ANALYSIS OF THE INTERACTION BETWEEN AIR TRANSPORTATION AND ECONOMIC ACTIVITY: A WORLDWIDE PERSPECTIVE

Mariya A. Ishutkina and R. John Hansman

This report is based on the Doctoral Dissertation of Mariya A. Ishutkina submitted to the Department of Aeronautics and Astronautics in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the Massachusetts Institute of Technology.

The work presented in this report was also conducted in collaboration with the members of the Doctoral Committee:

Prof. R. John Hansman (Chair)
Prof. John D. Sterman
Prof. Ian A. Waitz

Report No. ICAT-2009-2
March 2009

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

Analysis of the Interaction Between Air Transportation and Economic Activity: A Worldwide Perspective

by

Mariya A. Ishutkina

Submitted to the Department of Aeronautics and Astronautics
on March 11, 2009, in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Abstract

Air transportation usage and economic activity are interdependent. Air transportation provides employment and enables certain economic activities which are dependent on the availability of air transportation services. The economy, in turn, drives the demand for air transportation services resulting in the feedback relationship between the two. The objective of this work is to contribute to the understanding of the relationship between air transportation and economic activity. More specifically, this work seeks to (1) develop a feedback model to describe the relationship between air transportation and economic activity and (2) identify factors which stimulate or suppress air transportation development. To achieve these objectives this work uses an exploratory research method which combines literature review, aggregate data and case study analyses.

First, this work uses data at the individual country level to identify different types of growth patterns between air transportation passengers and GDP for 139 countries. This analysis is then used to identify twenty-two representative countries which span a range of possible interaction behaviors, geographies and income categories. The case study analysis at the individual country level is performed to describe the air transportation impact for each individual economy. These findings help develop a feedback model which describes the relationship between air transportation and economic activity. Specifically, the analysis is used to describe (1) how air transportation flows of passengers and cargo enable the flows of goods, services, knowledge, tourism, investment, remittances and labor among economies and (2) how air transportation flows can affect the country's factor, demand and business conditions. The feedback model is then extended to perform quantitative analysis of the evolution of the enabling impact of air transportation in a particular economy. Specifically, a quantitative system dynamics model is developed to describe the interaction between the demand for leisure travel and the resulting enabling impact of tourism on Jamaica's economy.

Case study analysis is also used to identify factors which may stimulate or suppress air transportation system development. The factors are identified both from the air transportation supply and demand sides. The following supply side change factors are identified: changes in the regulatory framework, infrastructure capability, vehicle capability and airline strategy. The air transportation demand is found to be directly affected by exogenous demand shocks, economic downturns, political and economic sanctions, and the development of other transportation modes. The analysis also identifies the following change factors which affect the demand indirectly by changing the country's economic attributes: economic liberalization, institutional and political reforms, supporting infrastructure investment, exchange rate fluctuations, political and macroeconomic stability, growing consumer demand, and changes in management practices. This analysis of stimulating and suppressing factors helps to describe the role of government intervention in changing air transportation system development and its impact on economic activity. The results of this work can help guide further development efforts, investment and policy decisions pertaining to air transportation usage especially in developing economies.

Thesis Supervisor: R. John Hansman
Title: Professor of Aeronautics and Astronautics

Acknowledgments

This work was supported by the MIT's Global Airline Industry Program under the Alfred P. Sloan Foundation grants # 2002-12-7 and # 2006-3-7, by the U.S. Federal Aviation Administration (FAA) under the Joint University Program (JUP) grant # FAA 95-G-017 and by the U.S. Federal Aviation Administration (FAA) grant # DTFA01-C-00030.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

1.1 Motivation

The relationship between air transportation and economic activity is complex. Over the last several decades, both air transportation usage and economic activity have been growing around the world. Between 1970 and 2005 the total number of air passengers carried by the world's airlines increased 6.5 times from 310 million to 2 billion passengers. During the same time period, the world's Gross Domestic Product (GDP) tripled from 12 to 36 trillion US$ [212]. As the air transportation usage grew, it came to play an important role in the global economy: in 2004, 40% of international tourists traveled by air while air cargo accounted for 40% of inter-regional goods exports [3]. Air transportation is the only feasible long-distance transportation mode for high-value perishable commodities and time-sensitive people and is often the only means of access for geographically isolated areas. Air transportation enables access to markets, people, capital, knowledge and skills, opportunity, and resources. As a result, the availability of air transportation services effectively increases the geographic scope and cycle time of economic activity.

