+6.2*
Bahamas-Barbad.	-15	+2	-1.5	+0.8	-2.3
Bahamas-Jamaica	+28	+3	+2.4	+0.2	+2.2
Barbados-Jamaica	+45	+6	+2.9	+1.4	+1.5
Barbados-T&T	+99	-5	+10	-0.5	+10.5
Guyana-T&T	-10	+9	+0.1	+1.2	-1.1
Jamaica-T&T	+75	+6	+4.9	+1.3	+3.6
Suriname-T&T	+30	+3	+1.4	+0.5	+0.9
MeanInt-Car (SQ)	+36	+3	+2.9	+0.7	+2.2
Intra-Car (Diff)	+19	-3	+3.7	-0.3	+4
Mean diff (n=24)	+71	-5	+3.4	-0.9	+4.3

Source: ICAO financial data, airline annual reports

By and large, reformed Caricom country-pairs revealed a higher average improvement in airline efficiency than on markets that maintained their air policy 'status quo' during the observation period. Although regional carriers tend to have higher factor prices and unit costs due to the shorter sectors they operate, when all carriers are aggregated for each country-pair the overall efficiency trends tend to emerge. On the Barbados-St. Lucia country pair, for instance, the introduction of the Caricom MASA in 1998 and the subsequent relaxation of the bilateral agreement in 2005 led to a more contestable market where potential and actual entry by foreign carriers, namely American Eagle in 2006, facilitated marked improvements in short sector real unit costs and labour productivity. Similarly, in the absence of an increase on the liberalisation scale, the more protected environment may have resulted in a more *liaises faire* approach to cost control.

On the Guyana-Trinidad & Tobago market, for instance, incumbents BWIA, LIAT and Suriname Airways all experienced real increases in unit costs over short sectors in the absence of the threat of or actual entry by foreign carriers. On aggregate, labour productivity actually decreased by 10 units between 1995 and 2006 and unit costs increased approximately 9 US cents during the same period. Although the more protected environment could have contributed to this result, the moderate level of variability between the 'status quo' country-pairs points to the presence of other factors determining the development of unit costs and productivity. The carriers sampled for the Guyana-Trinidad & Tobago market, for example, have different network and organisational structures. Continued subsidy of LIAT and BWIA including their Intra-Caricom services, may have compounded the no-reform effect. The Suriname government also owns a 100% stake in national carrier Suriname Airways suggesting perhaps that the organisational structure of the carrier may have been the main contributor to the lower revealed efficiency levels. A case-history approach to each market helps to account for some of the within group variation shown in Table 6.4.

Generally, on those markets with poor performing carriers which have little access to cost economies, preferential loans, and prospects for privatisation or simply have a high number of very short sectors in their route network, a compounding effect on efficiency levels was experienced. Consequently, if restrictive air policy was found to be one of the only impedance factors, efficiency levels generally improved over the period but at a dampened rate. Overall, reformed markets boasted a more efficient air service with an average real unit cost reduction of 0.9 US cents and an average labour productivity increase of 4.3% over and above the 'status quo' markets in the sample.

An important secondary observation is that across the board, airlines have made more significant productivity improvements while unit cost reductions have been more stagnant over the observation period. As unit operating costs include uncontrollable items such as fuel and to a lesser extent airport charges and taxes, air carriers operating in the region have been able to exercise more short-term, direct control over labour costs. This has especially been the case with US, Canadian and British airlines operating into the region. Caricom operators have generally faced more opposition from local labour unions, however, although recent labour growth has stagnated during the restructuring processes at Air Jamaica, Caribbean Airlines and LIAT/Caribbean Star. Abnormal increases in fuel prices have inevitably been a contributory factor when one considers that the nominal price of a barrel of oil in 1995 was only US$18. Only 5 of the 24 sampled country-pairs experienced aggregate air carrier reductions in real unit costs between 1995 and 2006. By contrast 21 of the 24 country-pairs benefitted from air carrier productivity gains reflecting the global response by air carriers to declining yields and the advent of low-cost carrier competition.

6.2.5. Total net gains (losses)

Reverting back to the counterfactual analysis, it is now possible to estimate net producer/consumer welfare gains (losses) by inverting then incorporating the adjusted efficiency estimates into the consumer surplus analysis discussed in section 6.2.3. The first step, however, is to predict net producer gains (losses) for the bilateral and multilateral scenarios. This is performed by reversing and then combining the observed efficiency gains given in Table 6.4 with the net producer surplus losses given in Tables 6.3(a)-(c). Recall that the creation of every new air passenger due the introduction of discounted fares is considered to be a marginal gain in revenue for the producer, given that this section of the demand curve was effectively redundant in the absence of such discounted fares. Thus, net producer surplus losses are simply the reduction in total revenue from existing passengers less the total revenue gained from the additional passengers that were previously unwilling to travel at the higher fares offered under a more restricted air policy framework. The results are presented in Tables 6.5(a)-(c).

Table 6.5(a)
Net welfare scenario 1 - bilateral reform (1 unit increase in librank on current restricted markets)

Market	Producer loss from price reductions to existing pax (US$)	Producer gain owing to new pax revenue (US$)	Net loss in total producer surplus (US$)	Net total producer losses (+efficiency gains)	Estimated gain in total CS ($US)	**Net welfare gain estimate ($US)**
US-Dominica	-11,628,672	4,595,652	-7,033,019	-6,681,368	16,224,324	**9,542,955**
US-Guyana	-18,689,993	5,258,709	-13,431,284	-12,759,720	23,948,703	**11,188,983**
US-Trinidad & Tobago	-23,405,666	799,770	-22,605,896	-21,475,601	24,205,436	**2,729,835**
Canada-Barbados	-18,754,761	2,896,390	-15,858,371	-15,065,452	21,651,150	**6,585,698**
UK-Bahamas	-3,163,172	63,615	-3,099,557	-2,975,575	3,226,786	**251,212**
UK-St.Lucia	-2,995,606	33,169	-2,962,437	-2,843,940	3,028,776	**184,836**
UK-Trinidad & Tobago	-3,257,270	26,084	-3,231,186	-3,101,939	3,283,355	**181,416**
Bahamas-Barbados	-1,132,921	436,925	-695,996	-668,156	1,569,845	**901,689**
Bahamas-Jamaica	-643,236	16,745	-626,491	-601,431	659,980	**58,549**
Barbados-Jamaica	-664,005	16,028	-647,977	-622,058	680,032	**57,974**
Barbados-Trinidad &Tobago	-333,281	1,983	-331,298	-318,046	335,263	**17,217**
Guyana-Trinidad & Tobago	-291,525	3,523	-288,001	-276,481	295,048	**18,567**
Jamaica-Trinidad & Tobago	-973,103	27,826	-945,277	-907,466	1,000,929	**93,463**
Suriname-Trinidad & Tobago	-435,064	19,644	-415,420	-398,803	454,708	**55,905**

Notes: Assumes constant elasticity of demand (1.0), Gains are applicable to time-period 2001-2006

Table 6.5(b)
Net welfare scenario 1 – bilateral reform (maintenance of 'status quo' on current reformed markets)

Market	Producer gain from price increases to existing pax (US$)	Producer loss owing to lost pax (US$)	Net gain in total producer surplus (US$)	Net total producer gains (-efficiency losses)	Estimated loss in total CS ($US)	**Net welfare loss estimate ($US)**
US-Bahamas	31,287,712	-423,282	30,864,430	29,321,209	-31,710,994	**-2,389,785**
US-Dominican Republic	8,559,120	-35,913	8,523,207	8,097,046	-8,595,033	**-497,987**
US-Barbados	13,177,109	-273,705	12,903,404	12,258,234	-13,450,814	**-1,192,580**
US-Jamaica	43,607,788	-673,375	42,934,413	40,787,692	-44,281,163	**-3,493,470**
US-St. Lucia	26,835,870	-2,253,565	24,582,305	23,353,190	-29,089,435	**-5,736,245**
UK-Barbados	10,904,128	-96,389	10,807,739	10,375,429	-11,000,517	**-625,088**
UK-Jamaica	15,840,807	-349,679	15,491,128	14,871,483	-16,190,486	**-1,319,004**
Barbados-Guyana	271,830	-3,607	268,223	257,494	-275,437	**-17,943**
Barbados-St. Lucia	588,471	-11,505	576,966	553,888	-599,976	**-46,088**
Dominica-Trinidad & Tobago	245,618	-6,935	238,683	229,135	-252,553	**-23,418**

Notes: Assumes constant elasticity of demand (1.0), Losses are applicable to various time-periods[77]

[77] Appendix I details in graphical form the number of years of counterfactual 'status quo' that applies to each of the above country-pairs.

Table 6.5(c)
Net welfare scenario 2 – multilateral reform (simultaneous reform giving librank of 5 on all markets)

Market	Producer loss from price reductions to existing pax (US$)	Producer gain owing to new pax revenue (US$)	Net loss in total producer surplus (US$)	Net total producer losses (+efficiency gains)	Estimated gain in total CS ($US)	**Net welfare gain estimate ($US)**
NA-Caricom	-214,915,619	44,327,723	-170,587,896	-162,058,501	259,243,342	**97,184,841**
UK-Caricom	-38,359,990	2,930,758	-35,429,233	-34,012,064	41,290,748	**7,278,684**
Intra-Caricom	-5,635,001	1,449,529	-2,790,315	-2,678,702	7,084,530	**4,405,828**

Notes: Assumes constant elasticity of demand (1.0), Gains are spread over *n* time-periods from 2006 onwards
The Intra-Caricom sub-group efficiency estimate is divided by a factor of 1.5 to take into account the alliance and ownership opportunities that could prevail in a liberalised Caricom MASA environment

First and foremost, when overall net producer losses are taken into consideration, total welfare gains are still significant both in the bilateral and multilateral scenarios. Due to the greater pre/post reform index disparity in the multilateral scenario, greater airfare and subsequently consumer surplus effects were observed in Table 6.5(c) as opposed to those shown for the bilateral reform scenario. Although the airline efficiency estimates relate to all possible determinants, it is important to note that both the producer surplus losses and the consumer surplus gains are only those associated with the counterfactual changes in air policy. If other endogenous and exogenous determinants of airfare are relaxed, it is probable that the airfare change estimates would be different to the ones relating purely to the traffic growth predictions proposed in this study.

A 5%, 4% and 4% average efficiency gain on NA-, UK- and Intra-Caricom markets respectively did not make significant enough differences to the producer surplus loss estimates resulting from the predicted downward pressure on yields in the reformed market environment. This indicates that in liberalised environments, air carriers would need to adjust their business models, take more aggressive approaches to drive down costs and introduce more sophisticated yield management techniques to claw back some of the consumer surpluses lost in the counterfactual scenarios.

The overall estimates for the US-Dominica and US-Guyana country-pairs appear to be overestimated given the comparably small underlying traffic volumes on these markets. This can be explained by the uniform way in which the regression model predicted growth in traffic resulting from a unit increase in liberalisation. This led to overestimations of airfare differentials on smaller markets and the reverse effect is observed for the markets with larger than mean average traffic volumes.

Consequently, it can be assumed that aggregate estimates are more accurate than individual country-pair estimates, although the US-Dominica and –Guyana cases were not repeated among the other country-pairs in the sample.

Net welfare, assuming constant elasticities, is thus estimated to be circa US$32 million above the 2006 baseline[78] in scenario 1 and US$109 million in the second scenario. Given 14 of the 24 sampled markets are mainly composed of travellers with higher than unity elasticity values, this approximation can be considered conservative.

6.3. MACROECONOMIC IMPACT ESTIMATION ABOVE BASECASE

The volume gain estimates from the two alternative scenarios explored for this study can now be converted into additional gross added value and employment gains to the national economies of the sampled Caricom member states. This can be performed either by using the 2006 baseline ratios as approximated for seven Caricom states, or by adapting a reliable ratio found in an alternative study. The second approach is only considered useful for cross-checking the ratios given by the 2006 Caricom impact assessment so as to ensure that they are credible. It is also useful to offer two alternative Caricom multipliers with the first including the more tentative catalytic results and the second accounting only for the direct, indirect and induced effects of the sector. The two estimates can be thought of as an upper and lower limit with the exact volume gain effect probably lying somewhere between these two extremes.

The liberalisation effects on cargo volumes and an exhaustive network of country-pairs from each member state have not been considered in the regression analysis; therefore it is reasonable to assume that the macroeconomic gain estimates accruing from an increase in passenger volumes on a limited number of markets would yield a conservative total impact estimate. For the sake of macroeconomic accuracy it would have been more reliable to include a demand function for freight traffic as well as a complete list of country-pair markets for each sample member state, but the former is beyond the immediate scope of this thesis and the latter would have made the data collection process both impractical and overcomplicated.

[78] That is, gains are only totalled for the 13 currently restricted markets. The 2006 baseline already includes all prior welfare gains made on reformed markets (Table 6.5(b)).

6.3.1. Employment and expenditure estimates

Table 6.6 shows aggregate macroeconomic impact in the Caricom region for the three alternative liberalisation scenarios with scenario 3, maintenance of current policy 'status quo', reflecting the 2006 baseline impact estimates. The accompanying Table 6.7 summarises the triangulation exercise, where passenger to expenditure and employments ratios obtained within this study are contrasted with those found in a selection of impact studies from other world regions.

Table 6.6
Annual change in employment and regional Gross Domestic Product for three liberalisation scenarios

Liberalisation scenario	Total number of passengers (000)	Estimated change in number of passengers (000)	Expenditure $USmn (excluding catalytic impact)	Impact as % of region's GDP	Expenditure $USmn (including catalytic impact)	Impact as % of region's GDP	Employment (excluding catalytic jobs)	Impact as % of region's labour force	Employment (including catalytic jobs)	Impact as % of region's labour force
Scenario 3	15,316	-	1,305	2.84	4,203	9.16	17,780	0.75	133,184	5.60
Scenario 1	15,197	-119	1,295	2.82	4,164	9.07	17,642	0.74	132,149	5.56
Scenario 2	15,937	621	1,358	2.96	4,367	9.51	18,501	0.78	138,584	5.83

Notes: Regional expenditure multiplier = 3.22, Regional employment multiplier = 7.49
Baseline figures apply to the year 2006
Traffic gains represent an average yearly estimate. Total gains would be a multiple of the yearly average by the amount of years in which no further reform takes place

Table 6.7
Cross-check of study's employment and expenditure ratios with those of other analyses

Name of study	GDP effect per passenger $US (excluding catalytic effects)	GDP effect per passenger $US (including catalytic effects)	Passengers per FTE job (excluding catalytic impacts)	Passengers per FTE job (including catalytic impacts)	Jobs/mppa (excluding catalytic)	Jobs/mppa (including catalytic)
Caricom impact study	85.23 (2006)	274.43 (2006)	861 (2006)	115 (2006)	1161 (2006)	8696 (2006)
Hong Kong study	-	395.04 (2003)	-	-	-	-
United Kingdom study	-	-	-	416 (1998)	-	-
ICAO study - Amsterdam	-	-	-	-	2387 (1997)	-
ICAO study - Cardiff	-	-	-	-	2056 (1997)	-
ICAO study - Newcastle	-	-	-	-	1110 (1994)	-

Sources: Fung et al. (2006), ICAO (2005), OEF (1999) and author

In Scenario 1, the bilateral scenario, it is estimated that there would be a net decrease in passenger volumes in the order of 119,000 passengers per annum. Recall that in this counterfactual scenario, those country-pairs that did actually push for further reform during the period saw their pre-reform liberalisation values used in place of the reformed values. The effect of reversing the observed deregulation effect on the US-Bahamas –Dominican Republic and –Jamaica markets overwhelmed the estimated gain effect of increasing the policy index by 1 unit on those markets that did not make any reform efforts during the period. The annual gross liberalisation effect is therefore around 302,000 extra passengers if already realised effects are taken into account. All currently restricted markets would stand to gain a total of 183,000 extra passengers per annum if their respective air service agreements were liberalised by one unit. At a base rate contribution of US$85.23 per passenger (excluding catalytic impacts), this would increase the air transport sector's GDP contribution by approximately US$16 million per annum (US$1,321-1,305 million). If catalytic effects are included, the GDP contribution increases by US$51 million per annum (US$4,254-4,203 million).

If the time-series effect is to be estimated, then these average annual volume gain estimates must be compounded for every additional year of no further reform. If, for instance, each bilateral agreement in the sample liberalised by one unit in 2007 and no further reform was witnessed until 2010, then the annual estimates need to be multiplied by a factor of four (4). The actual change in traffic, however, would depend on whether other determinants of air traffic remain constant or experience change. As the latter scenario becomes more likely, the accuracy of the liberalisation predictions become more uncertain.

The multilateral scenario (scenario 2) is predicted to reap the greatest gains for the region, however, as 621,000 extra passengers per annum are estimated to pass through the sample's airport gateways (see Table 6.1 for calculation steps). A simultaneous increase in the liberalisation index to a level above the most liberal bilateral agreement currently in force would see an additional US$53 million per annum accruing to the regional economy when catalytic effects are excluded, and an extra US$164 million per annum in the overall impact scenario. In percentage terms this translates into an extra 0.12% and 0.44% on top of the baseline regional output (GDP) figures. Although this may not seem very significant, it is important to remember that these figures need to be compounded in order to obtain a time-series estimate. Further, the marginal effects of cargo volume gains and gains on currently restricted country-pairs left out of the 24 country-pair sample are assumed to improve and not worsen the macroeconomic performance of the sector.

A similar trend is evident with the employment results. The chosen ratio, passengers per FTE job, was found to be only 861 at the lower impact limit and 115 as the upper limit when excluding and including catalytic impacts respectively. The high number of jobs provided by the tourism sector in a number of sampled states contributed to this contrast, as many were included in the catalytic category but not in the direct, indirect and induced category. This difference has a marked impact on employment performance of the air transport sector with the annual effect in the first scenario being relatively minor while the annual effect in the second scenario turns out to be moderately significant, especially when time-series effects are included. That is, when catalytic impacts are not included the sector's proportion of the labour force is predicted to increase by only 0.03%. Although this is positive, even when compounded by a number of years, it does not result in a pronounced effect. On the other hand when the upper limit is used, the sector's proportion of the labour force increases by an estimated 0.23%, which when compounded can yield the desired multiplier effect. As the resources and time required to introduce further policy reform is comparably insignificant, however, it is assumed that the opportunities foregone from a diversion of resources and investment would be marginal. Consequently, even a minor impact stemming from air policy reform may be a recommendable option, if this effect is greater that the partial opportunity cost of not investing in other areas of an economy.

The triangulation results shown in Table 6.7 suggest that the Caricom multipliers are somewhat inflated and that, as predicted, the true contribution of the sector is likely to lie somewhere between the non-catalytic and non-catalytic+catalytic estimates as shown in Table 6.6. By extension, it can be seen that the catalytic employment multiplier is likely to be overestimated, given the fact that it is around five times greater than direct impact estimates provided both by the Caricom study itself and also by the direct estimates offered by ICAO relating to large hub airports as well as regional airports[79]. The findings of Fung et al. (2006), however, are more consistent with the Caricom GDP multiplier. The GDP effect per passenger in Hong Kong (2003) was actually higher than the estimate offered in this study. This makes intuitive sense given the nature of Hong Kong airport as a major hub leading to greater spillover effects in terms of business and retail activity around the airport, home carrier administrative and maintenance facilities and so on. The catalytic multiplier for GDP is therefore estimated to be more realistic than the employment multiplier.

[79] Although it is important to recall that this multiplier is in line with an ICAO 2002 study, which estimated a global employment multiplier to a factor of 6.1 (See section 2.1.2, Chapter 2).

Further liberalisation may have different implications for each of the sample's individual member states. If we take the frequently used cases of Trinidad & Tobago and Barbados, for example, the contrasting development of their respective air policies as well as the heterogeneous distribution of the disaggregate baseline impact classifications yield quite different results. As expected, including catalytic expenditure makes a positive and significant difference to the Barbados results. In the bilateral scenario, if current air policy is relaxed by one unit on the Bahamas-Barbados, Barbados-Jamaica, Barbados-Trinidad & Tobago and Canada-Barbados markets, air traffic is predicted to increase by around 47,000 passengers per annum. On the other hand, if no reform had occurred on the US-Barbados, UK-Barbados and Barbados-Guyana markets during the 1995-2006 period, then traffic would have been around 30,000 passengers less than those actually recorded for the 2006 base year. The combined differential of 77,000 passengers therefore constitutes the scenario 1 liberalisation effect of the sampled country-pairs involving Barbados.

When catalytic impacts are excluded, the macroeconomic impact of an extra 47,000 passengers on currently restricted markets would be in the order of US$1.8 million from a 2006 baseline impact of US$88.6 million to US$90.4 million. When catalytic impacts are included, however, both the baseline and scenario 1 total GDP affect increases quite significantly. The 47,000 extra passengers in the total impact scenario yield an extra US$10 million in terms of GDP effect from a base of US$483 million to a bilateral reform scenario of US$492 million. In proportional terms, impacts in Barbados largely reflect the regional average with the sector forming an estimated 1.8% of GDP when catalytic impacts are excluded and 10% when catalytic impacts are included. A one unit increase in bilateral liberalisation in Barbados would increase these proportions by 0.10% and 0.23% per annum respectively, in excess of the regional sector growth prediction for scenario 1 (0.03% and 0.11% respectively).

The case of Trinidad & Tobago provides a good indication of the variation around the mean average regional impact values shown in Table 6.6. It is important to remember that the comparatively high outgoing expenditure figures in Trinidad & Tobago resulted in negative catalytic impact values in the order of US$156 million in 2006. Thus, when catalytic impact figures are included, net impact becomes an estimated US$234 (1.31% of GDP) million whereas when catalytic impacts are excluded the net figure actually increases to US$393 million (2.17% of GDP). Following the same air policy procedure as for Barbados, it is estimated that in scenario 1 Trinidad & Tobago can stand to gain an extra 51,000 passengers per annum by liberalising its currently restricted ASAs by one unit in the sampled country-pairs involving Trinidad & Tobago. This translates into an extra US$6 million to national output in the direct, indirect and induced scenario (US$399 million) and an additional US$4 million (US$238 million) when catalytic impacts are included. In percentage terms this increases what were already more modest impact ratios quite marginally.

By excluding catalytic impacts, sectoral contribution is estimated to improve 0.03% whereas when catalytic impacts are included this improvement reduces to 0.02% of GDP. In comparison with the other states in the sample, Trinidad & Tobago had the highest national output level in 2006. It also has a heavy manufacturing base, with high production of oil, gas and petrochemicals, which are not as heavily reliant on air transport as a means to connect their products to market. This combined with the fact that tourism intensity in the island is the lowest of any of the sampled countries results in the observed low sector contribution statistics. That said, as Trinidad & Tobago expands its tourism sector, the positive effect of liberalisation in absolute terms as well as the non-quantifiable impacts of providing a bigger network of services and extra capacity/frequency may supplement the purely quantitative effect as shown here.

In scenario 2, both Barbados and Trinidad & Tobago are better off than in scenario 1 and in the baseline scenario. The simultaneous ratification of liberal multilateral agreements on Intra- UK- and North America-Caricom markets is predicted to increase passenger flows through Trinidad & Tobago by 131,000 per annum and in Barbados by an additional 207,000 passengers per annum. It is unlikely, of course, that after years of painstaking and gradual negotiation that this will actually occur both to the desired level of liberalisation and member state participation. It is useful, however, to offer a maximum impact level from which to benchmark and inform more realistic and achievable policy decisions.

If a consensus was reached for Intra-Caricom markets only but not for UK- or North America-Caricom markets, for instance, Trinidad & Tobago and Barbados would stand to gain from a more plausible increase in air passenger output of 17,700 and 17,400 per annum above the one unit extra-bilateral gains respectively[80]. This could translate into an additional US$8 (exc. catalytic impacts) or US$5 million (inc. catalytic impacts) and US$3 (exc. catalytic impacts) or US$13 (inc. catalytic impacts) million in expenditure and an additional 120 (exc. catalytic impacts) or 238 (inc. catalytic impacts) and 173 (exc. catalytic impacts) or 941 (inc. catalytic impacts) jobs per annum for the economies of Trinidad & Tobago and Barbados respectively. It is interesting to note that the catalytic employment effect in Trinidad & Tobago is positive despite the negative effect net outgoing expenditure had on the island state's balance of payments in 2006. Additional passengers whether they are local residents or foreign visitors will increase employment, although the multiplier effect is not as high as that shown for Barbados, where a more developed tourism sector ensures the extra incoming expenditure facilitated by air transport is converted into extra off-site employment within the wider economy. A complete breakdown of the GDP and employment results by member state is provided in Appendix J.