Depending on the combination of unique economic and air transportation attributes, different mechanisms dominate the relationship between air transportation and economic activity. Because of these unique attributes, the nature of air transportation flows differs among the economies. In some countries, international visitors account for most of the travelers, while domestic traffic flows dominate in other economies. For example, the domestic traffic flows within the United States account for 90% of all U.S. passengers, whereas almost 90% of Ireland's air passengers travel internationally [208]. The dominant purpose of visit for passengers varies between the economies as well. According to the World Tourism Organization, more than half of all international overnight trips are taken for leisure purposes via all transportation modes [214]. However, the share of visits for a specific purpose varies significantly between individual economies. For example, nine out of ten visitors to Greece travel for leisure purposes while the primary purpose of visit for more than 70% of visitors to Russia is visiting friends and relatives [79].

While the relationship between air transportation and economic activity may be complex and nonhomogeneous, the data presented in Figures 1-1 and 1-2 support the hypothesis that the two systems may be interdependent. In particular, high correlation coefficients between air passengers and GDP imply that there is a strong linear relationship between the two variables. Air passengers and GDP exhibit high cor-

relation coefficients using both time-series and cross-sectional (i.e., analysis of the relationship at one point in time) analyses. In Figure 1-1 the air passenger and GDP data exhibit a correlation coefficient of 0.99. This correlation coefficient was calculated using time-series world aggregate data during the 1970–2005 time period [1]. The correlation coefficient was also computed using cross-sectional data for 137 countries for year 2005. In such a case, the air passenger and GDP data exhibit a correlation coefficient of 0.93 as shown in Figure 1-2. Given the scale and ubiquity of air transportation, it is important to understand how air transportation impacts economic activity and which factors affect the interaction between the two systems. Such an understanding may help guide further development efforts, investment and policy decisions pertaining to air transportation usage and the resulting enabling impact on an economy.

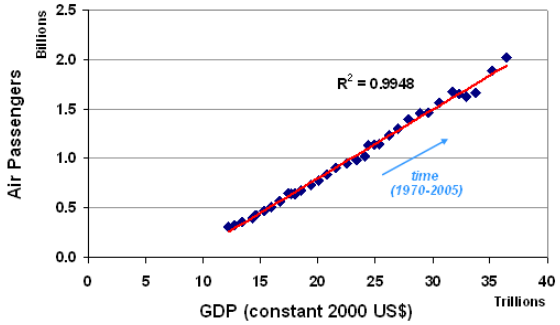


Figure 1-1: The correlation coefficient between air transportation passengers and GDP using world aggregate time-series data during the 1970–2005 time period is 0.99.

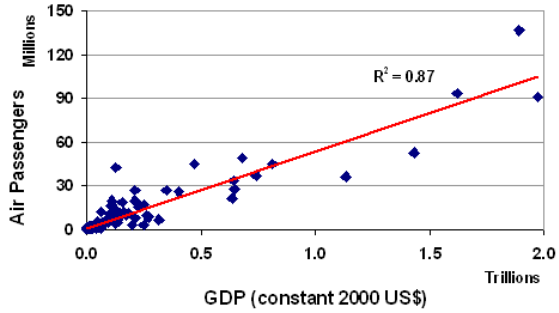


Figure 1-2: The correlation coefficient between air transportation passengers and GDP using cross-sectional data for 137 countries for year 2005 is 0.93. The sample excludes United States and Japan, if included, R^2 = 0.91, correlation coefficient = 0.95.

The feedback relationship between air transportation and an economy is described in Figure 1-3. The air transportation system is defined by its infrastructure capability, regulatory framework, vehicle and airline capabilities. Internal to the air transportation system is the supply and demand relationship where airlines provide supply through pricing and scheduling of flights based on the revenues and profitability of a particular

[1] All of the graphs in this work were produced by the author using the economic data from the World Bank database *World Development Indicators* and the air passenger data from the International Civil Aviation Organization (ICAO) database; unless noted otherwise. The data sources are described in detail in Chapter 3.

route. Air transportation impacts an economy by providing employment in the aviation sector and creating wider socioeconomic benefits through its potential to *enable* certain types of activities in a local economy because of its distinctive characteristics: speed, cost, flexibility, reliability, and safety. The region's economic activity in turn provides capital and generates the need for passenger travel and freight which drives the demand for air transportation services.