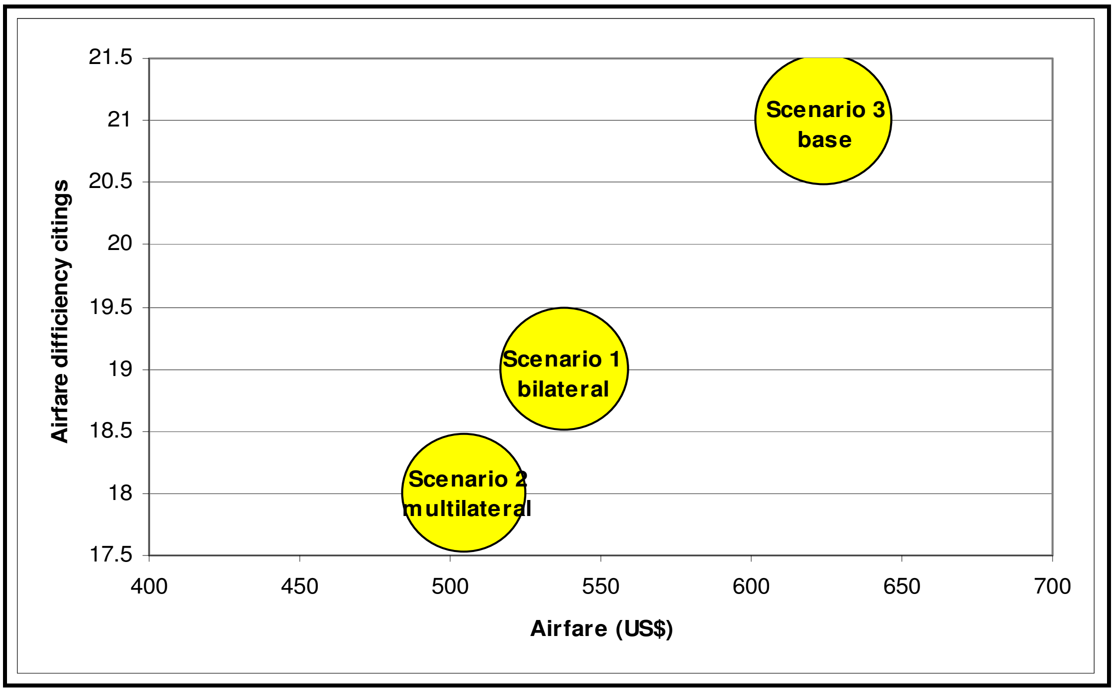
It is not possible to predict the network effects of the multilateral scenario on issues relating to multi-destination or multi-stop traffic. It can be assumed that an increasing percentage of long-stay visitors will be involved in such activities, especially if a more liberal Intra-Caricom environment leads to further competition and a reduction in airfares. It is impossible, using the proposed coefficients, to measure the magnitude and significance of these network effects, although this does not impact negatively on the macroeconomic gain assessment, given the fact that all additional trips along with their distribution among country-pairs are still encapsulated within the aggregate traffic estimates.

6.3.2. Business investment and productivity estimates

In accordance with the proposed method, 2006 average airfare results from the Caricom passenger survey, along with the percentage of respondents citing transport costs as a major barrier to investment and increased productivity from the business survey, will form the base relationship for estimating business investment gains. Results for the three scenarios are presented below in Figure 6.8.

[80] Albeit on a much smaller scale, this is a comparable scenario to what actually occurred after the *de facto* ratification of the open EU domestic market (see Appendix H).

Of the 211 business survey responses only 27% made extra remarks or comments based on the question of whether perceived deficiencies in air transport ever hindered plans to make investments in foreign markets. Although air transport activity was relatively high among most sectors and firm sizes, the majority of small to medium size enterprises were generally not too heavily involved in foreign investments and thus this question was only of real relevance to those firms who could make a rational business decision to invest abroad, but were hindered by real or perceived air transport service limitations. Of those 58 respondents who cited deficiencies, 29 (50%) stated that more than 20% of total sales were destined for foreign markets. Conversely, only 39 of the remaining 153 respondents (25%) cited that they had more than 20% of their products and services destined for foreign markets.



Source: Caricom passenger and business surveys
Note: The size of the bubbles represents the third value, that of the basecase and predicted number of business investment cancellations at different levels of airfare

Fig. 6.8 Relationship between levels of airfare, frequency of complaints pertaining to airfares and the number of resulting investment cancellations

As Figure 6.8 shows, at average business fare levels of US$624 per return fare, approximately 36% of the 58 negative responses cited airfares and/or freight rates by air as the main or one of the main hindrances to making investments in foreign markets. Of those 21 respondents, 13 or 62% of them actually stated that they cancelled their investment decisions altogether because of the lower consumer surplus values they placed on the baseline average fares. In the scenario 1 consumer surplus analysis, it was estimated that if the currently restricted country-pairs in the region were to liberalise by one unit on the liberalisation index, average airfares would decrease to US$538 per return fare. Therefore, at constant elasticities, average nominal fares are predicted to decrease by around 13.8%. In scenario 2 (the multilateral scenario), it is predicted that average fares would actually decrease to US$505 per return fare, representing a 19.1% reduction. Given the recent trend towards more economical business travel and the presence of a number of other hindering factors[81], it is assumed that the number of cancellations would not decrease by a proportional amount and consequently the responsiveness of the business community to an improvement in airfare was given a value of 0.5. With this level of responsiveness it is estimated that the 13 businesses which cancelled investments purely on air transport cost grounds would decrease to 12 in scenario 1 and 11 in scenario 2. As decreased airfares is typically a result of an increase in competition, however, the partial impact of airfare reductions should be combined with the possibility of increased capacity, more direct flights and critically, higher and more convenient frequencies. The real reduction in the number of cancellations may therefore be greater than those offered by a consumer surplus analysis in isolation.

While a small percentage of the total respondents were locally based multinational companies, the majority of respondents were responsible for local companies. These estimates are therefore based mostly on the views of Caricom businesses wishing to make investments in foreign countries either within the region or outside it. The scope of the survey did not include the views of international businesses that had considered the Caricom region as a place to invest but had pulled out in part due to real or perceived air transport deficiencies. Further, the small sample size of companies citing that air transport barriers altered their investment plans meant that further segmentation analysis whether by industry sector or by member state would have been unworkable and conclusions would have been statistically unreliable.

[81] For example, the issue of the lack of direct flights and inconvenient schedules/poor reliability was actually cited more often than transport costs as a major reason why cross-border investments were affected although in many cases further air policy liberalisation can have a positive effect on these supply factors as well.

6.4. CHAPTER SUMMARY

The liberalisation estimates based on historical data of the main air traffic determinants in 24 Caricom-country pairs became the principal input values of a scenario based counterfactual analysis. Three (3) liberalisation scenarios are offered; 1) Gradual bilateral reform, 2) Multilateral reform and 3) maintenance of air policy 'status quo'. In order to estimate consumer, producer and net welfare gains (losses), further upper/lower limit scenarios were made based on the assumption of high and low elasticities of demand and the presence or absence of significant network effects, limiting the possible impact of liberalisation on airline unit costs and labour productivity. Net gains were positive in all the above mentioned scenarios and were most noteworthy in the multilateral scenario, particularly if consumer responses to airfare reductions are found to be elastic and Caricom airlines are allowed to merge or form deep alliances in a revised Caricom MASA. Conversely, the lower limit is represented by a gradual approach to bilateral liberalisation, with low elasticities of demand and the presence of high factor input prices preventing the expected productivity and cost gains in more competitive environments.

Macroeconomic gains were estimated by comparing within sample basecase GDP per passenger and passenger per job ratios with adjusted ratios, which took the predicted counterfactual passenger output gains into account. The multilateral reform scenario, where catalytic impacts are included comprised the upper limit GDP and employment estimations, whereas the bilateral and non-catalytic impact scenarios produced the lowest aggregate gains. The cases of Trinidad & Tobago and Barbados were discussed to show the heterogeneity present in the sample with higher impacts in percentage terms recorded for smaller, poorly diversified tourism intensive states, and lower impacts recorded when the situation is reversed. Using the estimated increases in consumer surplus, the number of foreign investment cancellations would likely decrease albeit by an insignificant amount in both the bilateral and multilateral scenario. However, if higher consumer surplus values are supported by higher frequencies, more direct flights, better service levels and improved connectivity, the number of investment decisions stimulated by air reform may increase further.

7. CONCLUSIONS AND RECOMMENDATIONS

This section is split into four related parts. First, the main thesis' findings are summarised and conclusions are drawn. Second, based on these conclusions, a number of recommendations will be made for future policy after which the main research contributions of this study are reviewed. Limitations relating to the selected methodologies, data availability and scope will then be discussed, which is finally followed by a number of suggestions for further academic research in this area.

7.1. Summary of findings and conclusions

7.1.1. Outline

This research aimed to improve understanding of the effect of air policy reform both to the air transport industry itself as well as the national and regional economies of a sample of Caribbean community states. Current general economic theory on the subject of liberalisation impacts and case-study evidence emanating from the US, Europe and Asia were considered to have limited relevance for the Caricom region. New macroeconomic impact and liberalisation evaluation techniques were required in order to take account of; 1) the absence of input-output or detailed national account data 2) the added complexities of fragmented and disjointed air policy development and 3) a heterogeneous sample of tourism intensive markets on the one hand and thin/remote markets, essential for maintaining connectivity to global markets, on the other hand. Moreover, being the major output of the sector, it was important to devise the most appropriate set of air traffic volume determinants that could later be isolated from the partial effect of liberalisation. That is, a further contribution would be to introduce a unique demand function that would account for both the homogeneity of the case-study sample compared with regions composed of much larger economies, as well as the within sample socio-demographic and air transport sector heterogeneity of the selected island states.

The first step related to the deductive component of the research. Existing macroeconomic impact and liberalisation studies were collated and disseminated into categories broken down by region of interest along with their corresponding estimation techniques. This led to an original combination of evaluation techniques for this research, the selection and findings of which will be summarised first for the impact study and then for the liberalisation analysis.

7.1.2. Socio-economic impact assessment

It was found that net impact assessments which took both economic and social welfare as well as outgoing expenditures, airline losses/subsidies and sector leakages into account were the most relevant for the Caricom impact study. The selected research methodology was termed a 'multi-method net impact assessment', as it incorporated Caricom balance of payment and national account secondary data, as well as primary data composed of two supplier probes (for Trinidad and Barbados), net inflows of tourism expenditure, consumer surpluses, a capital investment project (in Barbados) and a Caricom local business survey. This data formed the basis of a baseline quantitative valuation of the sector (for the year 2006), which improved on the partial estimates undertaken prior to this study (by the local tourism sector and an academic paper focused solely on the impact of one national airline to the economy of Jamaica), whilst allowing for the abovementioned problems relating to the availability of reliable data. The more intangible catalytic impacts such as local carrier preferences, displacement in the event of a reduction in output levels, the facilitation of business productivity/investment and its role in the maintenance of social cohesion in the region were discussed descriptively and purposefully omitted from the main accounting exercise. These values were based purely on the available primary and secondary numerical data, which could later be linked in with the quantitative values derived from the liberalisation gain analysis. In this way, macroeconomic performance of changes in the region's air policy 'status quo' could be estimated with the qualitative benefits of liberalisation considered descriptively as an important secondary consideration.

The aggregate baseline assessment for the Caricom region showed that the air transport sector contributed a mean average of 16.8% towards real GDP and created 133,184 jobs in total (in the seven sampled member states) or a mean average of 19,026 jobs per member state. As expected, there was evidence of a significant variation around the mean values with St. Lucia's GAV, for example, being as high as 50.9% of GDP and Trinidad and Tobago's being as low as 1.31% of GDP. It was important, therefore, to use individual country-pair values when evaluating liberalisation scenarios, as the high variation in the baseline aggregate values would preclude them from producing statistically reliable air reform gain estimations.

Conversely, common patterns between member states were also found and are worthy of mention. Direct impact values were typically low compared to catalytic impact values. This was more apparent for those airports in the region that do not have any airlines based there. Even in those cases where airlines do use airports as bases or hubs, catalytic values were comparatively strong leading to generally large multipliers. Caricom multiplier estimate values were on average more significant than global estimates, although notable exceptions included Trinidad & Tobago with a negative multiplier value due to a net visitor expenditure deficit, Guyana, with a small market for tourism, and the Bahamas, which returned a large direct impact value due to the presence of Bahamasair and the export of air services by a number of domestic carriers serving the island chain. The global multiplier value according to Air Transport Action Group (2008) was 3.63. By comparison, the mean average multiplier for the Caricom region was 9.56, using a similar classification of impacts. As expected, by accounting for outgoing flows of traffic in order to produce net catalytic impact estimations, values were reduced to levels below the gross estimates provided by the CTO in 2003. Levels were only 5% lower, however, perhaps being explained by the exclusion of inflation, changes in exchange rates and cyclical expenditure growth as factors putting upward pressure on the nominal amount of visitor expenditure between 2003 and 2006. Finally, it was found that employment multipliers were largely consistent with GAV multipliers.

Other numerical indicators such as net consumer surplus and producer financial performance were not explicitly accounted for in the baseline estimates but nevertheless were important additions to the impact assessment. It was discovered, using published airline financial data, that Caricom air carrier revenue totalled US$815 million in 2006. However, this was not sufficient enough for local carriers to break even and in 2006 the four main Caricom carriers accumulated a total net loss of US$215.9 million or a net margin of -26.4%. According to the Caricom passenger survey, the average airfare paid was US$324 for Caricom carriers and US$576 for foreign carriers, reflecting the larger number of middle-long distance sectors operated by foreign carriers. Unit revenue (per mile) is therefore considered to be significantly higher for Caricom carriers suggesting that the heavy losses recorded in the baseline year was not caused by price capping behaviour. Aggregate value placed on tickets was generally positive as, on average, each passenger benefited from a consumer surplus of US$144.31. It was also found that Caricom residents generally placed lower values on air tickets than visitors, as did price elastic leisure passengers and travellers flying with Caricom carriers. Although this could indicate that Caricom carriers are charging disproportionately high airfares, consistently positive surpluses regardless of the test variable shows that value placed on mobility and connectivity outweighed any negative attitudes towards inflated airfares.

Social impacts in relation to business mobility, productivity and investment as well as the sector's role in supporting sustainable development and remote and island communities, were tested qualitatively using nominal and ordinal scale survey questions. Aggregate findings show that the relative importance of the sector is generally accepted and more importantly, due to the dependence of many member states on the travel industry, locals and visitors alike claimed that a significant reduction in service levels would lead to an equivalent reduction in demand and in turn low levels of displacement into other sectors of an economy. This finding indicates that the relative importance of the sector is, in fact, higher than the sector in other more diversified economies. Further, unlike findings from other studies, business survey respondents suggested that good air transport links were the most important prerequisite for foreign investment decisions. Ratings were generally higher for each investment factor, however, perhaps showing a degree of inexperience among Caricom businesses in the field of foreign investment compared with their UK and European counterparts. Transport, and more specifically air transport costs as a percentage of total production costs, are also shown to be sizeably higher than evidence originating from outside the region, further supporting both the emphasis placed on air transport by the region's business community and the significant role the sector generally plays in facilitating trade and commerce.

A relatively low level of carrier importing and a stated reduction in connectivity in the absence of local carriers by respondents of the passenger survey, suggest that local carriers play a significant facilitating role in the social cohesion of the community, despite the fact that passengers thought that a market served purely by foreign carriers would improve consumer surplus, quality of service and increase overall passenger flows.

7.1.3. Liberalisation analysis

With the baseline passenger to national output ratios determined (number of passengers per FTE job and GAV per passenger), the next and most critical stage of the research was to devise the most appropriate method by which to extract the partial effect of air policy liberalisation on traffic volumes. To achieve this, an econometric model was required in order to keep a number of other traffic determinants constant. Previous studies with traffic volumes as the dependent variable and change in air policy as a predictor were pooled and critically reviewed. It was found that on similarly fragmented air policy markets, the specification of liberalisation either as a discrete control variable or as an out of sample error term value did not produce any satisfactory results. The convoluted development of international ASAs involving Japan led Endo (2007), for example, to affirm that the effect of further reform was inconclusive.

The research strategy for this study was therefore split into three related steps that would aim to arrive at an improved specification of liberalisation as a predictor variable, and find the most relevant vector of remaining independent variables to predict Caricom air traffic. First, a descriptive time-series analysis gave a good primary indication of the strength of the liberalisation-traffic volume relationship, as well as the indirect effect of reform through its impact on airfares, service levels, competition and airline productivity. The reliability of a new ordinal scale liberalisation rank was tested in a pilot regression model on a sample of three homogenous US-Northern Caribbean country-pairs and any poor performing independent variables were noted in preparation for the main sample. 24 country-pairs involving the same seven representative Caricom states used for the socio-economic impact assessment were then split into three sub-samples by sector length and geographical region, and were estimated simultaneously to produce a set of 24 unique regression equations and three homogenous liberalisation coefficient values. The actual partial effect of these coefficients on individual country-pair traffic volumes was controlled by introducing a set of fixed-effect dummy variables, which yielded unique intercept values for each market.

It is shown that there is a consistently positive statistical relationship between air policy reform and air traffic growth with flexibility towards tariffs and carrier entry (frequency and capacity) leading to greater output and competition levels. However, these relationships are neither stable nor static, as the cyclical effect of time along with a number of disturbing factors can produce latent or dampened covariant effects. The positive effects were felt most strongly on previously restricted markets and on markets where the number of effective competitors has increased and low-cost carrier entry has occurred. The simultaneous estimation approach picked up the marginal effects of recent air policy adjustments (e.g. Canada-Barbados), but the full effects from the relevant country-pair's perspective was likely to have been overlooked, as observations for the year 2007 were omitted from the sample. The inverse is generally seen on markets that experience no or limited reform during the observation period. The retention of entry and tariff barriers has generally led to more modest traffic growth with a number of notable exceptions:

- Country-pairs that already had a liberal pre-reform status did not benefit from an increase in output both in absolute and percentage terms to levels experienced in restricted markets.
- Country-pairs with a moderate carrier designation status could still experience exponential gains in traffic volumes in the presence of healthy underlying economic growth, even if further carrier entry did not occur (The US-Trinidad & Tobago market is a typical example of this as the incumbents American Airlines and BWIA provided large capacity and frequency increases on the back of a buoyant Trinidadian economic growth rate due to the increased exporting of manufactured products, petroleum and natural gas during the observation period).

Thirteen of the twenty-four sampled country-pairs maintained air policy 'status quo' during the historical observation period. The simultaneous estimation approach effectively meant that these pairs took on the function of a control group, calibrating the overall liberalisation coefficients for the three sub-samples to yield plausible estimates. A relaxation in air policy leading to a one unit increase in the liberalisation index was estimated to increase traffic by around 250,000, 22,000 and 8,000 passengers per annum on NA-, UK- and Intra-Caricom markets respectively. The disparity between the results reflects the fact that the air policy reform effect is primarily dependent on the market potential and market maturity of a country-pair's route network. If the underlying drivers of demand are not present, the liberalisation effect will clearly be limited. The unique intercept values for each country-pair attempted to pick up such non-observed variation by explicitly altering the absolute effect of the partial coefficient values. This explicit intercept value effect along with the implicit dampening effect of underlying demand and market maturity on the IV coefficients accounted for the observed and unobserved socio-demographic, economic and air transport sector variance between the sampled country-pairs.

7.1.4. Counterfactual scenarios

The liberalisation effect coefficients had a number of implications for the thirteen currently restricted markets. Making forecasts into the future was avoided to prevent the need to make any assumptions about possible changes to other traffic determinants used in the regression analyses. Plausible counterfactual predictions of liberalisation induced traffic gains were made for both bilateral and multilateral reform scenarios. In line with historical evidence, bilateral reform was assumed to produce only a one unit increase in the liberalisation index in the short term, whereas for a revised multilateral agreement to stand any chance of unanimous ratification by the region's member states, it was assumed that it had to be more liberal than the most open US-Bahamas bilateral agreement. Thus some states, in this scenario, would see up to a 3 unit increase in the liberalisation index. Predictions were made under these two scenarios for additional yearly traffic volumes which in turn became the main input for the net welfare gain analysis and the macroeconomic performance estimation. Additional passenger estimates were compared with a third scenario; maintenance of air policy 'status quo' to reveal the counterfactual effect of reform.

Further scenarios were made available for the bilateral and multilateral options in order to offer upper and lower limit estimations relating to high and low elasticities of demand, the presence or absence of network effects and finally the exclusion and inclusion of catalytic visitor expenditures. The following key points can be extracted from these scenarios with the most accurate predictions being thought to lie somewhere between these upper and lower limits (see Chapter 6 for actual values):

- Net welfare (consumer/producer) gains were positive in all scenarios but were most noteworthy in the multilateral scenario, particularly if consumer responses to airfare reductions are found to be elastic, and Caricom airlines are allowed to merge or form deep alliances in a revised Caricom MASA.
- Net welfare gains were least significant in the gradual bilateral approach especially when combined with low elasticities of demand and high factor input prices preventing the expected productivity and cost gains in more competitive environments.
- Higher macroeconomic employment and expenditure estimates were recorded in the multilateral scenario with gains increasing significantly when catalytic impacts were included in the estimate. The lower limit was located in the bilateral scenario and when catalytic impacts were excluded.
- The heterogeneity of the sample can be summarised by the cases of Trinidad & Tobago and Barbados, however, with higher impacts in percentage terms recorded for Barbados, the smaller more poorly diversified tourism intensive state, and lower for Trinidad & Tobago where the situation is reversed.
- The reported number of business investment cancellations would decrease as consumer surpluses increase but by a marginal amount both in the bilateral and multilateral scenarios. If liberalisation leads to increased frequencies, improved connectivity and more efficient services levels, then the number of investment alterations may decrease further.

7.2. Policy recommendations

First and foremost, if it is a major policy of Caribbean states to look for ways to induce tourism growth, then this study's findings of historical gains on a number of partially liberalised Caricom markets challenge current restrictive practises in the region. This applies both to the countries sampled in this study and to the remaining Caricom countries that could be party to a revised Caricom MASA or more liberal bilaterals with a common set of source markets. Caution is advised when making generalisations, however, due to the heterogeneous make up of the region. Incorporating the most indicative set of scenarios and assumptions would improve the accuracy of the possible macroeconomic impacts of reform. For tourism intensive, poorly diversified economies, for instance, it may be wise to use high elasticities and include catalytic impacts to estimate macroeconomic performance, whereas the reverse is recommended for economies with large outgoing passenger flows. The direction of impact is invariably positive, however, regardless of its magnitude. When important social benefits are also included such as enhanced access to global markets and increased business productivity, it is concluded that liberal access to the region's air transport markets produces an overall gain in welfare. As discovered in this research, Caricom countries have limited control over the supply of air services and over the stimulation of demand in their source markets. Along with improvements to tourism infrastructure, joint marketing and host country service improvements, the region's air policy framework represents one of the last remaining control levers which could stimulate air traffic to the abovementioned levels.

After the implementation of open-skies between the US and Aruba, no local carriers have entered the market. If further Caricom liberalisation were to affect the mix of carriers in a similar way, it is recommended that measures are taken to safeguard the facilitating role of local carriers in maintaining connectivity between the region's smaller and peripheral communities and global markets. A moderately low importing ratio would also suggest the presence of national carrier preferences. These measures do not involve a continuation of artificial market restrictions, however, but the progressive withdrawal of government participation in the strategic direction of local carriers, and the facilitation of further integration between regional carrier marketing, distribution, operational and financial systems. In this way local carriers would be in a better position to compete effectively on lucrative markets and collude effectively on non-commercial Intra-Caricom sectors (as most of the lucrative, competitive routes are typically but not exclusively found on Extra-Caricom country-pairs). Consumers, whether local or visitor, and economies at large could then benefit further from the generally lower fares and higher service levels provided by foreign carriers as well as the additional foreign exchange earnings provided by the predicted increase in traffic volumes after further reform takes place.

It is advised that multilateral reform would produce the greatest net welfare and macroeconomic gains for the Caricom region as a whole, although when broken down by member state, the distribution of gains is dependent on the preceding stage of bilateral air policy liberalisation and whether there is evidence of the presence of first mover advantages (Mandel and Schnell 2001) both in terms of direct traffic and transfer traffic volumes. The Dominican Republic, Jamaica and the Bahamas, for instance, may be reluctant to negotiate multilaterally if it means more passengers would transfer to alternative Caricom destinations as a result of the further entry, competition and increased consumer surpluses associated with a more liberal multilateral agreement. The comparatively liberal agreements in force for the Dominican Republic, Jamaica and the Bahamas may have therefore led to some first mover advantages in these markets. It is believed, however, that their closer geographical proximity to North American source markets relative to other Caricom destinations will lead to competitive airfares in absolute terms even in a liberal multilateral scenario. This combined with the potential for larger numbers of multiple destination tourists and connecting passengers could mitigate the risk of losing any bilateral first mover advantages.

7.3. Key contributions to the field

Two intensively researched subjects, in Europe, North America and more recently Asia, have not yet been considered for independent small island groups; those of the net overall impact of the air transport sector to such regions and the effect of liberalisation on comparatively thin but essential air networks. As a result, the first and clearest contribution of this research is related to the application of general economic theory to an understudied geographical region.

Second, up until the writing of this thesis, there was no historical or current database recording the development of bilateral and multilateral air policy in the Caricom region. The template and sampled country-pairs used for this study can be carried forward and built upon for any of the unobserved Caricom country-pair markets. More generally, policy makers and industry bodies from both the Caricom region and other regions with similarly complex regulatory frameworks would benefit from both the comparative time-series functionality of the policy database as well as the manipulation techniques used to arrive at the liberalisation index. The likely outcomes of the relaxation of any economic clause can therefore be much more visible to policy makers and negotiators. Also, the framework suggested for this thesis can be customised in other regions to include further or more relevant policy levers, a number of intuitive lever weightings and an exhaustive sample of country-pairs. In the absence of detailed records provided by such a historical policy database it would be difficult to devise a set of likely outcomes for markets with complex regulatory frameworks.

Third, the time-series and regression analysis found that, for the sampled Caricom countries, liberalisation does not have a stable relationship with competition and therefore the terms cannot be used synonymously like they have been in previous liberalisation studies. Without permission to enter markets, competitive behaviour between air carriers would obviously not be possible, but given the majority of today's bilateral and multilateral ASAs can facilitate the entry of at least two carriers the actual level of observed capacity, frequency, price and service level competition depends on how footloose carriers are to enter and leave markets and how truly contestable they are. Failure to see liberalisation and competition on two different levels results in the often made assumption that liberalisation effectively means extra competition. This distinction is particularly relevant for some Caricom markets which in some cases are natural monopoly markets or where local carriers are not at liberty to be totally responsive to regulatory framework adjustments. Further, the threat of entry, provided by a liberal designation policy, can produce the desired output effects as incumbent carriers have been observed to increase capacity in an attempt to keep airfares below new entrant marginal cost levels.