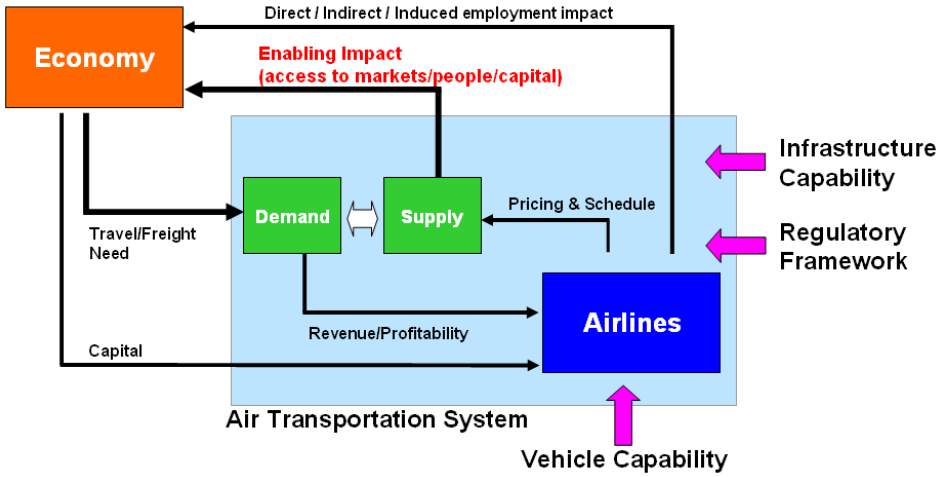


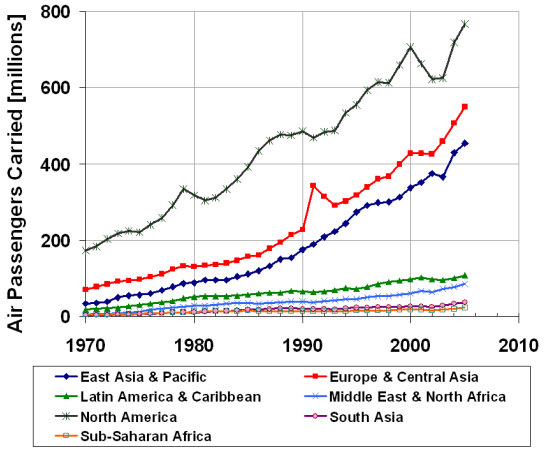
Figure 1-3: Feedback-based interaction between Air Transportation System and an Economy. (Adapted from Hansman [97].)

Presently, the literature lacks a comprehensive way of describing the relationship of air transportation to economic activity because the analysis ignores some interaction effects. There are two major types of studies evaluating the impact of air transportation. These studies and their limitations are reviewed in Chapter 2. First, are studies evaluating the direct, indirect and induced employment impact of air transportation. Direct impact is the employment in the aviation industry, indirect impact is the employment in the industries down the aviation supply chain, and induced impact is the employment supported by the spending of those directly and indirectly employed in the aviation industry. These studies ignore the enabling impact of air transportation and are typically done for the developed economies because they use data-intensive regional input-output matrices which are rarely available for the developing countries.

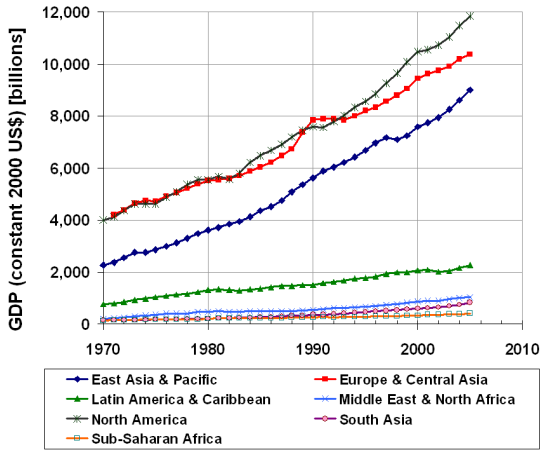
Second, are studies which attempt to evaluate the enabling, or catalytic, impact of air transportation. The enabling impact of air transportation is defined as the total economic impact on employment and income generated by the economic activities which are dependent on the availability of air transportation services. The enabling impact of air transportation is achieved through passenger and cargo flows which occur between a given economy and the rest of the world where a given economy can be defined as a country, a region, or a city depending on the analysis scope. The enabling impact of air transportation is difficult to quantify because it is difficult to isolate the impact of air transportation from other uncontrolled variables, such as globalization or institutional effects. The presence of these confounding factors makes it difficult to quantitatively evaluate the enabling impact of air transportation. In addition, the analysis of the inherent data limitations in Chapter 3 suggests that statistical tools may fail to capture or mask some of the interaction dynamics between air transportation and economic activity. To avoid some of these issues, studies typically