Finally, policy makers can now measure in terms of magnitude and distribution the gains from regional liberalisation, as opposed to the more traditional bilateral approach. This can enhance and inform political debate in the region, as well as act as a decision support tool for the Caricom secretariat along with individual member states and source markets.

7.4. Limitations

7.4.1. Scope

The macroeconomic baseline consisted of a sample of seven representative states in the Caricom region. The reliability of any generalisations made for other Caricom states or other states in the wider Caribbean are dependent on the statistical applicability of this sample. The regression analysis did not include an exhaustive list of country-pairs from the seven representative states with some notable source markets for some member states being left out of the sample (e.g. Canada-, Germany-Jamaica). Freight volumes were not explicitly included as an air transport output although in reality it forms an important ancillary stream of expenditure and employment in the case-study region. Neither the 2006 database nor the air traffic dependent variable included freight volumes, however, meaning the passenger impact multipliers can be assumed to be realistic (neither underestimated nor overestimated). In previous studies, including freight volumes in the sample typically increases net impact estimations, suggesting that the overall passenger based Caricom estimates are somewhat conservative. The supplier probes and national account data only encompassed two member states, meaning indirect and induced impacts were not accounted for in the remaining five sampled countries. It is conceded that this has implications for the accuracy of the overall estimates, although such inclusions would only serve to increase total impact estimates further. Finally, even if marginal increases in the indirect and induced impact of the sector were noted, the cost of externalities would have to be subtracted from this in order to make the social component of the assessment more useful and quantifiable[82].

7.4.2. Methodological issues

Up to the time of writing a consistent set of input-output tables or national account data for a breakdown of air transport contributions was not available for any of the sampled states in the case of the former and only for Trinidad & Tobago and Barbados in the case of the latter. This precluded the application of input-output estimations of induced and catalytic impacts or a workable general equilibrium analysis although it is important to note that the use of such tools does not guarantee an improvement in such impact estimations (see Montalvo 1998). It is made clear in previous literature for instance that indirect, induced and catalytic impacts have previously been assessed more qualitatively (e.g. Airport Operators Association 2005, Oxford Economic Forecasting 1999, 2002 and Airports Council International 2004). This is primarily because at every stage in the expenditure cycle there are leakages in terms of savings, payments for imports and taxation, which diverts money out of the region or into other sectors, and unless a thoroughly exhaustive resource intensive

[82] Government tax revenues shown in the two supplier probes have not been explicitly included in the quantitative assessment. As alluded to by Pearce (2005), environmental levies and taxes would need to be subtracted from externality costs to yield a net environmental cost.

input-output analysis is conducted, quantitative inferences become less and less valid the further down the impact chain you go (Caribbean Tourism Organisation 2005). Moreover, expenditure employment and output can only be counted once. The looser the relationship is between a particular industry and its perceived benefit, the more likely that various sectors make controversial and conflicting assumptions sometimes leading to double counting and overestimations.

Some prudent measures were therefore put in place to partially mitigate for the uncertainty inherent in the studies quantitative results. First, only direct and indirect wages were included in order to formulate the induced impact values. Direct and indirect intermediate and investment expenditure along with government taxes flowing to sources further down the supply chain were purposely not accounted for. Second, as previously mentioned, the overall multiplier for those sample states which were not included in the mini-case study analysis did not include indirect and induced impacts. Third, net consumer surplus (i.e. after accounting for producer losses) was not added to the air transport facilitated net expenditure flows into the region. This is considered to partly compensate for the fact that net catalytic flows were not adjusted to include possible sector leakages. Finally, the counterfactual analysis offered two separate macroeconomic gain scenarios, one to include the facilitation of catalytic tourism exports into the region and the other to exclude it. This resulted in quite marked differences in overall impact values for most of the sampled countries and thus each scenario can be considered to represent the upper and lower limit of air transport impact respectively.

7.4.3. Data availability

In terms of the time-series panel data set, fare data was not available on a route or country-pair basis. The most relevant data which was accessible to the author was a breakdown of average yields by route group. As the regression sample was broken down into similar sub-groups, however, it is believed that the aggregate values can be used to compare the partial impact of airfares across these route groups. The data sources for the dependent variable air traffic did not break it down into non-stop and connecting traffic, so although true O-D was picked up through the E/D immigration cards provided by the region’s airports, it was not possible to measure change in the number of connecting passengers as a result of further liberalisation.

Finally, airline productivity and cost data was only available on an aggregate level, although the author gained access to US route group data for the former (Duke and Torres 2005). The implication was that the partial productivity and cost effects of air reform on a particular Caricom country-pair was not directly traceable. The inclusion of change in network and route group productivity and costs was still assumed to give a fair indication of the effects of country-pair reform, however, when the weighted average was taken across the total number of airlines operating routes subject to such reforms. In other words, the annual change in average local and foreign carrier productivity and cost values on a given country-pair would give a reliable estimation of the partial effects of liberalisation when compared across a number of country-pairs at different stages of liberalisation. This determinant was not included as an independent variable in the regression specifications although it was used in the descriptive time-series analysis as well as the net consumer/producer gain analysis in the counterfactual study (Chapter 6).

7.5. Lines of further study

The next step for the socio-economic assessment would be to repeat it using input-output tables in an attempt to pick up a more accurate estimate of induced and catalytic impacts on other sectors of the economy. To enhance the currently offered multi-method net impact evaluation for this study, internalised congestion and environmental costs would have to be subtracted from an enlarged supplier probe and national account data sample. To add an important longitudinal dimension to the socio-economic impact assessment, it is also suggested that the net multi-method approach used in this study can be repeated over several years. This would improve the future accuracy of the dynamic time-series effects of liberalisation, as a unique baseline impact scenario would be available for comparison to a set of corresponding demand function observations. As the macroeconomic ratios used for this study only applied to one year (2006), it was impossible to approximate percentage change in baseline employment, expenditure and business investment values. Only a cross-sectional snapshot of additional national output over and above the 2006 baseline was available.

The inclusion of freight and even general aviation activities both in the baseline impact assessment and within an extended set of single equation regression models would improve the accuracy of the liberalisation gain assessment. The regional sub-groups used in this study can be used to predict three different output DVs; passenger, cargo and general aviation traffic volumes. As the drivers for freight and general aviation transport are considered to be different, the specification of IVs used to predict the single equation DVs would also be different. Moreover, the accessibility and consistency of freight and general aviation traffic data poses additional research complications for what may be, for some island states, a marginal improvement in the accuracy of the macroeconomic performance forecasts.

The liberalisation index can be developed further to include levers such as ownership and control rights as well as cabotage rights. It is likely these advancements will come to pass after regulatory negotiations in other regions. The observed effects of such reform can subsequently be applied to the liberalisation index to yield new maximum partial impact values. New weightings can also be developed in the future with multiple designation and open tariff rights predicted to become a regular feature of future bilateral and multilateral policy accords. If the benefits of such measures are exhausted and underlying demand is stimulated, then policy levers relating to new sources of inequality between markets, such as restricted domestic networks and limited capital investment in national carriers, would assume a more important role in stimulating additional air traffic volumes.

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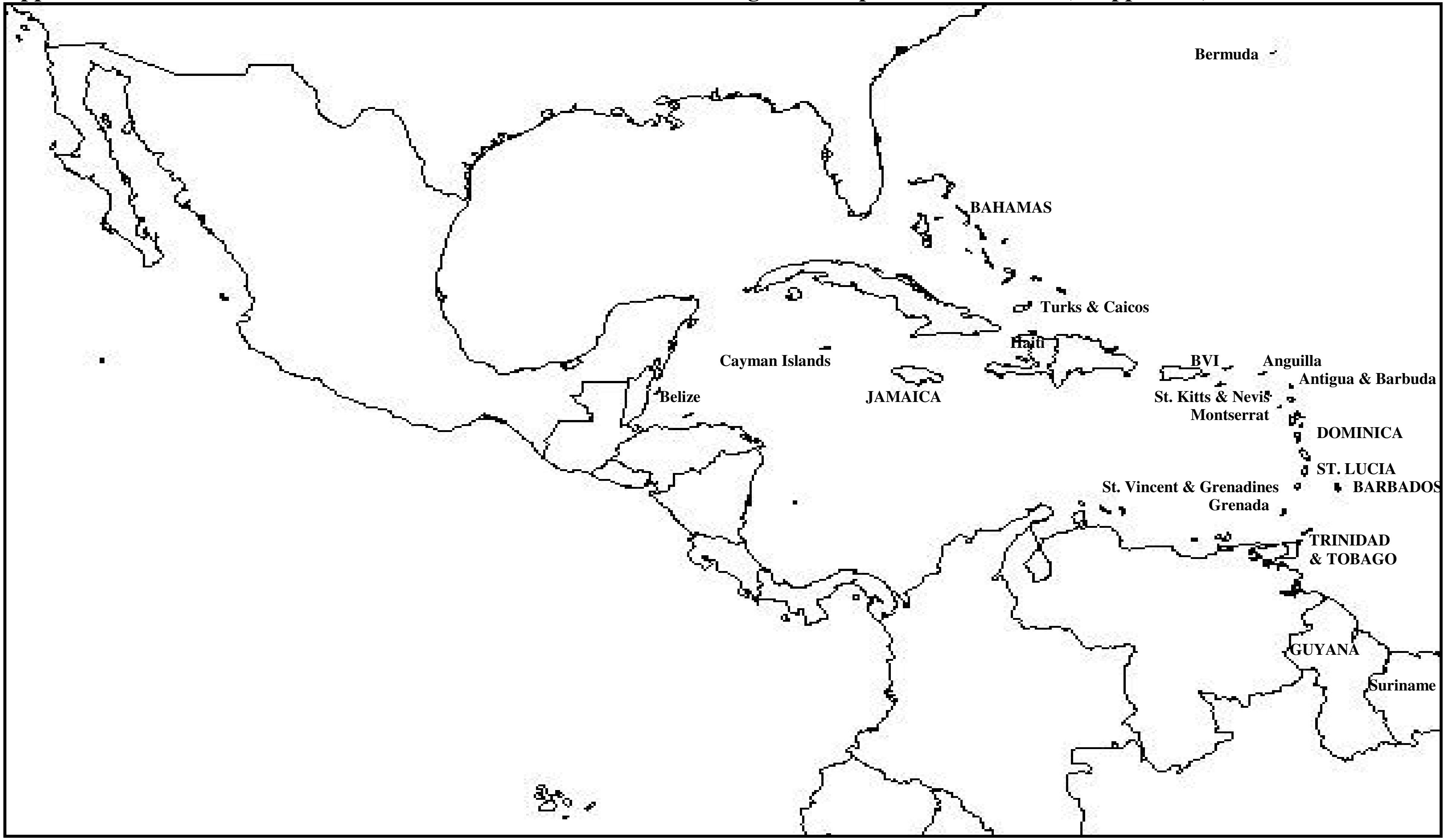
Appendices

Appendix A: Location of full and associate Caricom member states along with sampled member states (in uppercase)



Appendix B: Directional traffic flows between country-pairs

North America-Caricom markets

Year	US-Bahamas		US-Dominican Republic		US-Jamaica		US-Barbados		US-Dominica		US-Guyana		US-St. Lucia		US-Trinidad & Tobago		Canada-Barbados	
	Visitors	Residents	Visitors	Residents	Visitors	Residents	Visitors	Residents	Visitors	Residents	Visitors	Residents	Visitors	Residents	Visitors	Residents	Visitors	Residents
1995	80.8	19.2	36.2	63.8	73.6	26.4	58.8	41.2	83.4	16.6	88.0	12.0	88.1	11.9	49.3	50.7	72.2	27.8
1996	79.5	20.5	35.7	64.3	72.9	27.1	59.4	40.6	82.9	17.1	85.8	14.2	87.4	12.6	54.4	45.6	71.4	28.6
1997	84.6	15.4	35.9	64.1	74.2	25.8	60.0	40.0	83.5	16.5	76.1	23.9	86.6	13.4	55.6	44.4	73.8	26.2
1998	81.3	18.7	38.1	61.9	73.1	26.9	60.2	39.8	84.6	15.4	96.5	3.5	89.5	10.5	52.6	47.4	69.5	30.5
1999	82.4	17.6	37.8	62.2	72.3	27.7	58.7	41.3	82.1	17.9	98.9	1.1	75.3	24.7	50.1	49.9	69.8	30.2
2000	80.7	19.3	41.7	58.3	76.4	23.6	59.3	40.7	87.1	12.9	65.6	34.4	91.2	8.8	50.8	49.2	70.2	29.8
2001	85.8	14.2	45.0	55.0	74.0	26.0	59.8	40.2	93.4	6.6	73.0	27.0	93.5	6.5	47.0	53.0	66.7	33.3
2002	85.5	14.5	50.1	49.9	74.9	25.1	63.6	36.4	98.3	1.7	99.2	0.8	96.2	3.8	55.2	44.8	66.5	33.5
2003	71.7	28.3	51.1	48.9	77.0	23.0	63.7	36.3	94.1	5.9	69.0	31.0	89.5	10.5	55.3	44.7	68.9	31.1
2004	73.1	26.9	52.8	47.2	75.3	24.7	59.1	40.9	93.5	6.5	83.4	16.6	86.3	13.7	54.8	45.2	72.1	27.9
2005	76.8	23.2	54.0	46.0	76.8	23.2	63.8	36.2	96.0	4.0	78.8	21.2	79.6	20.4	53.6	46.4	64.6	35.4
2006	77.5	22.5	54.5	45.5	76.4	23.6	64.2	35.8	94.4	5.6	86.2	13.8	66.8	33.2	51.2	48.8	63.1	36.9

United Kingdom-Caricom markets

Year	UK-Bahamas		UK-Barbados		UK-Jamaica		UK-St. Lucia		UK-Trinidad & Tobago	
	Visitors	Residents	Visitors	Residents	Visitors	Residents	Visitors	Residents	Visitors	Residents
1995	92.1	7.9	86.4	13.6	72.3	27.7	97.9	2.1	52.7	47.3
1996	89.9	10.1	83.6	16.4	72.1	27.9	96.4	3.6	60.2	39.8
1997	93.1	6.9	82.2	17.8	69.5	30.5	98.2	1.8	54.6	45.4
1998	94.5	5.5	79.6	20.4	71.6	28.4	92.1	7.9	58.6	41.4
1999	90.1	9.9	81.0	19.0	70.0	30.0	91.3	8.7	59.3	40.7
2000	93.4	6.6	82.7	17.3	68.9	31.1	98.7	1.3	57.7	42.3
2001	92.6	7.4	72.4	27.6	64.0	36.0	99.2	0.8	59.3	40.7
2002	93.1	6.9	70.8	29.2	62.8	37.2	98.6	1.4	55.1	44.9
2003	88.4	11.6	76.2	23.8	70.5	29.5	97.7	2.3	61.1	38.9
2004	90.6	9.4	74.4	25.6	65.9	34.1	95.5	4.5	60.2	39.8
2005	91.2	8.8	75.1	24.9	62.1	37.9	94.3	5.7	62.3	37.7
2006	89.5	10.5	78.3	21.7	60.3	39.7	93.4	6.6	61.9	38.1

Intra-Caricom markets

Year	Bahamas-Barbados		Bahamas-Jamaica		Barbados-Guyana		Barbados-Jamaica		Barbados-St.Lucia		Barbados-T&T		Dominica-T&T		Guyana-T&T		Jamaica-T&T		Suriname-T&T	
	Bah Res	Barb Res	Bah Res	Jam Res	Barb Res	Guy Res	Barb Res	Jam Res	Barb Res	St. L Res	Barb Res	T&T Res	Dom Res	T&T Res	Guy Res	T&T Res	Jam Res	T&T Res	Sur Res	T&T Res
1995	56.6	43.4	54.5	45.5	33.4	66.6	41.4	58.6	53.7	46.3	51.9	48.1	24.1	75.9	71.0	29.0	47.8	52.2	47.5	52.5
1996	52.9	47.1	51.5	48.5	32.5	67.5	47.2	52.8	51.6	48.4	52.5	47.5	25.6	74.4	74.5	25.5	49.3	50.7	49.8	50.2
1997	53.1	46.9	49.9	50.1	31.4	68.6	48.3	51.7	49.3	50.7	51.0	49.0	24.1	75.9	75.2	24.8	48.9	51.1	50.2	49.8
1998	57.0	43.0	54.6	45.4	32.7	67.3	38.1	61.9	50.1	49.9	54.3	45.7	20.0	80.0	73.3	26.7	48.9	51.1	47.0	53.0
1999	56.2	43.8	58.1	41.9	40.2	59.8	41.3	58.7	41.6	58.4	56.9	43.1	22.7	77.3	69.6	30.4	49.2	50.8	48.7	51.3
2000	55.4	44.6	55.9	44.1	39.1	60.9	45.0	55.0	42.5	57.5	57.3	42.7	16.2	83.8	67.8	32.2	49.3	50.7	49.9	50.1
2001	55.4	44.6	62.5	37.5	36.9	63.1	42.9	57.1	47.7	52.3	57.0	43.0	33.2	66.8	71.2	28.8	49.9	50.1	51.5	48.5
2002	50.9	49.1	64.5	35.5	37.8	62.2	44.3	55.7	54.2	45.8	57.1	42.9	21.8	78.2	69.3	30.7	47.8	52.2	50.2	49.8
2003	54.1	45.9	34.2	65.8	30.2	69.8	43.6	56.4	54.2	45.8	57.5	42.5	25.2	74.8	71.4	28.6	45.8	54.2	50.9	49.1
2004	53.2	46.8	53.3	46.7	31.3	68.7	43.9	56.1	50.8	49.2	57.2	42.8	21.7	78.3	68.6	31.4	46.1	53.9	51.5	48.5
2005	52.4	47.6	52.5	47.5	29.7	70.3	42.1	57.9	50.2	49.8	58.4	41.6	29.4	70.6	69.4	30.6	45.2	54.8	53.7	46.3
2006	49.8	50.2	54.1	45.9	28.3	71.7	46.7	53.3	52.7	47.3	56.3	43.7	28.0	72.0	70.8	29.2	43.9	56.1	55.4	44.6

Source: Author based on annual airport traffic and E/D data along with Caribbean Tourism Organisation visitor data

Appendix C: Jamaica Air Passenger Survey - Executive summary of results

Introduction

The primary objective of the Caricom wide passenger survey conducted by David Warnock-Smith, of Cranfield University UK, between the months of May 2006 and February 2007, at a number of key regional airports was to partially satisfy the data requirements necessary for the progression and the completion of a personal PhD thesis on the subject of the socio-economic impact of the air transport industry to the Caricom region. However it was discovered at an early stage that there would be a number of external stakeholders who would also be interested in some or all of the aggregated and disaggregated results of the passenger survey given its originality in terms of its potential for providing comparative results between Caricom states and also with respect to the combining of visitor travel patterns as well as travel trends among the regions indigenous populations. Interested parties include regional and national tourism authorities, airports, air carriers and government authorities. The author conducted the survey basing himself in Barbados for the duration of the data collection period.

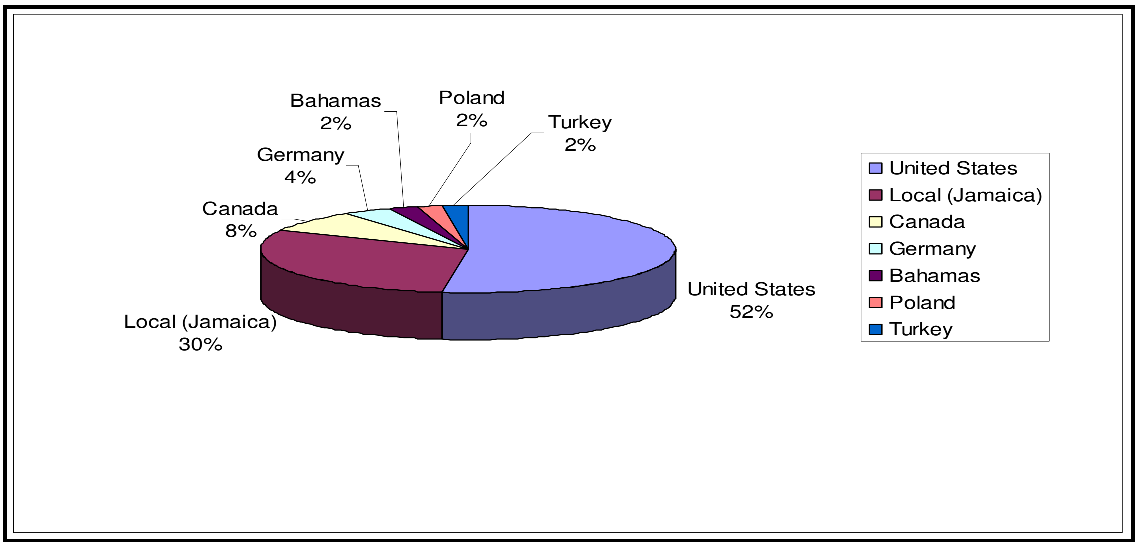
The results summarized below have been customized specifically for airport stakeholders, with a number of questions contained within the survey being of direct interest to airport managers. Airport managers naturally need to keep a close eye on, *inter-alia,* travel trends, passenger opinions about the regions airports and their travel experiences as well as local and visitor air fare and expenditure trends or similar trends affecting the long-run demand of airport usership.

It is important to note that the following Jamaica results only present a snapshot in time that is of two busy high season days between the dates of 12th and 13th of December 2006. In order to make some valid inferences on a longitudinal basis the survey would need to be repeated both during the low season and on various days of the week. It may be added that the results shown below are based on surveys conducted during one of the busiest days of the week at Montego Bay (MBJ), a Sunday, and a typical day of the week at Kingston (KIN), a Monday as per the winter 2007 airline schedule.

This summary will present results and observations pertaining to the place of residence of air travellers passing through both MBJ and KIN airports, the ratio of incoming to outgoing passengers, passenger ratings of airport facilities and service levels, the average stay of visitors disaggregated by airport, a summary of some of the passenger remarks relating to their travel experiences and the average air fare that both locals and visitors have to bear in order to travel to and from Jamaica broken down by short, medium and long distance sectors. Finally the document will provide a summary of some empirical observations made by the author whilst conducting the surveys in person at the two Jamaica airports.

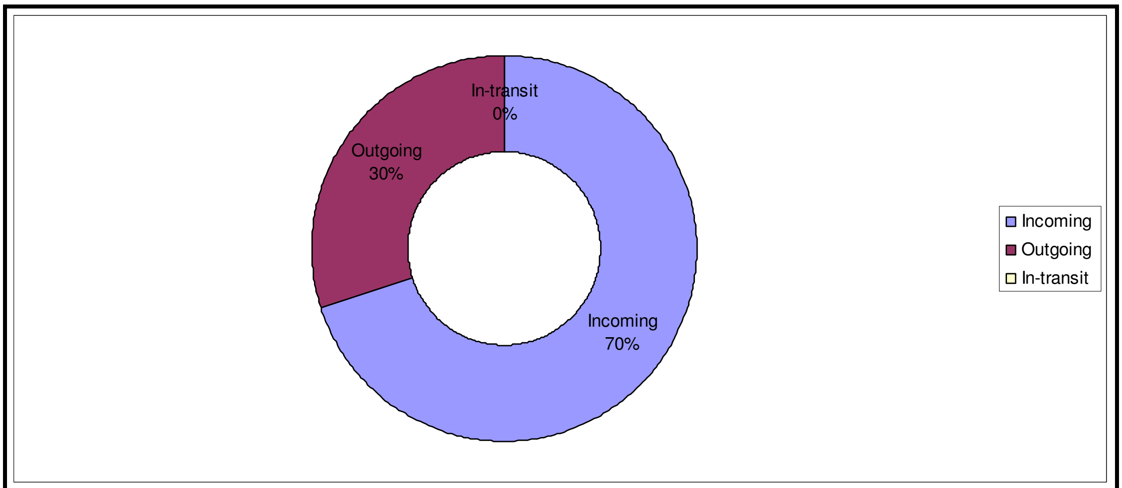
Presentation of results

Figure 1: Place of residence of departing passengers from MBJ and KIN airports



The survey shows clearly that the United States is the main source market of visitors to Jamaica with over 50% of all respondents citing that their place of residence was the United States (US). Interestingly there were no visitors from the United Kingdom (UK) captured by the survey. It should be noted however that Jamaica currently enjoys both scheduled and charter services from the UK to Montego Bay and scheduled services only through to Kingston. It is reasonable to assume that the survey results are not representative of the current situation on the UK – Jamaica market although it does reflect a lower frequency when compared to air services from source markets. Perhaps the most significant finding stemming from the 'place of residence' question was the large percentage of Jamaican residents captured by the survey. A more balanced flow of air traffic normally leads to more a more consistent portfolio of air services as many scheduled carriers recognise that the success or failure of a route does not depend almost entirely on the unpredictable tourism sector. The other finding worthy of note is the lack of respondents citing their place of residence as another Caricom or Caribbean state (only 2%). When combined with the results from **Figure 2** it becomes clear that, despite Jamaica having the largest number of US gateways in the Caricom region, travellers based in other Caricom states are not using Jamaica as a sub-regional hub in order to make connections into the US and North America. As per the winter timetable 2007 only Air Jamaica offered the option of doing so from a number of Caricom states.

Figure 2: Ratio of local to visitor traffic at MBJ and KIN airports



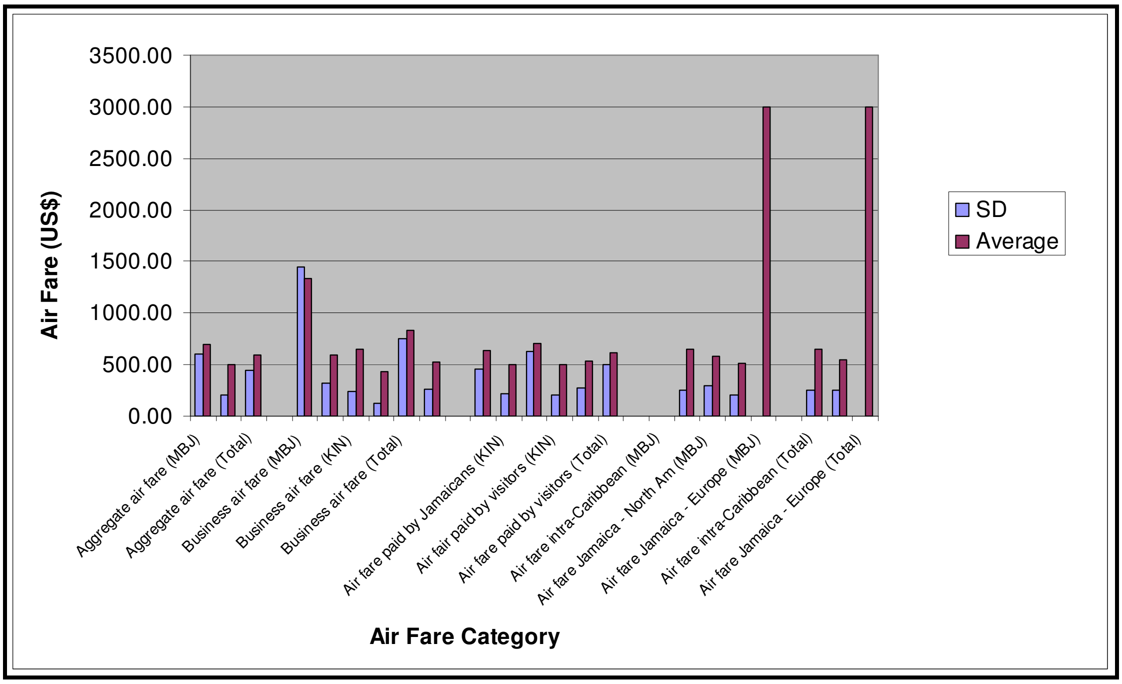
Like most Caribbean islands Jamaica boasts a large surplus in the international trading of tourism services. However in comparison to most Caricom states the survey results implicate that in Jamaica's case there is a less notable trade imbalance. This can be partly explained by the large Jamaican Diasporas now residing the US and the UK, for example, which often necessitate large amounts of VFR (Visiting Friends and Relatives) type traffic. The survey results support this assumption with as much as 53% of all Jamaican respondents citing VFR as their main purpose of travel. Although current GDP (PPP) in Jamaica does not suggest high levels of disposable income for leisure travel, perhaps Jamaica's geographical proximity to the US mitigates this problem to some extent. For those not citing VFR as their main purpose of visit (47%), 30% said they were travelling for business purposes which 15% cites shopping/holiday as their major reason for travel.

Figure 3: Bar chart to show passenger ratings of facilities and overall service levels at both MBJ and KIN airports

Overall, passenger ratings of airport facilities and service levels were very positive for both Montego Bay and Kingston airports. At Montego Bay and Kingston 100% of all respondents rated their airport experience at a satisfactory level or above, with 10% stating that their experience was excellent. At Kingston airport respondents were not quite as contented with the facilities and service levels with 47% of respondents giving a satisfactory response. At Montego Bay more respondents tended to gravitate towards a good rating as opposed to a satisfactory one with as much as 60% of all respondents giving a good rating. Similarly 7% of respondents gave a rating of excellent at Kingston whereas at Montego Bay the figure was slightly higher at 12%.

Passengers at both Montego Bay and Kingston have been subject to inconveniences due to intensive phases of construction work taking place at both airports in the past few years. At Kingston these inconveniences were more notable than at Montego Bay at the time the survey was conducted. The fact that the new concourse at Kingston had not yet been not completed could go some way to explaining the higher number of satisfactory ratings at Kingston as compared to Montego Bay. Also it is reasonable to assume that inconveniences are generally noticed more by business travellers and by those that use the same airport facilities on a regular basis. The survey results show that at Kingston there are a higher number of business travellers and frequent users than at Montego Bay perhaps reflecting higher levels of expectation and consequently poorer facility and service ratings.

Figure 4: **Mean average and standard deviation of air fares disaggregated by local and visitor traffic, short, medium or long sector traffic, and business and leisure traffic at both KIN and MBJ airports**



It is found in **Figure 4** that, on average, every air passenger pays US$594.82 for his/her return ticket into or out of Jamaica. As expected however there was a high level of variation in the set of values with the aggregate standard deviation of each value being as high as US$446.19. Possible reasons for this high variation in air fares include flight sector distance, whether the traveller was on business or leisure, whether the respondent received a discounted fare or used a Frequent Flyer Programme (FFP) or whether the respondent was purchasing his/her ticket from Jamaica or abroad. A good illustration of this variation is shown when the results are disaggregated by sector distance. Usually intra-Caribbean average fares are lower than middle-distance flight sectors into North America. However Jamaica's geographical position in the Northern Caribbean means that certain US destinations can also be considered short sector routes. For example flight time between Jamaica and Miami is scheduled at two hours which is actually less or equal to some regional destinations in the Southern Caribbean. It is for this reason perhaps that the average fare paid for an intra-Caribbean journey was higher than normal at US$648.82 with a comparatively high standard deviation for each value (US$256). Short distance flights to the US and Canada cost each respondent less than intra-Caribbean sectors at US$546.83 on average where as long distance journeys to the UK and Europe showed the highest mean average of US$1472.50 as expected. Furthermore, on less competitive sectors average air fares are generally higher. The introduction of low cost carriers Spirit on the South Florida market and Jet Blue on the New York market has perhaps served to reduce average air fares to levels below intra-Caribbean routes where only one or two carriers provide a service. It is interesting to note that air carriers make every effort to price discriminate between passengers based on their respective price elasticities of demand. The average local respondent only paid US$535.36 for his/her return journey where as the average visitor paid on average US$84.25 more. Typically the average business respondent paid US$316 more than the average leisure traveller. The business results show a higher level of variability also and can be partly explained by the fact that some regular travellers build up air miles and end up paying heavily discounted fares. But if these exceptions are taken away variability decreases showing that discrimination for more flexible fares is practised in a uniform way amongst air carriers.

Table 1: Summary of passenger remarks related to facilities and service of Jamaica's airports

Montego Bay (MBJ)

1. Facilities are going to be excellent. Airport staff, however, has to ensure that A/C is always working in customs and immigration area
2. Arrivals area needs work to get it up to the same standard as the new departure area to ensure a consistently high level of facilities in all areas
3. A poor air transport experience does not take away from the attractiveness of Jamaica as a destination
4. Montego Bay airport is excellent. Particularly impressed with short lines for customs/immigration unlike US
5. Incoming flight was delayed. Trip was dependent on time factor. I won't forget this experience
6. MBJ combined with Montego Bay the town has a good set up for cruise stay tourism and should make every effort to further improve this product
7. Jamaica is currently well served from the UK. I think a good choice of services and a competitive network makes an airport attractive to passengers even if facilities are slightly dated
8. Given only a satisfactory airport rating because the area around Gate 4 is scruffy
9. Air Jamaica always experiences delays and it is not helped by the fact that they always have to stop in Kingston. Airport in-transit procedure could be more convenient with less entering and leaving of different areas of the airport

Kingston (KIN)

10. Airport will be good when it is completed. They are doing a satisfactory job of minimizing the inconveniences owing to construction work
11. Airport seems to take little interest in making airport environment healthier and less depressing Better ground access needed preferably with some proper landscaping in airport areas
12. Mandeville as a remote community has a poor service at the moment
13. Airline check in area was dirty (Air Jamaica)
14. Caribbean has such a strong tradition that a poor airport/airline service would not take away from that

Table 2: Initial observations of survey results for Jamaica's major airports

Montego Bay (MBJ)

1. Brand loyalty for Air Jamaica appears to have built up among Jamaicans living abroad where as residents of other nationalities tend not to consider Air Jamaica when organising their flights details (50% of all surveyed Jamaican foreign residents used Air Jamaica as their air carrier of choice).

2. Air Jamaica flights on day of survey were mostly delays and as a result received the lion's share of passenger complaints.

3. Survey results indicate a low number of in-transit passengers making interline or online transfers (1%) and a low level of multi-destination type tourism (2%).

4. At the time of research there was a notable difference in the standards of facilities between the two main concourse areas. This was recognised by a few respondents.

5. Moderate/High number of travellers passing through MBJ bought package holidays. Moreover there were some notable cases of cruise passengers choosing Jamaica as the place to depart region.

6. A high variation and choice of US destinations from MBJ. This was reflected in the survey results by the fact that a low number of respondents had to make onward connections. This shows clearly that, compared to other airports in the region, MBJ serves a high number of US gateways.

7. The designated smoking area in a plus point for MBJ as it was not evident at other airports in the region.

8. A low level of business passengers were captured by the survey although these results could have been intensified by the fact that the survey was carried out on a Saturday, a busy day for leisure travellers but not for business travellers.

9. The number of Jamaican residents travelling from MBJ was low. Those that did used mainly Air Jamaica flights. The number of Jamaicans citing their major purpose of visit as tourism was minimal.

Kingston (KIN)

10. A low number of Jamaican survey respondents were departing for other Caricom (Caribbean destinations).

11. KIN had a good choice of catering at reasonable prices.

12. A mainly local usership of airport but many form part of Jamaican Diaspora residing or having friends/relatives residing in other countries.

13. Despite the fact that there was a low level of leisure travellers passing through Kingston a notable number of passengers cited study or training as their main purpose of trip providing evidence that Kingston airport facilitates the essential connectivity necessary for the transfer of knowledge between nations.

14. The inconvenience caused by the upgrading of the airport appeared to be minimal, even in peak periods. The only minor negative observation was that arriving and departing passengers have to funnel through the same doors which, according to a few respondents led to confusion at times.

15. Some surveyed respondents cited poor ground access as an issue which needs to be resolved with some urgency at KIN.

Table 3: Average length of stay for air visitors entering Jamaica and locals travelling to other destinations at both MBJ and KIN airports

Average stay (incoming passengers) = 8.08 days not including outlier of 90 days

Average stay (incoming passengers) departing from MBJ = 8.33 not including outlier of 90 days

Average stay (incoming passengers) departing from KIN = 7.69

Average stay (outgoing passengers) = 16.71 days not including outlier of 180 days

Average stay (outgoing passengers) departing from MBJ = 22 days not including outlier of 180 days

Average stay (outgoing passengers) departing from KIN = 11.82 not including outlier of 60 days

Appendix D: Example of the pilot passenger survey (Barbados)

BARBADOS

Pilot Passenger Survey

This survey is being conducted by David Warnock-Smith (PhD student)
On behalf of Cranfield University, UK

(NAME OF TRAVELLER NOT REQUIRED)

To be conducted in the departure areas of the regions airports (targeted to outgoing passengers returning to their place of residence or to locals starting their journey)

i) Date of interview

……………………………………………………………………………………

ii) Time of interview

……………………………………………………………………………………

iii) Date, Time and Flight number of flight

……………………………………………………………………………………

iv) Final Destination

……………………………………………………………………………………

1(a). Are you a Barbadian resident?

Yes ☐ No ☐

1(b). If the answer to 1 (a) is 'no' where is your normal place of residence?

……………………………………………………………………………………

2. What best describes your journey today?

On a holiday/leisure trip and returning home ☐

On a holiday/leisure trip and en route to destination ☐

On a business trip and returning home ☐

On a business trip and en route to destination ☐

Other (please specify) ☐

……………………………………………………………………………………

3. How many people (adults and children aged 15 and under) are travelling in your party (circle)?

Adults	1	2	3	4	5	>5
Children	1	2	3	4	5	>5

4. What is (was) the duration of your trip to the region (No. of nights)?

In Barbados ....

In other Caribbean countries ....

Outside the region ....

5. Where is (was) your main destination during this trip?

Caricom (specify country) ☐ ....

Other Caribbean (specify country) ☐ ....

Overseas (specify country) ☐ ....

6. What are (were) the main purposes of your visit to Barbados (your destination)?

Holiday	☐	Sports	☐
Holiday/Business	☐	Education	☐
Honeymoon	☐	Hospital treatment	☐
Conference/meeting	☐	Shopping	☐
Festival	☐	Other (please specify)	☐
Business Only	☐	....	
Visiting Friends and Relatives	☐		

7. How important was the price of your flight ticket in your decision to make this trip?

Vital ☐

Very important ☐

Somewhat important ☐

Not important ☐

8. How important was the convenience of your flight times and booking process in your decision to make this trip?

Vital ☐

Very important ☐

Somewhat important ☐

Not important ☐

9. How was your trip booked?

Airline call centre ☐

Airline ticket office ☐

Private travel agent ☐

Internet ☐

Other (please specify) ☐

…………………………………….

10.(a) Are you a Caribbean national living abroad?

Yes ☐ No ☐

(b) If not is this your first visit to Barbados?

Yes ☐ No ☐

(c) If you visited Barbados before have you ever visited on a cruise ship?

Yes ☐ No ☐

(d) Is this your first visit to the Caribbean region?

Yes ☐ No ☐

(e) If not where else have you been to in the region?

…………………….. ……………………..

…………………….. ……………………..

…………………….. ……………………..

(f) Have you ever used any other form of transport for your travel needs in the region apart from air and cruise ship transport (please specify)?

……………………………………….

11. In what type of accommodation did you stay in Barbados (where are you going to stay outside Barbados)?

International Hotel Chain ☐

Local Hotel ☐

Guest House ☐

Private House ☐

Boat/Yacht ☐

Apartments (catered) ☐

Apartments (self catered) ☐

Other (please specify) ☐

…………………………………..

12. With which airlines are you (have you been) travelling with during your trip?

……………………………………

……………………………………

13(a). What was (will be) your estimated total expenditure for your trip?

$US………….....

13(b). How much of this expenditure was (will be) directed towards:

Air Fares	☐	Other meals and drinks	☐
Accommodation	☐	Taxi/Car rentals/tours/bus	☐
Entertainment/recreation	☐	Other shopping	☐
Souvenirs	☐	Other spending (please specify)	
Business transactions	☐	**………………………………………**	

14. How many persons are covered by the above expenditure (circle)?

1 2 3 4 5 6 7 8 9 10 >10

15. Is (was) your flight to your destination direct?

Yes ☐ No ☐

16. How would you assess the overall service level of the airline with whom you are travelling?

Excellent ☐

Good ☐

Satisfactory ☐

Poor ☐

Very poor ☐

Other comments:-
………
………

17. How would you assess the facilities and the overall service of the airport in Barbados?

Excellent ☐

Good ☐

Satisfactory ☐

Poor ☐

Very Poor ☐

Other comments:-
....
....

18. **If you have been to any other airport in the region how would you assess those in terms of facilities and overall service?**

Excellent ☐

Good ☐

Satisfactory ☐

Poor ☐

Very Poor ☐

19. **If you are travelling as a tourist and/or visiting friends and relatives please state to what extent you agree with the following statements (circle).**

(a) Barbados (or destination) would be a less attractive place to visit if **air transport was expensive**

Strongly agree *Agree* *No difference*

(b) Barbados (or destination) would be a less attractive place if there were **only a few travel options**

Strongly agree *Agree* *No difference*

(c) Barbados (or destination) would be a less attractive place if it was **difficult to get to and from the airport**

Strongly agree *Agree* *No difference*

(d) Barbados (or destination) would be a more attractive place if **connections were more convenient** within, to and from the region

Strongly agree *Agree* *No difference*

20. **If you are travelling on business what type of activities are you (were you) undertaking as part of your business trip?**

Visiting existing customers	☐	Visiting existing suppliers	☐
Visiting potential customers	☐	Visiting potential suppliers	☐
Visiting part of own company/subsidiary	☐	Attending meeting	☐
Visiting (potential) business partner	☐	Attending training exercise	☐
Undertaking work tasks/contract work	☐	Attending job interview	☐
Assessing area for potential investment	☐	Studying	☐
Other (please specify)	☐		

21. **If you are travelling on business or conducting some business activity during your trip please state to what extent you agree with the following statements (circle).**

(a) My business or the business I work for would be more **able to attract suitable staff** if air transport was more economical and more efficient

Strongly agree *Agree* *No difference*

(b) My business or the business I work for would have **improved access to customer markets** if air transport was more economical and more efficient

Strongly agree *Agree* *No difference*

(c) My business or the business I work for would have **better access to suppliers** if air transport was more economical and more efficient

Strongly agree *Agree* *No difference*

(d) My business or the business I work for would **have much improved communication** with other parts of the firm/business partners if air transport was more economical and more efficient

Strongly agree *Agree* *No difference*

(e) My business or the business I work for would consider **exporting/importing more high value products** if air transport was more economical and more efficient

Strongly agree *Agree* *No difference*

22. Please describe any other benefits for you or your business which could be derived from a more efficient and economic air transport network in the region.

……………………………………………………………………………………………………
…………………………………………………………………………………………………...

23. **What is the occupation of the chief income earner in your household?**
……………………………………………………………………………..

24. **In general how important do you see air transport's role in the region in terms of (please specify level of importance on a scale of 1 to 10; 1 being Not important and 10 being Very Important) :-**

(a) Contributing to sustainable development in the region (tourism, productivity a and negatively on the environment)

1 2 3 4 5 6 7 8 9 10

(b) Supporting remote and island communities (improved access to basic facilities, improved quality of life in remote community)

1 2 3 4 5 6 7 8 9 10

(c) Widening choice (less seasonality in sales of fruit and vegetables, larger range of holiday destinations, cheaper and more frequent access to air transport services for passengers, freight and post)

1 2 3 4 5 6 7 8 9 10

(d) Delivering humanitarian aid in emergency situations

1 2 3 4 5 6 7 8 9 10

Appendix E: Example of the main Caricom passenger survey (Jamaica)

JAMAICA

Air Passenger Survey

This survey is being conducted by David Warnock-Smith (PhD student)
On behalf of Cranfield University, UK

(NAME OF TRAVELLER NOT REQUIRED)

i) Date of interview

……………………………………………………………………………………

ii) Time of interview

……………………………………………………………………………………

iii) Flight number of flight

……………………………………………………………………………………

1(a). Are you a Jamaican resident?

Yes ☐ No ☐

1(b). If the answer to 1 (a) is 'no' where is your normal place of residence?

……………………………………………………………………………………

2. What best describes your journey today?

On a holiday/leisure trip and returning home ☐

On a holiday/leisure trip and en route to destination ☐

On a business trip and returning home ☐

On a business trip and en route to destination ☐

Other (please specify) ☐

……………………………………………………………………………………

3. How many people (adults and children aged 15 and under) are travelling in your party (circle)?

Adults	1	2	3	4	5	>5
Children	1	2	3	4	5	>5

4. What is (was) the duration of your trip to (outside) the region (No. of nights)?

In Jamaica **……………………**

In other Caribbean countries **……………………**

Outside the region **……………………**

5. Where is (was) your main destination during this trip?

Caricom (specify country) ☐ ………………………………
Other Caribbean (specify country) ☐ ………………………………
Overseas (specify country) ☐ ………………………………

6. What are (were) the main purposes of your visit to Jamaica (your destination)?

Holiday	☐	Sports	☐
Holiday/Business	☐	Education	☐
Honeymoon	☐	Hospital treatment	☐
Conference/meeting	☐	Shopping	☐
Festival	☐	Other (please specify)	☐
Business Only	☐	…………………………………	
Visiting Friends and Relatives	☐		

7. How important was the price of your flight ticket in your decision to make this trip?

Vital	☐	Very important	☐
Somewhat important	☐	Not important	☐

8. How important was the convenience of your flight times and booking process in your decision to make this trip?

Vital	☐	Very important	☐
Somewhat important	☐	Not important	☐

9. How was your trip booked?

Airline call centre	☐	Airline ticket office	☐
Private travel agent	☐	Internet	☐
Other (please specify)	☐		

…………………………………….

10.(a) Are you a Caribbean national living abroad?

Yes ☐ No ☐

(b) If not is this your first visit to Jamaica?

Yes ☐ No ☐

(c) If you visited Jamaica before have you ever visited on a cruise ship?

Yes ☐ No ☐

(d) **Is this your first visit to the Caribbean region?**

Yes ☐ No ☐

(e) **If not where else have you been to in the region?**

…………………….. ……………………..

…………………….. ……………………..

…………………….. ……………………..

(f) **Have you ever used any other form of transport for your travel needs in the region apart from air transport (please specify)?**

……………………………………….

11. **In what type of accommodation did you stay in Jamaica (where are you going to stay outside Jamaica)?**

International Hotel Chain	☐	Boat/Yacht	☐
Local Hotel	☐	Apartments (catered)	☐
Guest House	☐	Apartments (self catered)	☐
Private House	☐		

12. **With which airlines are you (have you been) travelling with during your trip?**

……………………………………

……………………………………

……………………………………

13(a). **What was (will be) your estimated total expenditure for your trip?**

$JM or US…………..

13(b). **What was your estimated expenditure for your air ticket?**

$JM or $US…………..

13(c). **You would still have travelled unless your air fare went up by:-**

1-20%	☐	81-100%	☐
21-40%	☐	Above 100%	☐
41-60%	☐	0% or less	☐
61-80%	☐	Would pay any price	☐

13(d). Does your total expenditure include?

Accommodation ☐ Other meals and drinks ☐

Entertainment/recreation ☐ Taxi/Car rentals/tours/bus ☐

Souvenirs ☐ Other shopping ☐

Business transactions ☐ Other spending (please specify) ☐

……………………………………….

14. How many persons are covered by the above expenditure (circle)?

1 2 3 4 5 6 7 8 9 10 >10

15. Is (was) your flight to your destination direct?

Yes ☐ No ☐

16. How would you assess the overall service level of the airline(s) with whom you are travelling?

Excellent ☐ Good ☐

Satisfactory ☐ Poor ☐

Very poor ☐

Other comments:-

………

………

17. How would you assess the facilities and the overall service of the airport in Jamaica?

Excellent ☐ Good ☐

Satisfactory ☐ Poor ☐

Very Poor ☐

Other comments:-

………

………

18. If you have been to any other airport in the region how would you assess those in terms of facilities and overall service?

Excellent ☐ Good ☐

Satisfactory ☐ Poor ☐

Very Poor ☐

19. **If you are travelling as a tourist and/or visiting friends and relatives please state to what extent you agree with the following statements (circle).**

(e) Jamaica (or destination) would be a less attractive place to visit if **air transport was expensive**

Strongly agree *Agree* *No difference*

(f) Jamaica (or destination) would be a less attractive place if there were **few air carriers and low frequencies**

Strongly agree *Agree* *No difference*

(g) Jamaica (or destination) would be a less attractive place if it was **difficult to get to and from the airport**

Strongly agree *Agree* *No difference*

(h) Jamaica (or destination) would be a more attractive place if **more air connections were available** within, to and from the region

Strongly agree *Agree* *No difference*

20. **If you are travelling on business what type of activities are you (were you) undertaking as part of your business trip?**

Visiting existing customers	☐	Visiting existing suppliers	☐
Visiting potential customers	☐	Visiting potential suppliers	☐
Visiting part of own company/subsidiary	☐	Attending meeting	☐
Visiting (potential) business partner	☐	Attending training exercise	☐
Undertaking work tasks/contract work	☐	Attending job interview	☐
Assessing area for potential investment	☐	Studying	☐
Other (please specify)	☐		

…………………………………………………

21. **Please state to what extent you agree with the following statements (circle).**

(f) My business or the business I work for is more able **to attract suitable staff** when there is economical and efficient access to air transport

Strongly agree *Agree* *No difference*

(g) My business or the business I work for is more able to have **improved access to customer markets** when there is economical and efficient access to air transport

Strongly agree *Agree* *No difference*

(h) My business or the business I work for is more able to have **better access to suppliers** when there is economical and efficient access to air transport

Strongly agree *Agree* *No difference*

(i) My business or the business I work for is more able to **improve communications** with other parts of the firm/business partners when there is economical and efficient access to air transport

Strongly agree *Agree* *No difference*

(j) My business or the business I work is more able to **consider exporting/importing more high value products** when there is economical and efficient access to air transport

Strongly agree *Agree* *No difference*

22. What is the occupation of the chief income earner in your household?

……………………………………………………………………………..

23. In general how important do you see air transport's role in the region in terms of (please specify level of importance on a scale of 1 to 10; 1 being Not important and 10 being Very Important) :-

(a) Contributing to sustainable development in the region (tourism, productivity a and negatively on the environment)

1 2 3 4 5 6 7 8 9 10

(b) Supporting remote and island communities (improved access to basic facilities, improved quality of life in remote community)

1 2 3 4 5 6 7 8 9 10

(c) Widening consumer choice (larger range of holiday destinations, cheaper and more frequent access to air transport services for passengers, freight and post less seasonality in sales of fruit and vegetables and other perishables)

1 2 3 4 5 6 7 8 9 10

(d) Delivering humanitarian aid in emergency situations

1 2 3 4 5 6 7 8 9 10

Appendix F: Example of the main Caricom business survey

Basic company information

Position of questionnaire respondent within the company.	
Estimated turnover of company (US$).	
Sector(s) in which the company is involved.	
Approximate number of employees in the company.	
Location of company headquarters.	

Questionnaire

Question 1: Approximately what proportion of the sales of your company's products and/or services are destined for (please tick the corresponding box):-	**Proportion of sales (%)**									
Market	*0-10*	*11-20*	*21-30*	*31-40*	*41-50*	*51-60*	*61-70*	*71-80*	*81-90*	*91-100*
Local or domestic markets.										
Intra Caribbean markets.										
Outside the Caribbean region.										

Question 2: Approximately what proportion of your company's factors of production are sourced in (please tick the corresponding box):-	**Proportion of factors of production (%)**									
Market	*0-10*	*11-20*	*21-30*	*31-40*	*41-50*	*51-60*	*61-70*	*71-80*	*81-90*	*91-100*
Local or domestic markets.										
Intra Caribbean markets.										
Outside the Caribbean region.										

Question 3: How frequently would you say that your company utilizes air transport services (please tick the appropriate boxes)?			
Frequency/Type of service	*Passenger*	*Cargo*	*Courier*
Multiple times per day.			
Daily.			
Three-six times a week.			
Weekly.			
Monthly.			
Yearly.			
Other (please specify below).			

Question 4: Please indicate the relative importance of each of the factors below in determining your company's investment decisions for entering into new markets (please tick the appropriate box for each factor).	**Scale of importance**			
Factor	*Vital*	*Very important*	*Somewhat important*	*Not important*
Size of local Market.				
Availability of skilled labour.				
Cost of labour.				
Access to cheaper raw materials and intermediate products/services.				
Quality of infrastructure (land transport, communications, utilities).				
Government regulation of business.				
Business tax incentives.				
Quality of air links.				
Quality of sea links.				
Property costs/rent.				
Other factors (please specify below and rate).				

Question 5: Approximately what proportion of your company's production costs is incurred by international transport (please tick the appropriate box)?	
0-10%	
11-20%	
21-30%	
31-40%	
41-50%	
51-60%	
61-70%	

Question 6: Of those international transport costs approximately what proportion is attributed to (please tick the corresponding box):-	Proportion of transport costs (%)									
Factor	*0-10*	*11-20*	*21-30*	*31-40*	*41-50*	*51-60*	*61-70*	*71-80*	*81-90*	*91-100*
Employee/customer/supplier travel expenses by air.										
Employee/customer/supplier travel expenses by ship.										
Product to market expenses by air.										
Product to market expenses by ship.										
Product to market by air courier.										
Import receipts by air.										
Import receipts by ship.										
Import receipts by air courier.										
Other (please specify below and rate).										

<u>Question 7</u>: How important do you feel the existence of good passenger air transport links are for (please tick the appropriate box for each factor):-	**Scale of Importance**			
Factor	*Vital*	*Very important*	*Somewhat important*	*Not important*
Servicing customer needs and meeting clients.				
Efficiency of production.				
Making investments in new and foreign markets.				
Sales and marketing.				
Meeting and servicing the needs of suppliers.				
Research, development and innovation of services and products.				
Better quality of life for staff in locations with better air links.				
Staff who regularly commute to work.				
Overseas competition in your markets.				
Increasing profitability.				
Caribbean integration of trade, tourism and culture.				

<u>Question 8 (a):</u> Has the absence of good and/or efficient air transport links ever affected your company's investment decisions (please tick the appropriate box)?	
Yes	
No	

<u>Question 8 (b):</u> If your answer to question 8 (a) was 'Yes' how has the absence of good and efficient air transport links affected your company's investment decisions (please tick the appropriate box)?	
No investment was made.	
Investment was made anyway but with higher costs.	
Investment was made elsewhere within Caribbean.	
Investment was made elsewhere outside Caribbean.	

Source: On-line survey provider - freeonlinesurveys.com

Appendix G: Caricom air policy development database (full accounts)

UK-Caricom markets

Country-pair	UK-Bahamas		UK-Barbados		UK-St. Lucia		UK-Jamaica		UK-Trinidad & Tobago	
Year	**Before reform (dates)**	**After reform (dates)**	**Before reform (dates)**	**After reform (dates)**	**Before reform (dates)**	**After reform (dates)**	**Before reform (dates)**	**After reform (dates)**	**Before reform (dates)**	**After reform (dates)**
Official bilateral in force	**None**	**None**	**Revised Bermuda II**	**Further updated Bermuda II**	**Revised Bermuda II**	**Revised Bermuda II**	**Bermuda II**	**Revised Bermuda II**	**Bermuda II**	**Revised Bermuda II**
Policy notes	***No official ASA in place***	***No official ASA in place***	***1999 ASA, 1997 MoU.***	***2005 ASA and MoU***	***1989 ASA, 1987 MoU***	***2007 ASA and MOU. ASA not yet in administartive force.***	***1970 ASA, numerous MoUs***	***Negotiations on-going. 2005 draft ASA, 2005 and 2007 MoUs.***	***1967 ASA numerous MoUs***	***2007 ASA and MOU. ASA not yet in administrative force.***
Policy control variable										
Designation	Multiple designation for UK carriers	Multiple designation for UK carriers	Multiple designation. Majority O&C but Barbados can designate BWIA on Barbados-London route	Multiple designation for EC and Caricom carriers	Multiple designation. Majority O&C	Multiple designation for EC and Caricom carriers	Multiple designation. Majority O&C. (note: Jamaica did not accept that it was a multi-designation agreement)	Multiple designation for EC and Caricom carriers	Multiple designation. Majority O&C	Multiple designation for EC and Caricom carriers
Access Points	Open route access for UK carriers	Open route access for UK carriers	Open route schedule	Open route schedule	Restricted route schedule, London only UK point.	Open route schedule	Restricted route schedule	Open route schedule	Restricted route schedule	Open route schedule
5th Freedoms	Not addressed	Not addressed	Balanced exchanged of 5th freedom rights, pre-determined points	Balanced exchanged of 5th freedom rights, pre-determined points	V limited 5ths	UK=between StL and any point in Caricom StL=between UK and any point in EU	V limited 5ths	Balanced exchange of 5th freedom rights, pre-determined points	V limited 5ths	Balanced exchanged of 5th freedom rights, pre-determined points
Capacity/frequency	Increases subject to Bahamian government approval	Increases subject to Bahamian government approval	No frequency restrictions on 3rd/4ths	No frequency restrictions on 3rd/4th/5ths	No frequency limits on 3rd/4ths but BWIA limited to 1spw as a 5th from St Lucia	No frequency restrictions on 3rd/4th/5ths	No frequency restrictions	No frequency restrictions on 3rd/4th/5ths	No frequency restrictions	No frequency restrictions
Tariffs	Double dissapproval	Double dissapproval	Double disapproval	Double disapproval	Double disapproval	No filing, no restrictions (except on intra-EU services)	Double approval	Limited intervention. Disapproval only by country of designation	Double disapproval	Limited intervention. Disapproval only by country of designation

Source: UK Civil Aviation Authority

US-Caricom markets

Country-pair	US-Bahamas		US-Dominican Republic		US-Jamaica		US-Guyana	
Year	1995-1998	1999-2006	1995-1999	2000-2006	1995-2002	2003-2006	1995-2006	1995-2006
Official bilateral in force	Bermuda 1 (1946)	Bermuda 1 (1946)	1986 traditional agreement	1986 agreement	1968 traditional agreement	1968 traditional agreement	Acceeded to the 1946 US-UK agreement in 1966	Acceeded to the 1946 US-UK agreement in 1966
Policy notes	*Bahamas was party to the above agreement as a UK dependency until 1973*	*De facto open regime in practise since 1998/9*	*Provisionally put into force to replace the bilateral agreement of 1949*	*Open Skies not ratified in 1999 or 2006 but more flexible approach adopted in practise since 1999/00*	*Terms shown reflect incremental amendments made in 1979 and 1999*	*Open Skies agreement not ratified but partly applied since 2003*	*No major changes since this acession*	*No major changes since this accession*
Policy control variable								
Designation	US = Multiple designation with restrictions: limited foreign ownership Bahamas = Multiple designation with restrictions: limited foreign ownership	US = Multiple designation with no restrictions: limited foreign ownership Bahamas = Multiple designation with no restrictions: limited foreign ownership	US = Multiple designation with restrictions: limited foreign ownership Dom Rep = Multiple designation with restrictions: limited foreign ownership	US = Multiple designation but not blanket: limited foreign ownership Dom Rep = Multiple designation but not blanket: limited foreign ownership	US = Multiple designation with restrictions: limited foreign ownership Jamaica = Multiple designation with restrictions, limited foreign ownership	US = Multiple designation with restrictions: limited foreign ownership Jamaica = Multiple designation with restrictions, limited foreign ownership	US = Multiple designation with restrictions Guyana = Multiple designation with restrictions	US = Multiple designation with restrictions Guyana = Multiple designation with restrictions
Access Points	US = Pre-determined points Bahamas = Pre-determined points	US = Open Bahamas = Open	US = Pre-determined points Dom Rep = Limited to 2 points	US = Pre-determined points Dom Rep = Open	US = Specific points restricted Jamaica = Free	US = 10 points Jamaica = Open	US = New York and Miami Guyana = open access	US = New York and Miami Guyana = open access
5th Freedoms	US = Pre-determined points Bahamas = Pre-determined points	US = On a reciprocity basis when required Bahamas = On a reciprocity basis when required	US = Limited Dom Rep = Unlimited from 2 access points	US = Limited Dom Rep = Unlimited to Central/South America from any entry point	US = Limited (applied on comity and reciprocity basis) Jamaica = Limited (applied on comity and reciprocity basis)	US = Limited (applied on comity and reciprocity basis) Jamaica = Limited (applied on comity and reciprocity basis)	US = No beyond points, intermediate points through POS and BGI Guyana = Beyond points to South America	US = No beyond points, intermediate points through POS and BGI Guyana = Beyond points to South America
Capacity/frequency	US = Increases subject to consultations Bahamas =Increases subject to consultations	US = No controls Bahamas = No controls	US = Increases subject to approval Dom Rep = Increases subject to approval	US = No controls Dom Rep = No controls	US = Increases subject to approval Jamaica = Increases subject to approval	US = No controls Jamaica = No controls	US = Increases subject to consultations Guyana =Increases subject to consultations	US = Increases subject to consultations Guyana =Increases subject to consultations
Tariffs	US = Single disapproval Bahamas = Single disapproval	US = Double disapproval Bahamas = Double disapproval	US = Double disapproval Dom Rep = Double disapproval	US = Double disapproval Dom Rep = Double disapproval	US = Double approval Jamaica = Double approval	US = Double disapproval (mandatory 15 days notice) Jamaica = Double disapproval (mandatory 15 days notice)	US = Single disapproval Guyana = Single disapproval	US = Single disapproval Guyana = Single disapproval

Country-pair	US-Trinidad & Tobago		US-Barbados		US-Dominica		US-St. Lucia	
Year	1995-2006	1995-2006	1995-1999	2000-2006	1995-2006	1995-2006	1995-2004	2005-2006
Official bilateral in force	1990 traditional agreement	1990 traditional agreement	1982 traditional agreement	1982 traditional agreement	Accession to the US-UK Bermuda II Agreement	Accession to the US-UK Bermuda II Agreement	Accession to the US-UK Bermuda II Agreement	Accession to the US-UK Bermuda II Agreement
Policy notes	*No major changes since the ratification of the 1990 accord*	*No major changes since the ratification of the 1990 accord*	*Various attemps made for further liberalisation in 1990 and again in 1991*	*MOU: Designation extended to include"community of interest" principle*	*Acceded to the above agreement in 1977. Official terms have not been changes since that date*	*Acceded to the above agreement in 1977. Official terms have not been changes since that date*	*Acceded to the above agreement in 1979. Official terms have not been changes since that date*	*Acceded to the above agreement in 1979. MOU 2005: 5th freedoms*
Policy control variable								
Designation	US = Multiple designation subject to restrictions T&T = Multiple designation subject to restrictions	US = Multiple designation subject to restrictions T&T = Multiple designation subject to restrictions	US = Multiple designation subject to restrictions Barbados = Multiple designation subject to restrictions	US = Extended multiple designation subject to restrictions Barbados = Extended multiple designation subject to restrictions	US = Multiple designation Dominica = Multiple designation	US = Multiple designation Dominica = Multiple designation	US = Multiple designation St. Lucia = Multiple designation	US = Multiple designation St. Lucia = Multiple designation
Access Points	US = Pre-determined points T&T = Open access	US = Pre-determined points T&T = Open access	US = Pre-determined points Barbados = Open access	US = Pre-determined points Barbados = Open access	US = Limited to MIA and SJU Dominica = Open access	US = Limited to MIA and SJU Dominica = Open access	US = Limited to MIA and SJU St. Lucia = Open access	US = Limited to MIA and SJU St. Lucia = Open access
5th Freedoms	US = Limited intermediate and beyond rights T&T = Limited intermediate and beyond rights	US = Limited intermediate and beyond rights T&T = Limited intermediate and beyond rights	US = Limited intermediate and beyond rights Barbados = Limited intermediate and beyond rights	US = Exceptions made on a reciprical basis Barbados = Exceptions made on a reciprical basis	US = Limited intermediates and no beyonds Dominica = Open intermediates and no beyond rights	US = Limited intermediates and no beyonds Dominica = Open intermediates and no beyond rights	US = Limited intermediates and no beyonds St. Lucia = Open intermediates but no beyond rights	US = Limited intermediates and no beyonds St. Lucia = Open intermediates and beyond rights
Capacity/frequency	US = No controls T&T = No controls	US = No controls T&T = No controls	US = No controls Barbados = No controls	US = No controls Barbados = No controls	US = Increases subject to consultations Dominica =Increases subject to consultations	US = Increases subject to consultations Dominica =Increases subject to consultations	US = Increases subject to consultations St.Lucia =Increases subject to consultations	US = Increases subject to consultations St.Lucia =Increases subject to consultations
Tariffs	US = Single disapproval (30 days notice for carriers) T&T = Single disapproval (30 days notice for carriers)	US = Single disapproval (30 days notice carriers) T&T = Single disapproval (30 days notice for carriers)	US = Single disapproval (30 days notice for carriers) Barbados = Single disapproval (30 days notice)	US = Single disapproval (30 days notice for carriers) Barbados = Single disapproval (30 days notice for carriers)	US = Double approval Dominica = Double approval	US = Double approval Dominica = Double approval	US = Double approval St. Lucia = Double approval	US = Double approval St. Lucia = Double approval

Source: Office of Aviation Analysis, US Department of Transportation

Appendix H: Descriptive account of comparable ASAs for qualification

The following out of sample accounts attempt to record and take stock of some well known and rigorous efforts at further international air policy relaxation. The accounts related below by no means try to build up a case in favour of policy reform for the Caricom region but rather serve to familiarise the reader with some of the important interactions between traffic developments and liberalisation.

A. Aruba – United States of America (Source: World Bank Study 2006)
Medium sector

Before the ratification of the Open Skies agreement with the United States (1997), American airlines was the only US based scheduled operator offering services on the Aruba-United States market. After all restrictions on designation and capacity were lifted, other airlines such as Delta, United, Continental and US airways quickly commenced scheduled services together with American increasing the US tourist total share of arrivals to 64% in 2004 from 33% in 1996 (World Bank 2006). After the signing of the agreement, 1998 saw the introduction of charter services on the Boston-Aruba pair leading to an increase of 360% in charter traffic between 1998 and 2003 although this was from a near zero volume base.

B. New Zealand – Australia (Source: InterVistas 2006)
Medium sector

The Single Market Agreement (1996) which eventually led to the enforcement of truly open skies in 2002 has, *inter alia*, permitted flag carriers to connect the Trans-Tasman to their global networks as a result of fewer restrictions on frequencies, designations and beyond rights. The air transport indicators which can be used to test these ASA changes can be summarised in a 'connectivity' assessment. This can be captured through data collected on service quality (changes in passenger attitudes towards online and interline service) as well as changes to 5th freedom capacity as a percentage of total capacity (ASK). It was found that liberal beyond rights have helped connect Trans-Tasman to the global networks of both Qantas and Air New Zealand (NZ). A greater variety of business models have since been attracted to the market after 2003 with effective competition improved after the entry of Emirates (FSC) and Pacific Blue (LCC) as well as large market share increases for Freedom Air International. The two incumbents Qantas and Air NZ have not only survived this liberalisation process but have also seen gross increases in capacity despite their relative loss of market power (Online Airline Guide 2008).

C. United Kingdom-India (Source: UK Civil Aviation Authority 2006)
Long sector

After the loosening of regulatory constraints governing the UK-India country-pair in 2004, the number of passengers carried by airlines from both sides increased dramatically between 2004 and 2006 suggesting that demand had previously been suppressed. In 2004 capacity was no longer restricted on all UK-India routes apart from the Delhi/Mumbai-London Heathrow routes which in themselves were allowed to triple in capacity through the same three (3) year period. For the consumer this has resulted in a greater choice of gateways, cheaper discount fares and much higher frequencies. The impact on air carriers is mixed. Although UK carriers experienced increases in revenue, reductions in yield resulted in net losses to the tune of £16 million between 2005 and 2007. New entry for Indian carriers has brought about latent benefits and efficiency improvements for incumbent carriers and the UK has benefited from a significant increase in the number of online and interlining passengers using UK airports for transfers or stopovers. Modelling efforts suggests a net benefit to UK airports of around £12 million in increased profits as a result of increased landing/parking fees and greater consumer retail expenditure. Heathrow capacity and slot constraints have dampened this effect at the airport. Greater business and leisure activity as well as increased trade between the UK and India is implied but not proven by the study's findings.

D. EU multi-lateral agreement (Source: Williams 2005, Ankha 2005)
Short sector

The key features of the European common market are that, since the 3rd Package of liberalisation which came into force in 1997, all 8th freedoms of the air can be exercised by carriers with an EU Air Operators Certificate. There have been no pricing controls on Intra-European routes and no capacity restrictions. Moreover national ownership and control was replaced by community ownership. In addition, non-EU European states have been welcome to join the agreement, as is the case with Norway, Iceland and Switzerland (Williams 2005). Although there are other multilateral agreements which involve countries with more comparable socio-economic and geographic characteristics, it is fair to say that other current agreements are still fragmented and works-in-progress to some extent with common goals often being complicated by a continued adherence to bilateral agreements by signatory states which predate these multilateral agreements.

Controlling for sector distance, it has been proven that as a result of the complete liberalisation of community pricing controls there has been a reduction in average fares as low-cost carriers have looked to take advantage of latent demand caused by the previously monopolistic fares of hubbing flag carriers. If a truly binding Caricom MASA was also to abolish all pricing controls on Intra-Caribbean routes (See Chapter 6, section 6.2.3. for more detail)., it could lead to comparable reductions in average airfares between country-pairs on similar sector lengths. This can also be evaluated with the assumption that non-Caricom member states could also join a common aviation market thus enabling the author to contrast airfares between a wider range of Caribbean country-pairs.

Finally the common market for aviation adopted by EU states allowed for community ownership. This resulted in notable productivity and efficiency gains as a direct result of the acquisitions and take-overs which occurred between European carriers after the introduction of the 3rd package of liberalisation measures (e.g. the Air France-KLM merger in 2004).

E. Central American "Open Skies" with the US
Medium sector

For the majority of Central American states, their bilateral relationship with the United States is a central issue in their aviation policies given the US is the main source market for the majority of these countries. In order to ensure continuity of local services however the disparity in market size, travel propensities and carrier competitiveness had to be redressed as far as possible before US-Central America ASA's could be further liberalised. The various small carriers of the region were therefore integrated in order to take advantage of scale and scope economies enabling more competitiveness with their larger US counterparts.

This integration process lasted almost seven years due to the fact that two of the carriers, Aviateca and AeroNicaragua were 100% state owned, but in 1998 it paid off when the US DOT approved an American Airline-Grupo TACA codesharing agreement. For this to be approved the relevant member states were obliged to conclude more liberal bilaterals in 1997 when six separate bilateral open skies agreements were concluded. These agreements resulted in some notable success stories. The US-Costa Rica open-skies agreement, by opening up of the number of permitted frequencies and capacity paved the way for Delta Airlines services from Atlanta to San Jose in 1998 leading to growth in traffic volumes of 118% on this market. Continental was able to increase its presence in Central America, concluding a strategic alliance with Panama based COPA airlines in 1998 along with a 49% stake in the company, and Delta and United each made substantial gains in Honduras, Nicaragua, Guatemala, Costa Rica and Panama with only marginal market share losses for incumbents Grupo TACA and American Airlines. This indicated that the new entrants were primarily market makers and not market takers as aggregate demand increased after the introduction of their services.

Finally, anti-trust immunity was not granted to Grupo TACA and American Airlines in 2002 despite the fact that it was granted for the COPA-Continental venture. The reason offered was that further Grupo TACA-American cooperation could have resulted in a reduction in competition and a return to market dominance. Thus it is apparent that under US 'open-skies' conditions, airline collusion and consolidation can be an appropriate alternative for air carriers, which if not monitored and controlled by a regulatory authority, can result in upward pressure on airfares and possible reductions in traffic volumes.

F. Pacific Island "Free Skies" or bilateral development (PRTS document 2004) Short/Medium sector

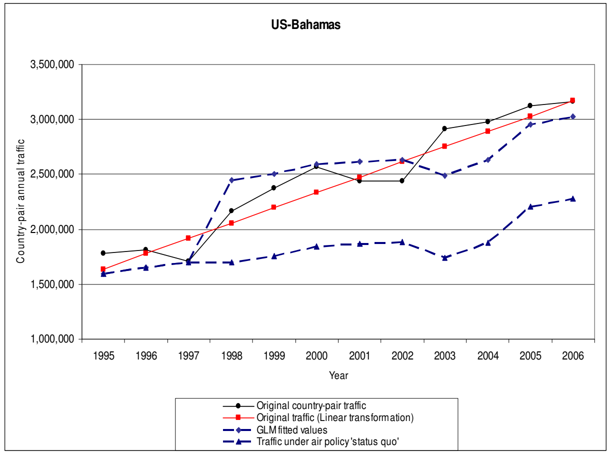
A similar dilemma to that seen amongst the Caricom and Cariforum member states can be witnessed on Pacific Island Forum markets. Debate is currently centred on the proposed adoption and enforcement of the PIASA multilateral air agreement which would, if implemented, see a simultaneous step change towards regional "open-skies". Like on Caricom markets, local flag carriers (ASPA – Association of South Pacific Airlines) are at odds with the objectives of the Pacific Island Forum and contend that further bilateral reform would produce identical yet more controllable gains for each state separately in accordance with the disparate socio-economic, airline market and socio-political ties that exist between many of the independent jurisdictions and island groups which make up the Pacific Island region.

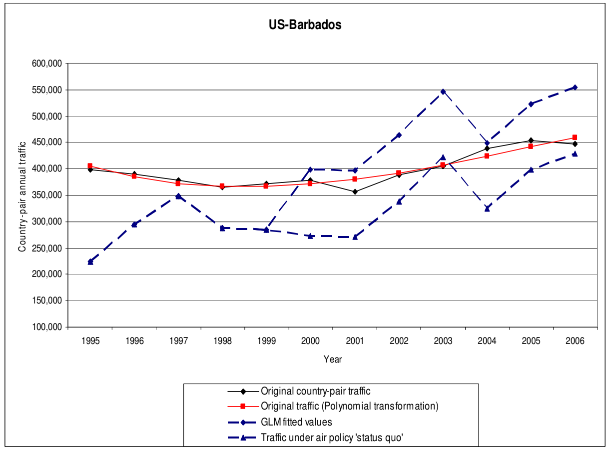
A recent study on the impact of multilateral liberalisation to the island of Fiji, for example, suggests that the net cost of non PIASA participation is only predicted to be in the order of US$1 million dollars (PRTS report 2004). This includes the conservative scenario of local carrier Air Pacific going out of business but with aggregate air traffic increases from the major source markets. If a multilateral agreement results in an improvement to airline coordination in areas relating to marketing and operations, perhaps a resulting increase in multi-destination tourism between the islands can ensure the survival of some local carriers operating in a semi-liberal market for air services.

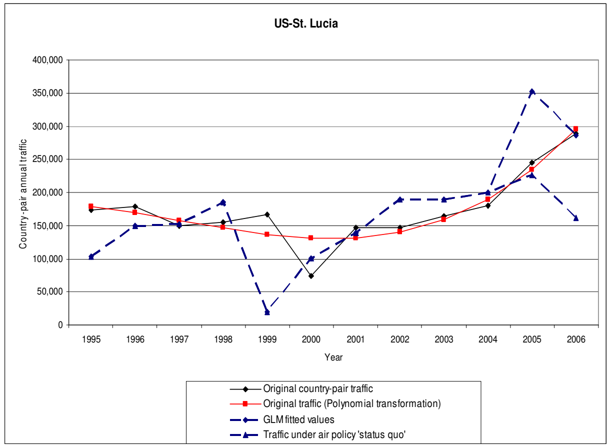
One of the benefits of the proposed multilateral is the staging approach to liberalisation where, before internal markets are opened up to more efficient foreign carriers from Australia and New Zealand, local carriers have the chance to ferment possible synergies on Intra-regional sectors before 5th and 6th freedom rights are granted to foreign carriers (PRTS report 2004). The aim of such a strategy is clearly to try to redress the possible unequal playing field by giving local carriers more first mover advantages and subsequent power to influence Intra-regional price and service levels (as was observed in Central America with the formation of Grupo TACA and COPA airlines).

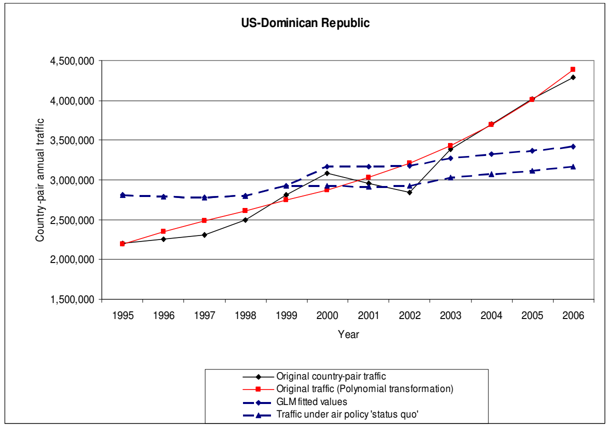
Appendix I: Counterfactual traffic gain charts for 24 Caricom country-pairs

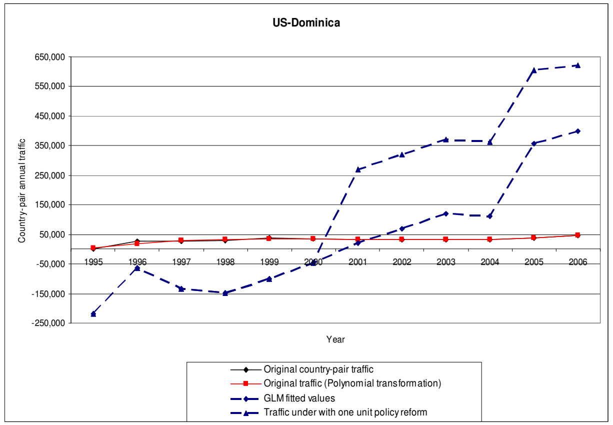
North America-Caricom markets

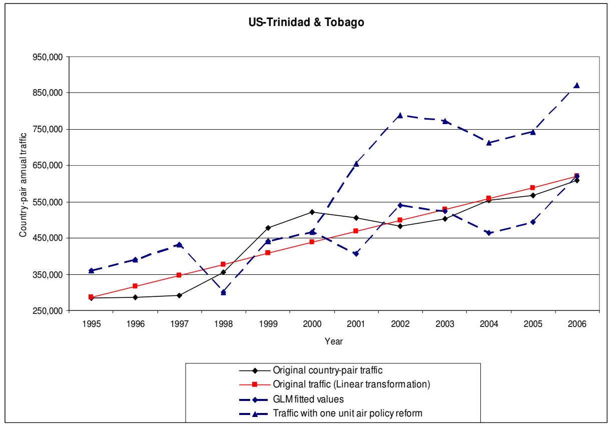


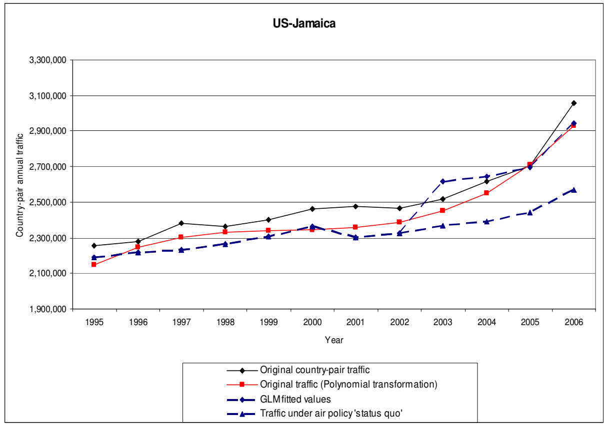


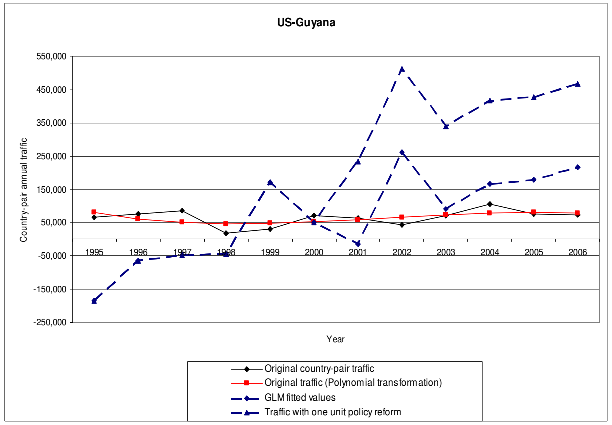


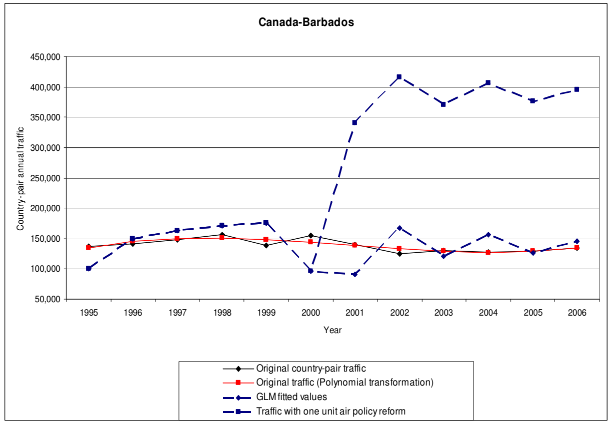


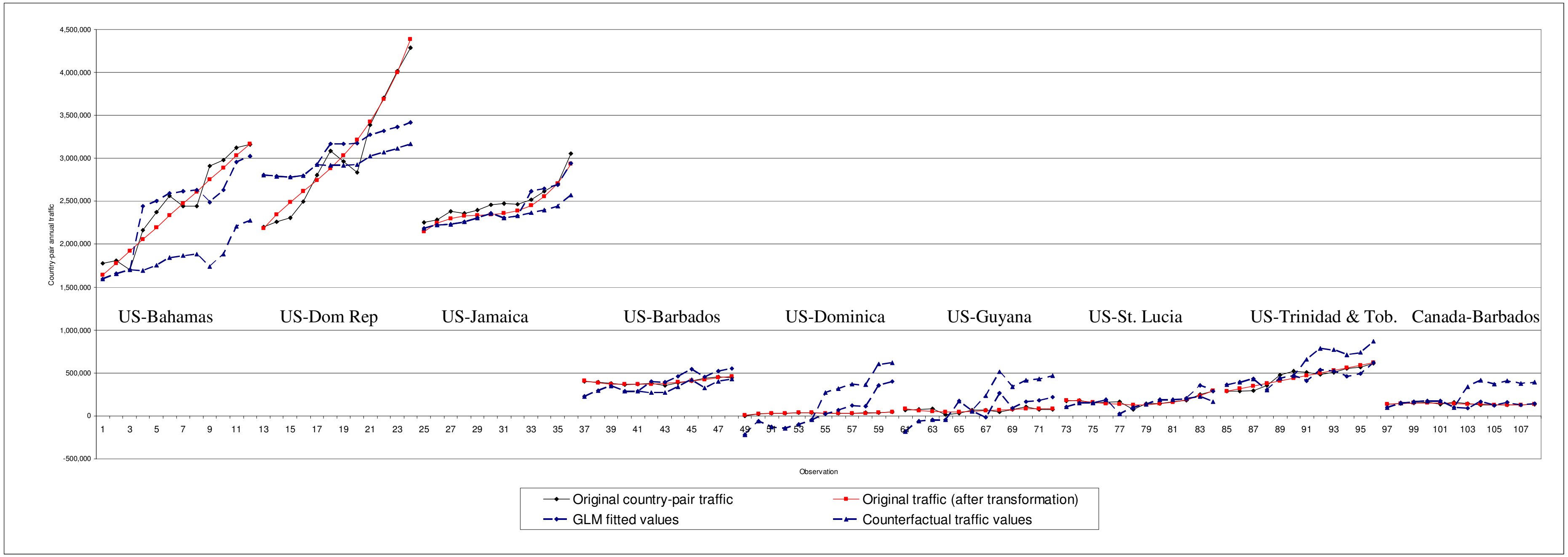




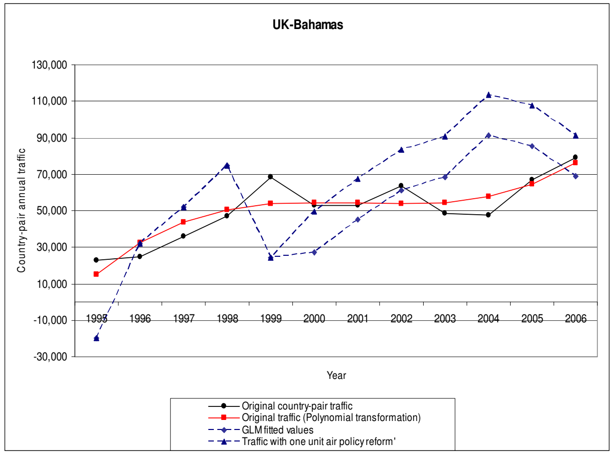

US-Jamaica
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Polynomial transformation)
GLM fitted values
Traffic under air policy 'status quo'

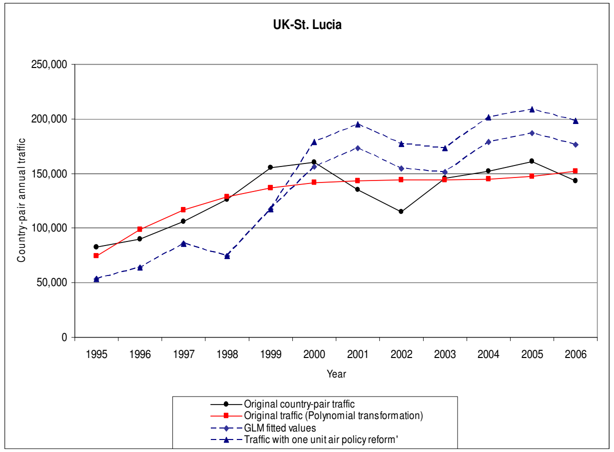

US-Guyana
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Polynomial transformation)
GLM fitted values
Traffic with one unit policy reform

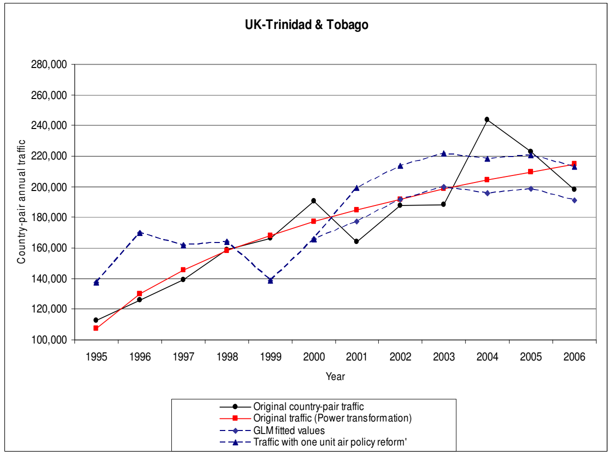

Canada-Barbados
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Polynomial transformation)
GLM fitted values
Traffic with one unit air policy reform

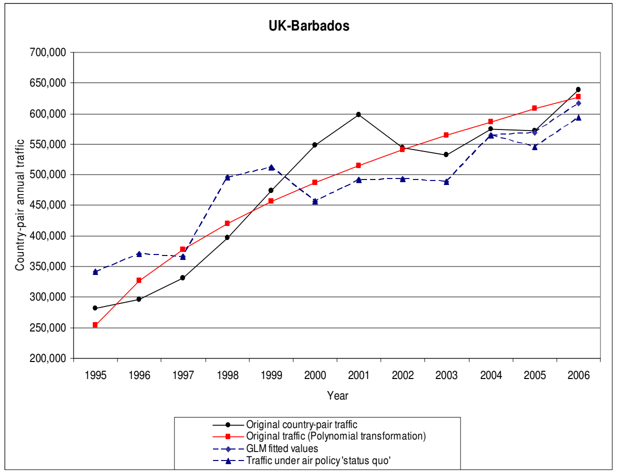

Country-pair annual traffic
US-Bahamas
US-Dom Rep
US-Jamaica
US-Barbados
US-Dominica
US-Guyana
US-St. Lucia
US-Trinidad & Tob.
Canada-Barbados
Observation
Original country-pair traffic
Original traffic (after transformation)
GLM fitted values
Counterfactual traffic values

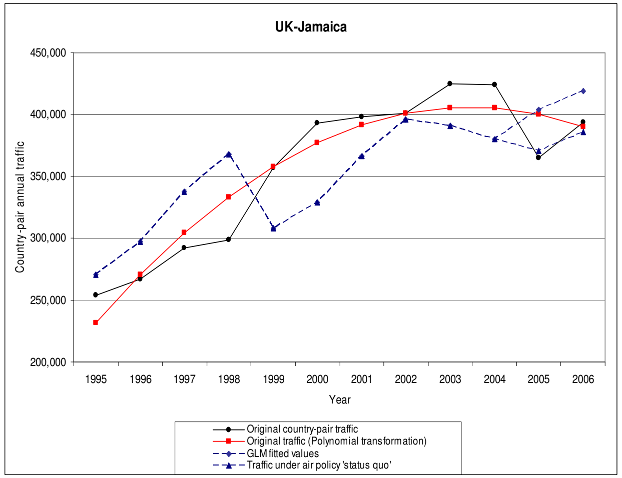
UK-Caricom markets

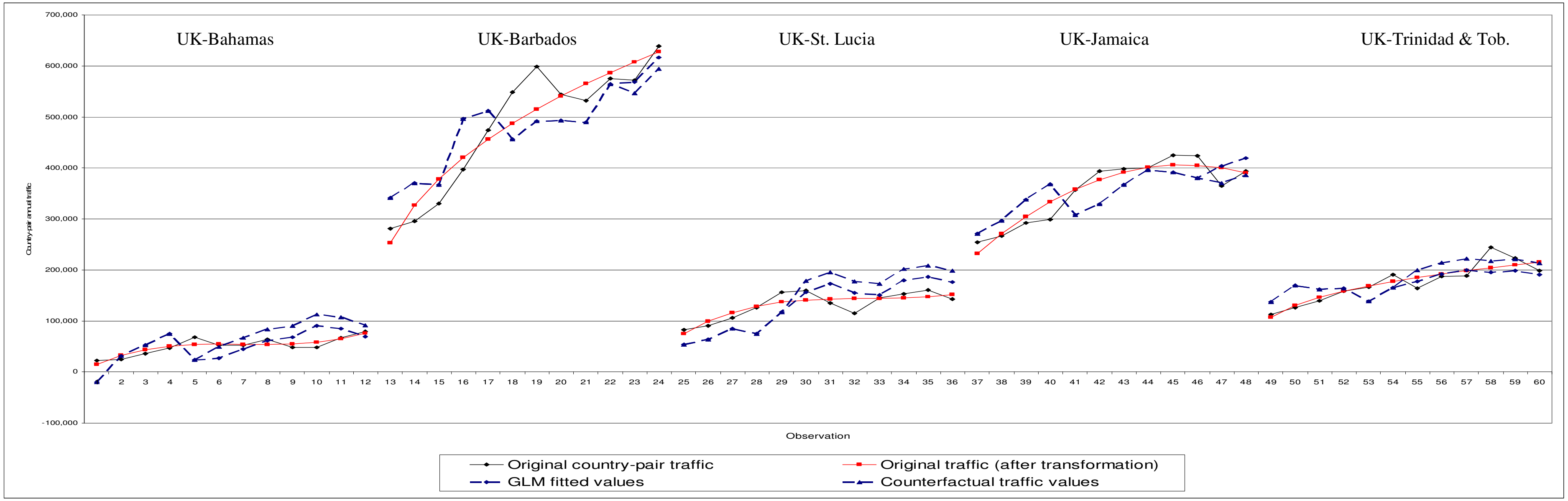




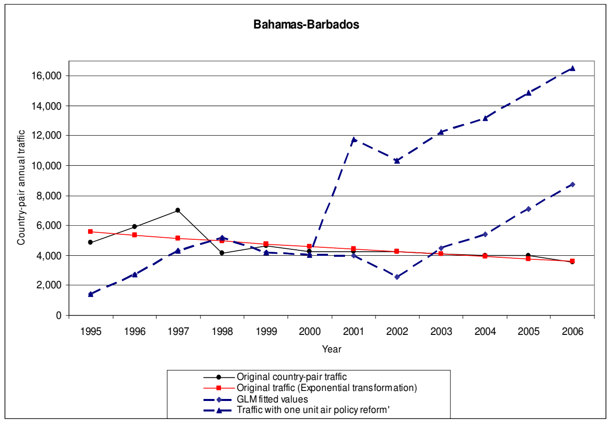


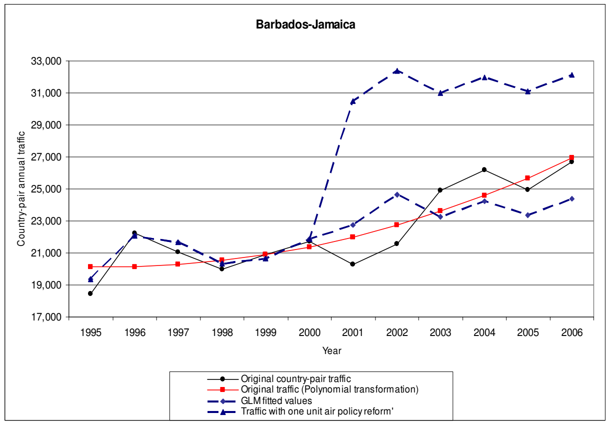


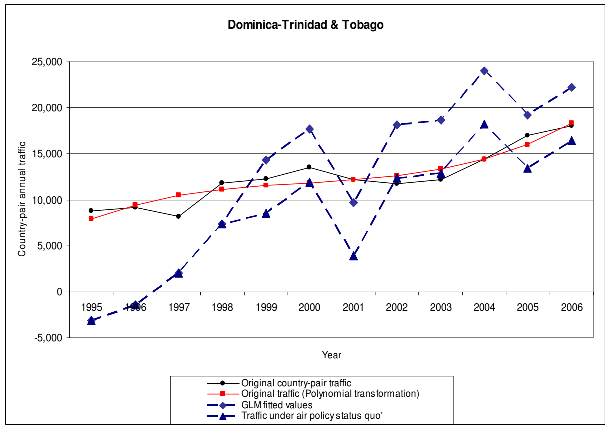


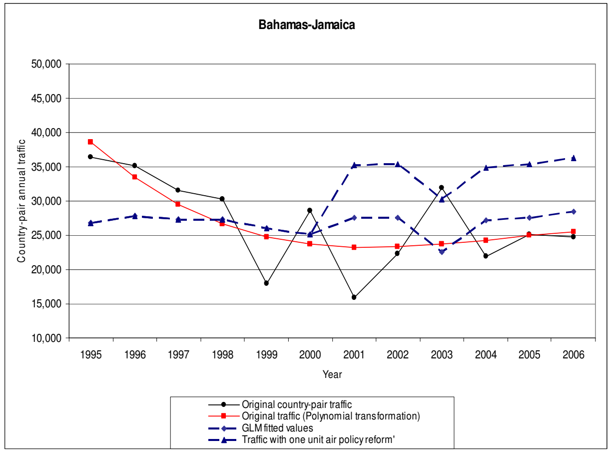


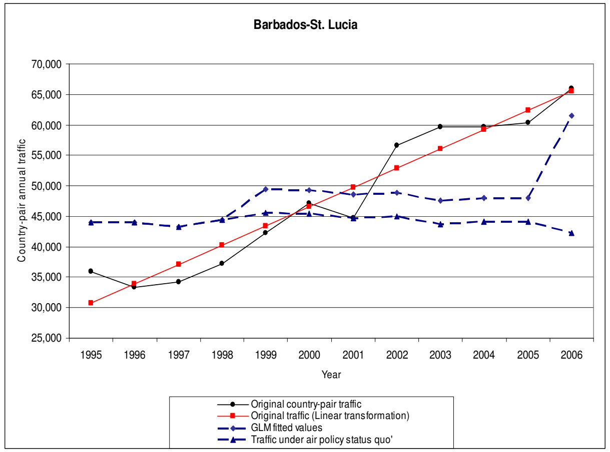
Intra-Caricom markets

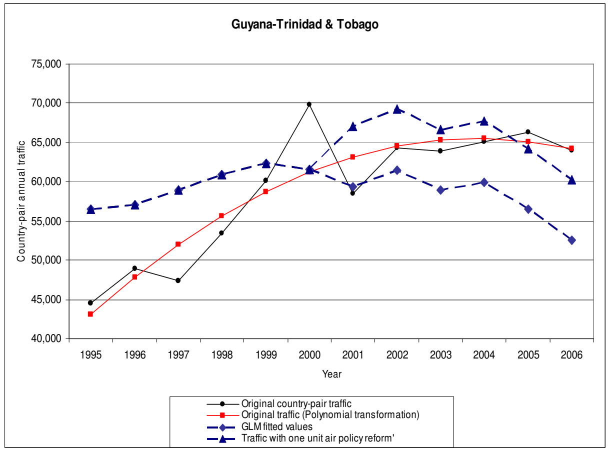


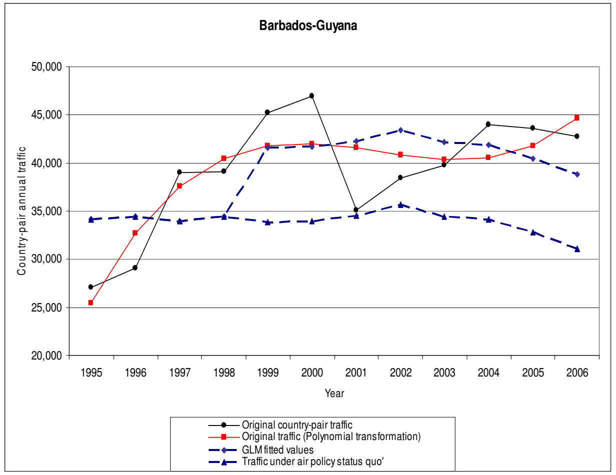


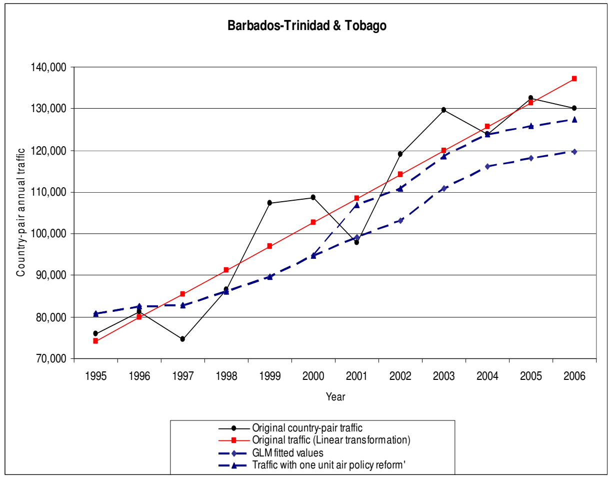


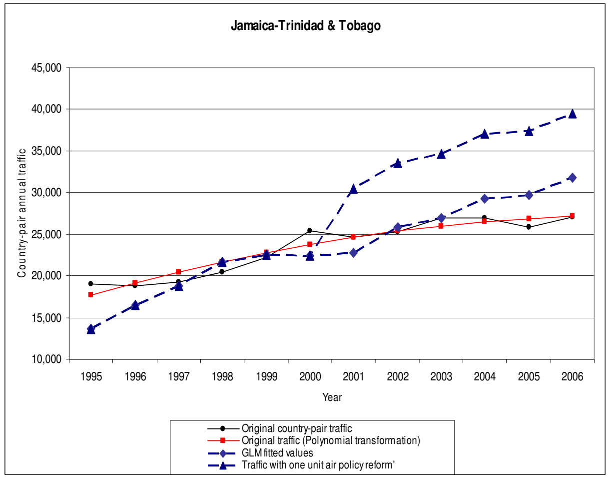

Bahamas-Jamaica
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Polynomial transformation)
GLM fitted values
Traffic with one unit air policy reform'

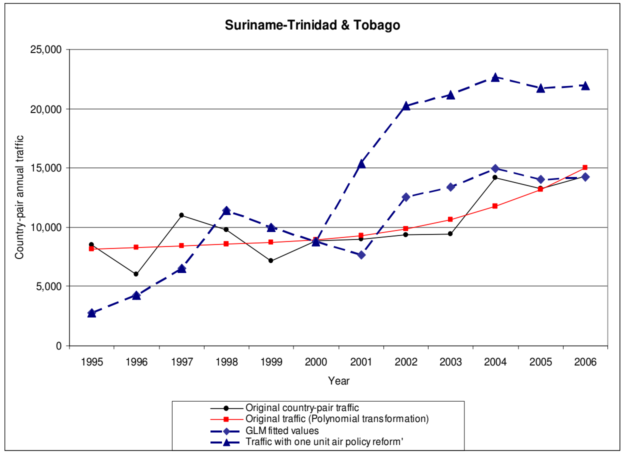

Barbados-St. Lucia
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Linear transformation)
GLM fitted values
Traffic under air policy status quo'


Guyana-Trinidad & Tobago
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Polynomial transformation)
GLM fitted values
Traffic with one unit air policy reform'

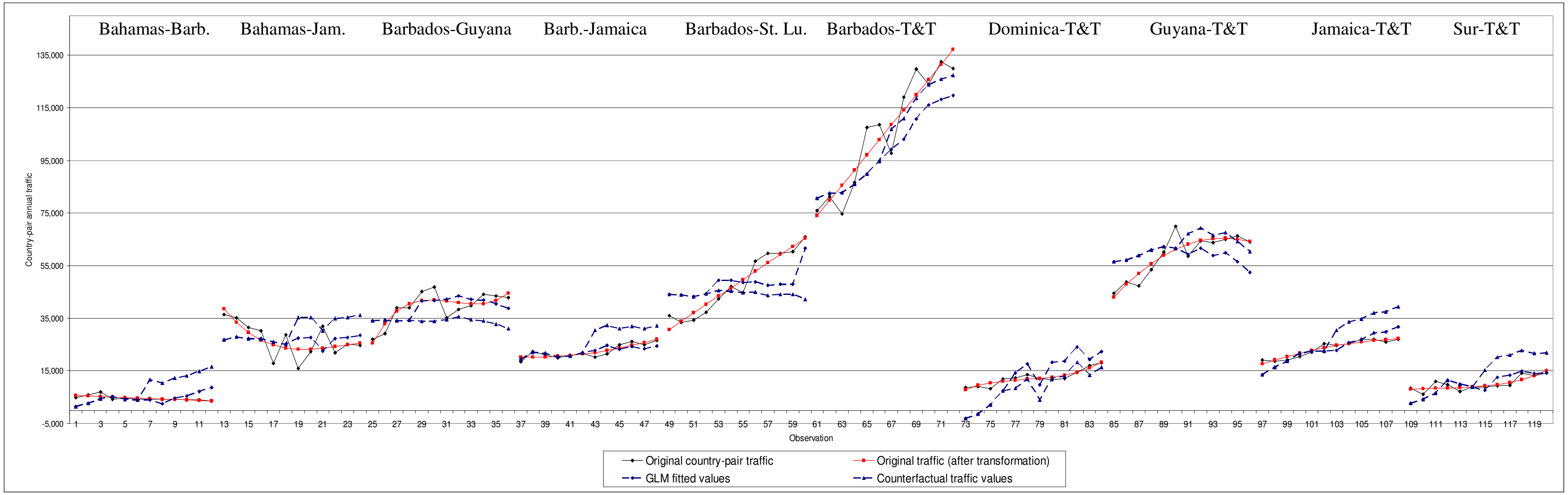

Barbados-Guyana
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Polynomial transformation)
GLM fitted values
Traffic under air policy status quo'


Barbados-Trinidad & Tobago
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Linear transformation)
GLM fitted values
Traffic with one unit air policy reform'


Jamaica-Trinidad & Tobago
Country-pair annual traffic
Year
Original country-pair traffic
Original traffic (Polynomial transformation)
GLM fitted values
Traffic with one unit air policy reform'



Suriname-Trinidad & Tobago
25,000
20,000
15,000
10,000
5,000
0
Country-pair annual traffic
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
Original country-pair traffic
Original traffic (Polynomial transformation)
GLM fitted values
Traffic with one unit air policy reform'



Bahamas-Barb.
Bahamas-Jam.
Barbados-Guyana
Barb.-Jamaica
Barbados-St. Lu.
Barbados-T&T
Dominica-T&T
Guyana-T&T
Jamaica-T&T
Sur-T&T
135,000
115,000
95,000
75,000
55,000
35,000
15,000
-5,000
Country-pair annual traffic
Observation
Original country-pair traffic
Original traffic (after transformation)
GLM fitted values
Counterfactual traffic values

Appendix J: Macroeconomic performance of bilateral and multilateral scenarios by member state

Scenario 1- Bilateral gains (for currently restricted markets only)

Member state	Additional passengers	2006 baseline traffic	Ratio GDP/passenger	Ratio GDP/passenger (Exc. Catalytic)	Predicted traffic	Predicted GDP impact ($US)	GDP impact increase ($US)	Predicted GDP impact exc. catalytic ($US)	GDP impact increase exc. Catalytic impact ($US)	Ratio jobs/passenger	Ratio jobs/passenger (exc. Catalytic)
Bahamas	7,211	3,329,000	425.72	125.89	3,336,211	1,420,291,747	3,081,747	419,995,603	915,603	0.00591319	0.00032922
Barbados	47,191	2,365,000	204.22	37.47	2,412,191	492,617,646	9,637,646	90,384,797	1,764,797	0.01447146	0.00265497
Dominica	37,446	168,000	397.86	8.69	205,446	81,738,746	14,898,746	1,785,326	325,326	0.03700595	0.00080357
Guyana	43,153	481,000	181.19	45.93	524,153	94,971,282	7,821,282	24,074,347	1,984,347	0.00638046	0.00064865
Jamaica	4,125	4,874,000	302.33	69.18	4,878,125	1,474,803,531	1,263,531	337,468,688	298,688	0.00940562	0.00052688
St. Lucia	3,173	914,000	482.48	48.34	917,173	442,517,629	1,527,629	44,336,143	156,143	0.01422867	0.00041403
Trinidad & Tobago	50,709	3,186,000	73.59	123.27	3,236,709	238,189,415	3,719,415	398,989,118	6,239,118	0.00349655	0.00220182
Annual totals	193,008	15,317,000			15,510,008	4,245,129,996	41,949,996	1,317,034,021	11,684,021		

Notes: For all bilateral agreements a one unit lib increase has been assumed.
Total additional passengers from an increase in liberalisation have to be compounded over all future years to which the reform applies.
The double counting of passengers is minimal but present nevertheless for some member states.

Scenario 2 – Multilateral gains (for currently restricted markets)

Member state	Additional Intra-Caricom pax	Additional Extra-Caricom pax	Total additional pax	2006 baseline traffic	Ratio GDP/passenger	Ratio GDP/passenger (Exc. Catalytic)	Predicted total traffic	Predicted GDP impact ($US)	GDP impact increase ($US)	Predicted GDP impact exc. catalytic ($US)	GDP impact increase exc. Catalytic impact ($US)
Bahamas	10,313	3,173	13,486	3,329,000	425.72	125.89	3,342,486	1,422,963,140	5,753,140	420,785,563	1,705,563
Barbados	17,403	41,606	59,009	2,365,000	204.22	37.47	2,424,009	495,031,118	12,051,118	90,827,617	2,207,617
Dominica	3,545	37,446	40,991	168,000	397.86	8.69	208,991	83,149,159	16,309,159	1,816,132	356,132
Guyana	6,446	41,606	48,052	481,000	181.19	45.93	529,052	95,858,932	8,708,932	24,299,358	2,209,358
Jamaica	12,247	0	12,247	4,874,000	302.33	69.18	4,886,247	1,477,259,056	3,719,056	338,030,567	860,567
St. Lucia	644	3,173	3,817	914,000	482.48	48.34	917,817	442,828,346	1,838,346	44,367,274	187,274
Trinidad & Tobago	17,725	44,779	62,504	3,186,000	73.59	123.27	3,248,504	239,057,409	4,587,409	400,443,088	7,693,088
Annual totals	68,323	171,783	240,106	15,317,000			15,557,106	4,256,147,160	52,967,160	1,320,569,599	15,219,599

Notes: Multilateral liberalisation has only been predicted for Intra-Caricom markets.
Total additional traffic is therefore the sum of the extra-regional bilateral gains as shown above in scenario 1 plus the Intra-regional gains from a revised Caricom MASA.
The double counting of passengers is minimal but present nevertheless for some member states.

Appendix K: Variables used for demand modelling (panel data set values)

North-America-Caricom markets

Panel data linear form													
Cross-section	Time-series	Prototype variables				Other endogenous variables				Other socio-economic variables			Geographic variables
Country-pair	Year	Y Country-pair traffic (pax)	X1 Weighted real GDP (PPP) $USbn	X2 Liberalisation scale	X3 Terrorism dummy	X4 QSI	X5 Real average Yield (Uscents/km)	X6 RTK/Revenue per employee (Mean: RTK = Tonnes * total revenue	X7 HHI inverse (no. of carriers)	X8 Trade in services (US$mn)	X9 GDP per capita difference (US$)	X10 Tourism ground costs (US$ per day/night)	X11 Total CP population (mn)	X12 Great circle distance (sm)
US-Bahamas	1995	2,139,058	5,869	1.5	0	1,750,500	8.20	91.06	2.11	973.10	15,465	120.54	266.21	865
US-Bahamas	1996	2,278,116	6,102	1.5	0	2,020,450	7.77	93.67	2.29	1023.13	16,272	122.25	269.79	865
US-Bahamas	1997	2,417,174	6,898	1.5	0	1,950,250	7.79	106.07	2.34	1106.33	17,122	117.06	273.04	865
US-Bahamas	1998	2,556,232	6,983	4.5	0	2,236,771	7.57	115.81	2.30	1183.78	17,086	115.89	276.24	865
US-Bahamas	1999	2,695,290	7,499	4.5	0	2,360,732	7.14	125.33	2.19	1278.88	17,414	125.71	279.42	865
US-Bahamas	2000	2,834,348	7,779	4.5	0	2,250,038	6.90	144.19	2.30	1412.68	18,248	136.41	282.56	865
US-Bahamas	2001	2,973,406	8,532	4.5	1	1,981,188	6.70	155.22	2.28	1303.42	18,797	130.21	285.59	865
US-Bahamas	2002	3,112,464	8,789	4.5	1	2,305,824	6.34	156.31	2.19	1376.09	19,030	133.30	288.56	865
US-Bahamas	2003	3,251,522	7,718	4.5	0	2,286,383	6.23	179.47	1.92	1450.34	20,244	129.79	291.43	865
US-Bahamas	2004	3,390,580	8,408	4.5	0	2,181,519	6.22	204.61	2.55	1497.44	22,187	122.74	294.22	865
US-Bahamas	2005	3,529,638	9,394	4.5	0	2,135,575	5.98	242.62	3.38	1543.82	23,897	146.85	297.09	865
US-Bahamas	2006	3,668,696	10,093	4.5	0	2,106,425	5.79	262.13	3.41	1586.67	25,273	150.56	299.96	865
US-Dom Rep	1995	2,188,146	2,651	2.5	0	950,150	8.20	187.87	1.47	1337.91	26,126	97.10	269.54	1,259
US-Dom Rep	1996	2,347,244	2,763	2.5	0	1,015,750	7.77	185.82	1.52	1495.90	27,189	87.36	272.80	1,259
US-Dom Rep	1997	2,486,575	2,953	2.5	0	965,250	7.79	188.87	1.49	1654.71	28,445	84.37	276.09	1,259
US-Dom Rep	1998	2,615,425	3,299	2.5	0	977,350	7.57	193.56	1.46	1777.15	29,611	82.73	279.34	1,259
US-Dom Rep	1999	2,743,075	3,469	2.5	0	1,302,050	7.14	195.34	1.88	1881.00	30,948	91.90	282.56	1,259
US-Dom Rep	2000	2,878,809	4,050	3.5	0	1,127,643	6.90	204.62	1.74	2132.74	32,244	86.37	285.75	1,259
US-Dom Rep	2001	3,031,911	4,506	3.5	1	1,011,898	6.70	185.10	1.59	2038.37	32,767	84.08	288.83	1,259
US-Dom Rep	2002	3,211,662	5,180	3.5	1	1,172,175	6.34	184.70	1.38	2008.07	33,664	82.76	291.84	1,259
US-Dom Rep	2003	3,427,348	5,528	3.5	0	1,238,020	6.23	222.52	1.76	2142.95	35,655	83.80	294.76	1,259
US-Dom Rep	2004	3,688,250	6,101	3.5	0	1,131,000	6.22	261.11	1.78	2239.84	37,649	83.57	297.59	1,259
US-Dom Rep	2005	4,003,652	6,636	3.5	0	1,253,000	5.98	304.21	1.84	2269.99	38,548	81.67	300.52	1,259
US-Dom Rep	2006	4,382,838	7,131	3.5	0	1,247,125	5.79	336.98	1.92	2446.90	40,538	80.62	303.43	1,259
US-Jamaica	1995	2,148,468	5,348	2	0	1,425,575	8.20	156.31	1.51	1278.38	25,708	94.25	268.56	1,064
US-Jamaica	1996	2,244,984	5,597	2	0	1,485,925	7.77	155.65	1.58	1306.25	26,247	94.07	271.07	1,064
US-Jamaica	1997	2,301,266	6,052	2	0	1,550,500	7.79	154.62	1.53	1394.56	27,595	90.63	274.33	1,064
US-Jamaica	1998	2,329,032	6,280	2	0	1,510,465	7.57	148.75	1.61	1468.25	28,725	90.78	277.54	1,064
US-Jamaica	1999	2,340,000	6,582	2	0	1,439,775	7.14	157.75	1.67	1572.50	30,363	92.72	280.72	1,064
US-Jamaica	2000	2,345,888	7,366	2	0	1,537,000	6.90	164.62	1.77	1658.49	31,896	87.35	283.86	1,064
US-Jamaica	2001	2,358,414	7,361	2	1	1,686,225	6.70	165.43	1.60	1659.81	32,469	80.94	286.91	1,064
US-Jamaica	2002	2,389,296	7,702	2	1	1,439,700	6.34	177.97	1.62	1739.35	33,229	78.83	289.88	1,064
US-Jamaica	2003	2,450,252	8,289	3	0	1,587,575	6.23	195.41	1.58	1823.71	34,676	79.85	292.75	1,064
US-Jamaica	2004	2,553,000	8,662	3	0	1,428,675	6.22	226.90	1.58	1901.30	36,518	79.38	295.54	1,064
US-Jamaica	2005	2,709,258	9,395	3	0	1,714,300	5.98	253.73	1.54	1911.52	38,428	79.78	298.42	1,064
US-Jamaica	2006	2,930,744	9,951	3.5	0	1,661,925	5.79	264.94	2.01	1943.66	40,238	79.19	301.29	1,064
US-Barbados	1995	404,789	4,272	2.5	0	179,450	8.20	149.31	2.15	544.84	20,637	125.65	266.41	1,941
US-Barbados	1996	384,782	4,560	2.5	0	190,250	7.77	149.89	2.08	576.71	21,420	140.36	269.75	1,941
US-Barbados	1997	372,219	4,893	2.5	0	195,250	7.79	149.76	2.01	606.14	22,142	150.73	272.99	1,941
US-Barbados	1998	366,283	5,171	2.5	0	185,400	7.57	150.00	1.94	652.16	22,764	133.87	276.19	1,941
US-Barbados	1999	366,162	5,343	2.5	0	196,575	7.14	155.94	2.07	669.12	23,901	123.72	279.37	1,941
US-Barbados	2000	371,038	5,717	3	0	205,475	6.90	158.31	1.94	717.37	25,205	119.89	282.51	1,941
US-Barbados	2001	380,097	5,948	3	1	214,763	6.70	179.94	2.00	716.95	25,977	112.52	285.54	1,941
US-Barbados	2002	392,525	6,539	3	1	225,988	6.34	183.69	2.10	703.21	27,121	113.54	288.51	1,941
US-Barbados	2003	407,505	6,857	3	0	228,100	6.23	214.23	2.24	710.88	27,673	121.77	291.38	1,941
US-Barbados	2004	424,224	6,798	3	0	224,825	6.22	226.94	1.92	745.77	29,525	113.30	294.16	1,941
US-Barbados	2005	441,866	7,804	3	0	223,100	5.98	259.09	1.81	760.97	30,861	117.13	297.04	1,941
US-Barbados	2006	459,615	8,361	3	0	224,700	5.79	303.97	1.79	795.60	32,036	115.31	299.91	1,941
US-Dominica	1995	4,124	6,057	2	0	4,500	8.20	58.70	0.51	48.29	24,705	98.20	266.12	892
US-Dominica	1996	18,955	6,362	2	0	16,100	7.77	56.77	1.20	52.40	25,725	99.83	269.62	892
US-Dominica	1997	28,308	6,808	2	0	14,250	7.79	62.11	1.00	61.28	27,058	83.52	272.86	892
US-Dominica	1998	33,283	7,265	2	0	15,000	7.57	64.45	1.00	62.23	28,126	71.49	276.06	892
US-Dominica	1999	34,975	7,471	2	0	23,000	7.14	73.48	1.00	71.28	29,497	78.91	279.23	892
US-Dominica	2000	34,483	8,395	2	0	16,000	6.90	88.43	1.00	64.17	31,019	75.30	282.37	892
US-Dominica	2001	32,904	9,287	2	1	15,000	6.70	91.95	1.00	59.31	31,816	74.88	285.40	892
US-Dominica	2002	31,335	10,104	2	1	15,000	6.34	99.93	1.00	62.75	32,781	71.68	288.37	892
US-Dominica	2003	30,874	10,126	2	0	14,500	6.23	103.67	1.00	66.51	34,045	83.48	291.23	892
US-Dominica	2004	32,619	10,752	2	0	15,000	6.22	141.60	1.00	70.79	36,052	69.93	294.01	892
US-Dominica	2005	37,666	11,740	2	0	21,560	5.98	191.98	1.88	71.61	37,981	71.79	296.89	892
US-Dominica	2006	47,114	12,292	2	0	33,060	5.79	123.93	1.70	78.08	40,009	73.83	299.75	892
US-Guyana	1995	80,632	6,392	1.5	0	41,875	8.20	135.29	1.55	153.16	26,896	31.36	266.15	2,343
US-Guyana	1996	62,171	6,585	1.5	0	32,450	7.77	138.38	2.01	160.15	28,029	36.68	269.67	2,343
US-Guyana	1997	51,469	6,205	1.5	0	75,250	7.79	140.02	2.15	162.04	29,418	41.74	272.91	2,343
US-Guyana	1998	47,163	8,287	1.5	0	57,040	7.57	152.49	1.50	160.97	30,716	32.95	276.11	2,343
US-Guyana	1999	47,888	9,000	1.5	0	78,875	7.14	152.31	1.73	165.26	32,257	61.62	279.28	2,343
US-Guyana	2000	52,279	6,324	1.5	0	53,550	6.90	278.06	1.82	182.84	33,814	78.10	282.42	2,343
US-Guyana	2001	58,972	7,260	1.5	1	44,200	6.70	271.63	1.29	183.45	34,561	68.34	285.45	2,343
US-Guyana	2002	66,603	10,197	1.5	1	54,450	6.34	378.29	1.79	185.71	35,347	58.96	288.42	2,343
US-Guyana	2003	73,806	7,426	1.5	0	62,850	6.23	388.36	2.07	184.74	36,649	56.29	291.28	2,343
US-Guyana	2004	79,218	9,591	1.5	0	65,500	6.22	404.80	2.00	189.25	38,799	37.72	294.07	2,343
US-Guyana	2005	81,473	9,637	1.5	0	79,975	5.98	362.06	1.94	197.11	40,879	42.15	296.94	2,343
US-Guyana	2006	79,208	11,224	1.5	0	49,925	5.79	257.31	1.46	204.20	43,044	43.53	299.81	2,343
US-St.Lucia	1995	179,423	6,399	2	0	85,650	8.20	161.58	1.33	175.74	23,963	132.25	266.18	1,846
US-St.Lucia	1996	169,882	6,708	2	0	98,250	7.77	162.10	1.35	173.03	25,132	136.99	269.65	1,846
US-St.Lucia	1997	158,241	7,061	2	0	95,500	7.79	164.45	1.22	182.58	26,578	137.10	272.89	1,846
US-St.Lucia	1998	146,537	7,686	2	0	100,675	7.57	173.02	0.99	200.15	27,511	143.68	276.09	1,846
US-St.Lucia	1999	136,810	6,852	2	0	91,150	7.14	173.83	0.85	207.86	28,834	124.81	279.27	1,846
US-St.Lucia	2000	131,098	8,790	2	0	108,000	6.90	176.67	0.70	212.97	30,378	115.10	282.41	1,846
US-St.Lucia	2001	131,440	9,297	2	1	82,300	6.70	172.51	0.87	189.34	31,284	107.22	285.44	1,846
US-St.Lucia	2002	139,875	9,889	2	1	92,750	6.34	198.64	0.92	180.55	32,025	106.68	288.41	1,846
US-St.Lucia	2003	158,440	9,632	2	0	78,750	6.23	231.52	1.00	226.90	33,185	107.70	291.27	1,846
US-St.Lucia	2004	189,176	9,924	2	0	109,150	6.22	261.92	1.00	236.15	35,143	104.87	294.05	1,846
US-St.Lucia	2005	234,120	9,735	2.5	0	128,450	5.98	309.80	1.12	243.81	36,605	109.54	296.93	1,846
US-St.Lucia	2006	295,311	8,698	2.5	0	142,650	5.79	290.86	1.24	272.22	38,540	107.73	299.79	1,846
US-T&T	1995	286,785	3,584	2.5	0	175,965	8.20	161.58	1.99	272.09	23,537	36.89	267.52	1,999
US-T&T	1996	317,053	4,179	2.5	0	195,150	7.77	162.10	2.15	296.54	24,452	26.06	270.23	1,999
US-T&T	1997	347,321	4,537	2.5	0	190,000	7.79	164.45	2.20	352.49	25,930	27.17	273.47	1,999
US-T&T	1998	377,589	4,522	2.5	0	200,410	7.57	173.02	1.42	375.11	26,975	30.51	276.68	1,999
US-T&T	1999	407,857	4,564	2.5	0	233,765	7.14	173.83	2.01	394.38	27,902	37.43	279.85	1,999
US-T&T	2000	438,125	4,902	2.5	0	206,400	6.90	176.67	1.97	311.93	28,310	39.32	282.98	1,999
US-T&T	2001	468,393	4,680	2.5	1	172,550	6.70	172.51	1.80	437.13	27,988	36.24	286.01	1,999
US-T&T	2002	498,661	5,680	2.5	1	207,238	6.34	175.48	2.03	449.34	28,700	39.98	288.98	1,999
US-T&T	2003	528,929	5,958	2.5	0	211,925	6.23	225.13	1.83	470.52	28,266	39.68	291.85	1,999
US-T&T	2004	559,197	6,310	2.5	0	228,750	6.22	252.05	1.35	494.20	29,360	40.03	294.64	1,999
US-T&T	2005	589,465	6,564	2.5	0	242,800	5.98	270.53	1.38	541.96	29,441	41.37	297.51	1,999
US-T&T	2006	619,733	6,678	2.5	0	231,063	5.79	282.60	2.07	560.99	28,835	39.77	300.38	1,999
Canada-Barbad	1995	134,553	464	2.5	0	30,000	8.20	118.99	1.22	640.73	13,107	125.36	24.18	2,424
Canada-Barbad	1996	145,067	475	2.5	0	34,150	7.77	121.97	1.28	674.90	13,209	134.46	24.40	2,424
Canada-Barbad	1997	150,159	520	2.5	0	36,500	7.79	125.96	1.25	701.71	13,099	138.33	24.65	2,424
Canada-Barbad	1998	150,938	516	2.5	0	38,200	7.57	130.74	1.33	735.80	11,611	137.07	24.86	2,424
Canada-Barbad	1999	148,511	554	2.5	0	32,200	7.14	138.51	1.35	747.29	12,510	136.08	25.06	2,424
Canada-Barbad	2000	143,987	599	2.5	0	38,000	6.90	147.91	1.23	787.43	14,157	121.40	25.29	2,424
Canada-Barbad	2001	138,473	594	2.5	1	27,000	6.70	180.29	1.38	783.31	13,640	113.60	25.55	2,424
Canada-Barbad	2002	133,077	620	2.5	1	39,600	6.34	181.61	1.73	764.31	14,314	115.98	25.84	2,424
Canada-Barbad	2003	128,907	668	2.5	0	44,000	6.23	220.81	1.48	775.45	17,528	114.80	26.10	2,424
Canada-Barbad	2004	127,071	742	2.5	0	30,000	6.22	324.67	1.65	808.66	20,745	114.70	26.35	2,424
Canada-Barbad	2005	128,676	706	2.5	0	39,000	5.98	340.90	1.48	832.02	23,883	115.47	26.61	2,424
Canada-Barbad	2006	134,831	732	2.5	0	38,000	5.79	353.43	1.56	866.29	26,618	116.30	26.88	2,424

UK-Caricom markets

Panel data linear form														
Cross-section	Time-series	Prototype variables				Other endogenous variables				Other socio-economic variables			Geographic variables	
Country-pair	Year	Y Country-pair traffic (pax)	X1 Weighted real GDP (PPP) $USbn	X2 Liberalisation scale	X3 Terrorism dummy	X4 QSI	X5 Real average Yield (Uscents/km)	X6 RTK/Revenue per employee (Mean: RTK = Tonnes * total revenue	X7 HHI inverse (no. of carriers)	X8 Trade in services (US$mn)	X9 GDP per capita difference (US$)	X10 Tourism ground costs (US$ per day/night)	X11 Total CP population (mn)	X12 Great circle distance (sm)
UK-Bahamas	1995	15,127	1,144	2.5	0	13,000	6.00	196.79	0.74	1,032.63	7,282	101.36	58.11	4,368
UK-Bahamas	1996	32,482	1,169	2.5	0	17,250	5.54	213.91	0.85	1,077.46	7,821	89.97	58.37	4,368
UK-Bahamas	1997	43,916	1,268	2.5	0	17,600	5.22	236.18	1.00	1,144.61	9,465	86.12	58.53	4,368
UK-Bahamas	1998	50,614	1,345	2.5	0	21,780	5.14	239.28	1.00	1,209.47	9,780	85.26	58.69	4,368
UK-Bahamas	1999	53,763	1,340	2.5	0	13,000	4.57	246.88	1.00	1,313.67	9,216	91.62	58.90	4,368
UK-Bahamas	2000	54,546	1,474	2.5	0	17,000	4.40	251.38	1.00	1,418.39	8,019	98.27	59.11	4,368
UK-Bahamas	2001	54,150	1,531	2.5	1	17,000	4.20	214.89	1.00	1,334.57	7,592	93.78	59.34	4,368
UK-Bahamas	2002	53,759	1,599	2.5	1	22,000	4.30	234.65	1.00	1,400.98	9,260	95.85	59.55	4,368
UK-Bahamas	2003	54,560	1,592	2.5	0	22,000	4.32	263.94	1.00	1,468.15	13,074	93.32	59.79	4,368
UK-Bahamas	2004	57,736	1,733	2.5	0	21,000	4.39	277.98	1.00	1,512.05	18,365	88.18	60.07	4,368
UK-Bahamas	2005	64,475	1,830	2.5	0	26,000	4.27	353.05	1.73	1,578.84	18,980	97.98	60.46	4,368
UK-Bahamas	2006	75,960	1,900	2.5	0	25,000	4.28	450.87	1.75	1,592.20	20,296	103.71	60.78	4,368
UK-Barbados	1995	253,659	1,073	3.5	0	68,500	6.00	166.04	1.41	574.88	12,454	138.21	58.07	4,220
UK-Barbados	1996	326,524	1,087	3.5	0	76,400	5.54	176.14	1.36	606.91	12,968	138.27	58.32	4,220
UK-Barbados	1997	378,500	1,120	3.5	0	82,700	5.22	188.10	1.45	629.33	14,485	147.28	58.47	4,220
UK-Barbados	1998	420,321	1,133	3.5	0	103,600	5.14	262.16	1.51	672.51	15,458	129.32	58.63	4,220
UK-Barbados	1999	455,916	1,205	3.5	0	97,500	4.57	257.51	1.57	687.97	15,703	119.09	58.84	4,220
UK-Barbados	2000	487,226	1,305	3.5	0	76,400	4.40	267.46	1.58	716.93	14,976	115.40	59.04	4,220
UK-Barbados	2001	515,370	1,198	3.5	1	82,300	4.20	267.60	1.63	731.94	14,772	108.18	59.27	4,220
UK-Barbados	2002	541,061	1,217	3.5	1	83,200	4.30	267.64	1.81	713.22	17,351	109.09	59.48	4,220
UK-Barbados	2003	564,782	1,373	3.5	0	85,000	4.32	281.17	1.64	717.91	20,503	116.09	59.71	4,220
UK-Barbados	2004	586,881	1,423	3.5	0	98,000	4.39	306.05	1.92	751.33	25,703	107.80	59.99	4,220
UK-Barbados	2005	607,617	1,508	4.5	0	94,000	4.27	298.78	2.69	779.79	25,943	110.98	60.38	4,220
UK-Barbados	2006	627,185	1,662	4.5	0	103,000	4.28	332.32	2.95	795.92	27,059	109.23	60.69	4,220
UK-St. Lucia	1995	74,773	1,216	2.5	0	21,000	6.00	176.63	2.11	184.00	15,779	101.35	58.12	4,246
UK-St. Lucia	1996	98,921	1,253	2.5	0	24,350	5.54	196.61	2.32	181.08	16,681	102.47	58.23	4,246
UK-St. Lucia	1997	116,635	1,337	2.5	0	28,750	5.22	232.81	2.69	189.34	18,921	102.55	58.38	4,246
UK-St. Lucia	1998	128,919	1,311	2.5	0	30,610	5.14	273.60	2.58	206.20	20,205	107.52	58.55	4,246
UK-St. Lucia	1999	136,777	1,358	2.5	0	29,320	4.57	262.83	2.87	213.65	20,636	93.34	58.76	4,246
UK-St. Lucia	2000	141,211	1,557	2.5	0	29,950	4.40	275.50	2.85	211.93	20,149	86.08	58.96	4,246
UK-St. Lucia	2001	143,226	1,640	2.5	1	27,750	4.20	293.96	2.74	193.91	20,078	80.19	59.19	4,246
UK-St. Lucia	2002	143,825	1,693	2.5	1	20,600	4.30	284.14	1.92	183.02	22,255	79.17	59.40	4,246
UK-St. Lucia	2003	144,011	1,759	2.5	0	19,350	4.32	289.79	2.36	229.37	26,015	80.51	59.63	4,246
UK-St. Lucia	2004	144,788	1,826	2.5	0	24,150	4.39	294.60	2.42	237.93	31,321	78.40	59.91	4,246
UK-St. Lucia	2005	147,159	1,892	2.5	0	27,800	4.27	307.38	2.31	250.92	31,688	81.58	60.30	4,246
UK-St. Lucia	2006	152,129	1,982	2.5	0	24,350	4.28	342.67	1.56	271.62	33,563	83.30	60.61	4,246
UK-Jamaica	1995	231,722	900	1.5	0	49,000	6.00	160.77	1.52	1,320.17	17,524	76.32	59.49	4,723
UK-Jamaica	1996	270,593	940	1.5	0	52,275	5.54	169.69	1.56	1,342.85	17,796	72.42	59.66	4,723
UK-Jamaica	1997	304,565	949	1.5	0	61,250	5.22	178.28	1.95	1,425.69	19,938	69.76	59.82	4,723
UK-Jamaica	1998	333,639	1,021	1.5	0	68,605	5.14	171.61	2.00	1,495.28	21,419	69.85	59.99	4,723
UK-Jamaica	1999	357,815	1,044	1.5	0	52,275	4.57	183.52	1.96	1,605.12	22,165	71.22	60.21	4,723
UK-Jamaica	2000	377,091	1,090	1.5	0	53,550	4.40	186.48	1.95	1,671.13	21,667	67.05	60.42	4,723
UK-Jamaica	2001	391,469	1,062	1.5	1	60,450	4.20	180.33	1.94	1,683.01	21,264	61.99	60.65	4,723
UK-Jamaica	2002	400,949	1,082	1.5	1	67,000	4.30	202.94	1.51	1,757.20	23,459	60.37	60.87	4,723
UK-Jamaica	2003	405,530	1,272	1.5	0	62,350	4.32	215.58	1.58	1,841.04	27,506	61.13	61.11	4,723
UK-Jamaica	2004	405,212	1,264	1.5	0	59,075	4.39	223.65	1.43	1,917.28	32,696	60.69	61.40	4,723
UK-Jamaica	2005	399,996	1,250	3	0	57,025	4.27	285.29	1.37	1,935.17	33,510	61.24	61.79	4,723
UK-Jamaica	2006	389,881	1,284	3	0	60,075	4.28	421.46	2.39	1,955.19	35,261	60.56	62.11	4,723
UK-T&T	1995	107,231	658	2.5	0	25,250	6.00	196.79	1.10	278.09	15,353	28.36	58.64	4,433
UK-T&T	1996	130,199	786	2.5	0	30,500	5.54	213.91	1.30	309.93	16,001	26.77	58.81	4,433
UK-T&T	1997	145,853	748	2.5	0	29,920	5.22	236.18	1.25	364.80	18,273	27.91	58.96	4,433
UK-T&T	1998	158,087	838	2.5	0	31,860	5.14	239.28	1.26	386.23	19,669	31.34	59.13	4,433
UK-T&T	1999	168,280	886	2.5	0	29,920	4.57	246.88	1.26	405.06	19,704	38.45	59.34	4,433
UK-T&T	2000	177,094	915	2.5	0	38,700	4.40	251.38	1.50	313.19	18,081	40.40	59.53	4,433
UK-T&T	2001	184,905	985	2.5	1	37,700	4.20	214.89	1.45	443.00	16,783	37.22	59.76	4,433
UK-T&T	2002	191,949	952	2.5	1	45,925	4.30	200.45	1.64	453.79	18,930	41.07	59.97	4,433
UK-T&T	2003	198,385	1,106	2.5	0	44,813	4.32	281.17	2.34	473.32	21,096	40.77	60.21	4,433
UK-T&T	2004	204,324	1,158	2.5	0	42,950	4.39	320.08	2.17	496.51	25,538	41.12	60.49	4,433
UK-T&T	2005	209,851	1,257	2.5	0	42,900	4.27	324.70	2.04	551.26	24,523	42.50	60.88	4,433
UK-T&T	2006	215,026	1,322	2.5	0	37,950	4.28	341.14	2.20	561.23	23,858	40.86	61.19	4,433

Intra-Caricom markets

Panel data linear form													
Cross-section	Time-series	Prototype variables				Other endogenous variables				Other socio-economic variables			Geographic variables	
Country-pair	Year	Y Country-pair traffic (pax)	X1 Weighted real GDP (PPP) $USbn	X2 Liberalisation scale	X3 Terrorism dummy	X4 QSI	X5 Real average Yield (Uscents/km)	X6 RTK/Revenue per employee (Mean: RTK = Tonnes * total revenue	X7 HHI inverse (no. of carriers)	X8 Trade in services (US$mn)	X9 GDP per capita difference (US$)	X10 Tourism ground costs (US$ per day/night)	X11 Total CP population (mn)	X12 Great circle distance (sm)
Bahamas-Barbados	1995	5,583	3.42	0.0	0	-1,984	12.30	123.28	0.50	1,108.97	5,172	107.81	0.36	1,441
Bahamas-Barbados	1996	5,369	3.64	0.0	0	-1,869	12.00	121.30	0.51	1,218.98	5,148	108.46	0.36	1,441
Bahamas-Barbados	1997	5,163	3.88	0.0	0	-1,799	11.70	125.49	0.50	1,295.84	5,020	110.36	0.37	1,441
Bahamas-Barbados	1998	4,965	4.14	0.0	0	-2,074	10.47	129.01	0.52	1,477.91	5,678	102.68	0.37	1,441
Bahamas-Barbados	1999	4,774	4.30	0.0	0	-2,215	10.16	134.41	0.58	1,326.94	6,487	102.56	0.38	1,441
Bahamas-Barbados	2000	4,591	4.50	0.0	0	-2,361	10.00	148.04	0.53	1,334.07	6,957	105.06	0.38	1,441
Bahamas-Barbados	2001	4,415	4.56	0.0	1	-2,310	9.80	138.52	0.54	1,447.64	7,180	99.44	0.38	1,441
Bahamas-Barbados	2002	4,246	4.77	0.0	1	-2,102	9.85	142.31	0.50	1,296.48	8,090	101.01	0.39	1,441
Bahamas-Barbados	2003	4,083	4.91	0.0	0	-2,179	10.02	163.63	0.51	1,282.19	7,429	102.76	0.39	1,441
Bahamas-Barbados	2004	3,927	5.22	0.0	0	-2,484	10.50	199.36	0.50	1,369.44	7,337	96.29	0.40	1,441
Bahamas-Barbados	2005	3,776	5.57	0.0	0	-2,657	11.01	243.04	0.50	1,416.10	6,963	105.79	0.40	1,441
Bahamas-Barbados	2006	3,631	6.00	0.0	0	-2,756	11.52	263.19	0.52	1,481.69	6,763	106.39	0.41	1,441
Bahamas-Jamaica	1995	38,611	6.50	2.0	0	18,000	12.30	124.75	1.10	5,034.73	10,242	89.50	1.68	453
Bahamas-Jamaica	1996	33,456	6.50	2.0	0	15,500	12.00	125.48	1.08	6,010.43	9,975	90.13	1.70	453
Bahamas-Jamaica	1997	29,533	6.59	2.0	0	18,000	11.70	120.38	1.08	6,340.97	10,473	86.54	1.72	453
Bahamas-Jamaica	1998	26,696	6.96	2.0	0	14,100	10.47	103.95	1.07	6,504.70	11,639	86.11	1.74	453
Bahamas-Jamaica	1999	24,799	7.34	2.0	0	17,000	10.16	120.16	1.11	7,495.48	12,949	91.01	1.74	453
Bahamas-Jamaica	2000	23,696	7.48	2.0	0	27,200	10.00	121.59	1.04	11,150.28	13,648	93.23	1.76	453
Bahamas-Jamaica	2001	23,238	8.06	2.0	1	17,000	9.80	145.76	1.05	6,993.00	13,672	87.98	1.77	453
Bahamas-Jamaica	2002	23,281	8.40	2.0	1	22,600	9.85	171.23	1.04	7,970.55	14,199	88.37	1.78	453
Bahamas-Jamaica	2003	23,678	7.32	2.0	0	17,000	10.02	167.22	1.10	7,788.73	14,432	87.34	1.79	453
Bahamas-Jamaica	2004	24,281	8.56	2.0	0	19,300	10.50	169.32	1.05	7,689.20	14,331	84.22	1.80	453
Bahamas-Jamaica	2005	24,945	8.94	2.0	0	20,575	11.01	149.77	1.01	9,127.71	14,530	94.41	1.81	453
Bahamas-Jamaica	2006	25,523	9.58	2.0	0	18,275	11.52	153.03	1.06	9,464.59	14,965	95.70	1.82	453
Barbados-Guyana	1995	25,481	2.90	1.5	0	14,500	12.30	94.36	1.52	209.30	6,258	70.65	0.24	463
Barbados-Guyana	1996	32,747	3.09	1.5	0	15,000	12.00	95.47	1.49	216.15	6,609	72.95	0.24	463
Barbados-Guyana	1997	37,594	3.31	1.5	0	18,575	11.70	97.53	1.61	216.47	7,276	79.31	0.24	463
Barbados-Guyana	1998	40,459	3.47	1.5	0	31,500	10.47	105.02	1.59	212.51	7,952	68.73	0.24	463
Barbados-Guyana	1999	41,781	3.50	2.5	0	49,125	10.16	198.48	2.32	218.21	8,356	76.47	0.24	463
Barbados-Guyana	2000	41,997	3.62	2.5	0	66,575	10.00	104.68	1.80	244.02	8,609	81.69	0.24	463
Barbados-Guyana	2001	41,546	3.69	2.5	1	54,950	9.80	114.51	2.15	245.09	8,584	74.63	0.25	463
Barbados-Guyana	2002	40,866	3.77	2.5	1	63,300	9.85	113.91	2.47	251.14	8,226	71.20	0.25	463
Barbados-Guyana	2003	40,394	3.96	2.5	0	62,900	10.02	145.56	2.47	249.91	8,976	73.50	0.25	463
Barbados-Guyana	2004	40,569	4.23	2.5	0	62,200	10.50	149.17	2.46	254.28	9,274	62.34	0.25	463
Barbados-Guyana	2005	41,829	4.47	2.5	0	85,500	11.01	143.78	2.50	265.53	10,018	65.76	0.25	463
Barbados-Guyana	2006	44,612	4.81	2.5	0	46,075	11.52	140.21	2.48	274.85	11,007	65.59	0.25	463
Barbados-Jamaica	1995	20,152	5.46	2.0	0	25,500	12.30	130.02	1.87	999.80	5,070	96.86	1.63	1,288
Barbados-Jamaica	1996	20,150	5.90	2.0	0	27,000	12.00	131.93	1.99	1,109.28	4,828	96.86	1.64	1,288
Barbados-Jamaica	1997	20,271	6.10	2.0	0	29,250	11.70	130.20	1.95	1,142.48	5,453	99.68	1.66	1,288
Barbados-Jamaica	1998	20,516	5.70	2.0	0	27,500	10.47	128.22	1.99	1,230.18	5,961	92.83	1.67	1,288
Barbados-Jamaica	1999	20,884	6.00	2.0	0	54,050	10.16	136.24	1.96	1,177.87	6,462	89.47	1.68	1,288
Barbados-Jamaica	2000	21,376	6.41	2.0	0	27,500	10.00	133.64	1.85	1,277.89	6,691	85.66	1.69	1,288
Barbados-Jamaica	2001	21,992	6.45	2.0	1	33,000	9.80	152.85	2.18	1,305.16	6,492	79.96	1.70	1,288
Barbados-Jamaica	2002	22,732	6.70	2.0	1	30,800	9.85	168.74	1.98	1,234.91	6,109	79.50	1.70	1,288
Barbados-Jamaica	2003	23,595	6.95	2.0	0	31,650	10.02	196.94	1.99	1,179.37	7,003	83.31	1.71	1,288
Barbados-Jamaica	2004	24,582	7.33	2.0	0	31,700	10.50	198.20	1.94	1,243.03	6,993	79.63	1.72	1,288
Barbados-Jamaica	2005	25,692	7.60	2.0	0	32,800	11.01	183.02	1.86	1,312.33	7,567	81.37	1.73	1,288
Barbados-Jamaica	2006	26,926	8.40	2.0	0	33,000	11.52	179.25	1.89	1,368.65	8,202	80.38	1.74	1,288
Barbados-St. Lucia	1995	30,713	1.84	2.0	0	112,250	12.30	89.08	1.35	236.34	3,325	79.99	0.22	121
Barbados-St. Lucia	1996	33,875	1.99	2.0	0	109,100	12.00	89.02	1.52	224.24	3,712	75.27	0.22	121
Barbados-St. Lucia	1997	37,038	2.16	2.0	0	110,250	11.70	87.71	1.48	236.70	4,436	73.78	0.22	121
Barbados-St. Lucia	1998	40,201	2.28	2.0	0	116,700	10.47	80.75	1.46	256.09	4,746	69.42	0.23	121
Barbados-St. Lucia	1999	43,364	2.59	2.5	0	133,730	10.16	111.77	2.45	271.05	4,934	72.31	0.23	121
Barbados-St. Lucia	2000	46,526	2.67	2.5	0	208,263	10.00	110.31	3.05	265.06	5,172	71.64	0.23	121
Barbados-St. Lucia	2001	49,689	2.50	2.5	1	188,250	9.80	124.93	2.95	225.33	5,306	66.92	0.23	121
Barbados-St. Lucia	2002	52,852	2.35	2.5	1	146,750	9.85	116.40	2.26	218.26	4,904	64.33	0.23	121
Barbados-St. Lucia	2003	56,014	2.45	2.5	0	162,188	10.02	115.84	2.57	291.82	5,512	67.26	0.23	121
Barbados-St. Lucia	2004	59,177	2.76	2.5	0	152,250	10.50	120.28	2.17	301.61	5,618	60.25	0.23	121
Barbados-St. Lucia	2005	62,340	2.98	2.5	0	141,125	11.01	110.53	1.91	315.32	5,744	62.59	0.24	121
Barbados-St. Lucia	2006	65,502	3.11	4.5	0	132,625	11.52	187.58	2.25	362.00	6,504	63.21	0.24	121
Barbados-T&T	1995	74,101	5.33	2.5	0	138,500	12.30	94.36	1.91	496.82	2,899	72.96	0.79	213
Barbados-T&T	1996	79,833	5.78	2.5	0	150,750	12.00	95.47	1.87	552.35	3,032	69.37	0.80	213
Barbados-T&T	1997	85,565	6.20	2.5	0	141,500	11.70	97.53	1.62	764.99	3,788	74.18	0.80	213
Barbados-T&T	1998	91,297	6.94	2.5	0	150,425	10.47	178.51	1.73	787.55	4,210	69.06	0.81	213
Barbados-T&T	1999	97,029	7.65	2.5	0	189,400	10.16	198.48	1.58	869.36	4,001	69.24	0.81	213
Barbados-T&T	2000	102,760	8.30	2.5	0	168,000	10.00	177.27	1.86	544.27	3,104	68.74	0.80	213
Barbados-T&T	2001	108,492	8.71	2.5	1	142,650	9.80	124.93	1.63	1,023.33	2,011	64.23	0.80	213
Barbados-T&T	2002	114,224	9.45	2.5	1	150,300	9.85	113.91	2.39	1,138.73	1,580	66.80	0.80	213
Barbados-T&T	2003	119,956	10.82	2.5	0	160,700	10.02	145.56	2.38	1,272.80	593	70.04	0.81	213
Barbados-T&T	2004	125,688	12.02	2.5	0	136,500	10.50	149.17	2.25	1,338.72	165	66.75	0.82	213
Barbados-T&T	2005	131,420	13.46	2.5	0	168,750	11.01	143.78	2.45	1,690.49	1,420	69.10	0.82	213
Barbados-T&T	2006	137,152	15.05	2.5	0	155,500	11.52	193.90	2.73	1,733.79	3,201	67.55	0.82	213
Dominica-T&T	1995	7,914	5.68	1.5	0	4,100	12.30	53.42	0.52	59.29	1,168	56.29	0.68	343
Dominica-T&T	1996	9,436	6.07	1.5	0	4,200	12.00	52.56	0.52	60.74	1,273	53.30	0.68	343
Dominica-T&T	1997	10,462	6.77	1.5	0	3,500	11.70	55.05	0.51	70.18	1,128	47.08	0.68	343
Dominica-T&T	1998	11,118	7.77	1.5	0	4,125	10.47	57.55	0.50	68.91	1,152	43.86	0.69	343
Dominica-T&T	1999	11,532	8.24	2.25	0	688	10.16	62.83	0.55	80.46	1,595	51.28	0.69	343
Dominica-T&T	2000	11,830	9.71	2.25	0	1,200	10.00	63.66	1.02	91.11	2,709	50.84	0.68	343
Dominica-T&T	2001	12,140	8.34	2.25	1	1,600	9.80	69.09	1.04	66.81	3,827	49.19	0.68	343
Dominica-T&T	2002	12,589	10.63	2.25	1	3,000	9.85	61.57	1.00	70.77	4,080	50.00	0.68	343
Dominica-T&T	2003	13,304	11.83	2.25	0	10,125	10.02	64.46	1.00	75.48	5,779	54.79	0.69	343
Dominica-T&T	2004	14,412	13.87	2.25	0	10,125	10.50	71.25	1.00	80.04	6,691	49.33	0.69	343
Dominica-T&T	2005	16,041	13.94	2.25	0	13,350	11.01	71.29	1.91	78.58	8,540	50.88	0.70	343
Dominica-T&T	2006	18,317	16.45	2.25	0	16,500	11.52	74.94	1.96	86.86	11,174	50.93	0.70	343
Guyana-T&T	1995	43,082	3.87	2.5	0	138,775	12.30	211.09	1.45	322.92	3,359	31.02	0.73	354
Guyana-T&T	1996	47,850	4.05	2.5	0	135,150	12.00	220.50	1.63	316.00	3,577	29.45	0.73	354
Guyana-T&T	1997	52,048	4.36	2.5	0	148,500	11.70	220.82	1.38	280.85	3,488	32.34	0.74	354
Guyana-T&T	1998	55,676	4.68	2.5	0	153,800	10.47	238.99	1.54	270.28	3,741	30.33	0.74	354
Guyana-T&T	1999	58,736	5.30	2.5	0	145,400	10.16	266.30	1.08	274.17	4,355	48.06	0.74	354
Guyana-T&T	2000	61,225	5.76	2.5	0	99,500	10.00	261.91	1.08	443.63	5,504	56.70	0.73	354
Guyana-T&T	2001	63,145	5.80	2.5	1	103,750	9.80	273.19	1.17	309.30	6,572	50.66	0.74	354
Guyana-T&T	2002	64,495	6.40	2.5	1	112,300	9.85	229.66	1.62	309.94	6,646	48.79	0.74	354
Guyana-T&T	2003	65,275	6.85	2.5	0	80,000	10.02	279.56	1.33	300.05	8,383	47.42	0.74	354
Guyana-T&T	2004	65,486	7.90	2.5	0	86,775	10.50	269.48	1.28	303.07	9,439	39.23	0.75	354
Guyana-T&T	2005	65,127	8.38	2.5	0	84,000	11.01	235.97	1.23	305.17	11,438	42.10	0.75	354
Guyana-T&T	2006	64,199	9.22	2.5	0	99,000	11.52	200.88	1.76	318.44	14,209	41.85	0.75	354
Jamaica-T&T	1995	17,650	8.03	1.5	0	13,000	12.30	130.02	1.15	346.90	2,171	65.57	2.12	1,241
Jamaica-T&T	1996	19,106	8.42	1.5	0	12,000	12.00	131.93	1.00	397.35	1,795	61.09	2.14	1,241
Jamaica-T&T	1997	20,444	8.84	1.5	0	12,000	11.70	130.20	1.00	489.18	1,665	60.04	2.16	1,241
Jamaica-T&T	1998	21,664	9.25	1.5	0	12,000	10.47	128.22	1.00	516.29	1,750	62.26	2.17	1,241
Jamaica-T&T	1999	22,765	9.83	1.5	0	37,500	10.16	136.24	1.00	524.86	2,461	68.44	2.18	1,241
Jamaica-T&T	2000	23,748	10.45	1.5	0	11,800	10.00	133.64	1.92	382.13	3,586	67.04	2.18	1,241
Jamaica-T&T	2001	24,613	11.00	1.5	1	12,000	9.80	159.93	1.00	599.65	4,481	62.06	2.19	1,241
Jamaica-T&T	2002	25,359	11.82	1.5	1	12,000	9.85	166.25	1.00	619.30	4,529	63.58	2.19	1,241
Jamaica-T&T	2003	25,987	13.28	1.5	0	12,000	10.02	226.67	1.00	634.25	6,410	63.92	2.21	1,241
Jamaica-T&T	2004	26,497	14.48	1.5	0	14,000	10.50	227.09	1.00	668.39	7,158	63.92	2.22	1,241
Jamaica-T&T	2005	26,888	15.84	1.5	0	12,000	11.01	216.27	1.00	769.42	8,987	65.05	2.23	1,241
Jamaica-T&T	2006	27,162	17.97	1.5	0	12,000	11.52	205.48	1.00	791.76	11,403	63.78	2.24	1,241
Suriname-T&T	1995	8,118	4.20	2.5	0	17,800	12.30	211.09	1.33	226.68	2,639	71.54	0.87	550
Suriname-T&T	1996	8,314	4.46	2.5	0	18,500	12.00	220.50	1.94	205.60	2,598	66.09	0.88	550
Suriname-T&T	1997	8,440	4.85	2.5	0	24,800	11.70	220.82	1.54	222.07	2,450	66.86	0.88	550
Suriname-T&T	1998	8,547	5.62	2.5	0	23,600	10.47	238.99	1.56	203.56	2,272	67.49	0.89	550
Suriname-T&T	1999	8,688	5.84	2.5	0	20,400	10.16	266.30	1.36	155.63	3,373	73.30	0.90	550
Suriname-T&T	2000	8,915	6.21	2.5	0	19,800	10.00	261.91	1.38	214.73	4,554	74.41	0.89	550
Suriname-T&T	2001	9,279	6.35	2.5	1	21,088	9.80	273.19	1.83	163.22	5,354	68.17	0.89	550
Suriname-T&T	2002	9,835	7.26	2.5	1	24,000	9.85	293.93	1.54	136.38	4,809	66.61	0.90	550
Suriname-T&T	2003	10,633	8.35	2.5	0	24,200	10.02	356.66	1.85	179.30	6,148	66.48	0.91	550
Suriname-T&T	2004	11,726	9.30	2.5	0	72,000	10.50	336.09	1.90	168.33	6,848	61.59	0.92	550
Suriname-T&T	2005	13,166	10.01	2.5	0	60,800	11.01	282.86	2.21	182.85	8,167	64.36	0.93	550
Suriname-T&T	2006	15,005	11.27	2.5	0	70,000	11.52	287.44	2.25	185.68	9,915	64.07	0.93	550