combine quantitative econometric modeling and qualitative techniques such as surveys of firms in the airport catchment area. The studies evaluating the enabling impact quantitatively typically measure the impact of changes in air transportation usage on tourism, trade, local investment and productivity improvement.

The majority of the enabling studies available in the literature have been done on a case by case basis: at either the level of individual airports or small developed economies. These studies, because of the inherent differences between countries, are not easily generalizable to other economies. In particular, the studies available in the literature do not currently cover the enabling impact of air transportation in developing economies. In addition, the literature lacks systematic studies which use worldwide country-level analysis to describe the relationship between air transportation and its impact on economic activity. The only studies which attempt to use worldwide cross-sectional data have been done using statistical tools and therefore have several inherent limitations. Because of the limited analysis scope and limitations of statistical analysis, it is difficult to generalize their observations about the relationship between air transportation and economic activity to other economies.



(a) Air passengers carried by airlines registered in those regions. The abnormally high values for years 1991 and 1992 for the Europe & Central Asia aggregate are due to the addition of Russia (1991) and other states (1992) to the aggregate and possible double-counting of some operations following the dissolution of USSR's Aeroflot into 300 regional airlines in December 1991.



(b) GDP (constant 2000 US$): country aggregates by region. The change in years 1989 and 1990 for European aggregate is due to the addition of Russia (1989) and other former USSR states (1990) to the World Bank's European & Central Asia aggregate.

Figure 1-4: The air transportation and GDP growth patterns vary with time and across different regional aggregates.

Despite the fact that there is evidence of the general interdependency relationship between air transportation and economy's GDP, the interaction and growth patterns between these variables vary both between economies and over time for a single economy. Figure 1-4 shows air passenger and GDP growth patterns for countries aggregated by geographic region. While both the volume of air passengers and GDP have been growing on average in every region, the individual growth rates and changes in the growth rates vary. For example, between 1970 and 2005, East Asia & Pacific, Middle East and South Asia came to play a more prominent role in the world's passenger traffic because their shares doubled during that time period. Meanwhile, the Latin American and Sub-Saharan African traffic grew at less than average growth rates.

In Figure 1-4(a) one can also observe that air passenger growth rates have changed over time as well. For example, the growth rate of East Asia & Pacific passenger traffic increased in the late 1980s, experienced a decline in 2003 but has been increasing since then. To fully understand the interaction between air transportation and economic activity, in addition to describing the enabling impact of air transportation, one needs to identify factors which may stimulate or suppress air transportation development. Since the growth patterns between regions and individual economies vary, it is instructive to look at different countries to cover the breadth of possible dynamics.

To summarize, the data and analyses done in the literature support the hypothesis that there is a feedback relationship between air transportation and economic activity. However, the available studies of the enabling impact of air transportation have the following limitations: (1) the analysis is usually performed on a case by case basis and therefore does not provide a comprehensive description of interaction dynamics between air transportation and economic activity, (2) the studies describe the enabling impact of air transportation only in developed economies, (3) the cross-sectional statistical approach may not be appropriate due to the data limitations identified in this work, and (4) the analyses do not describe in sufficient detail the air transportation system and factors which influence its development. This research attempts to alleviate some of these drawbacks by providing broad-scope analysis of the interaction between air transportation and economic activity and analysis of factors which influence their development.

1.2 Research Objectives

The goal of this research is to contribute to the understanding of the relationship between air transportation and economic activity. This work seeks to (1) describe the mechanisms through which air transportation enables economic activity, and (2) identify factors which stimulate or suppress air transportation system development. Such an understanding may help guide further development efforts, investment and policy decisions pertaining to air transportation usage particularly in developing countries.

1.3 Problem Definition

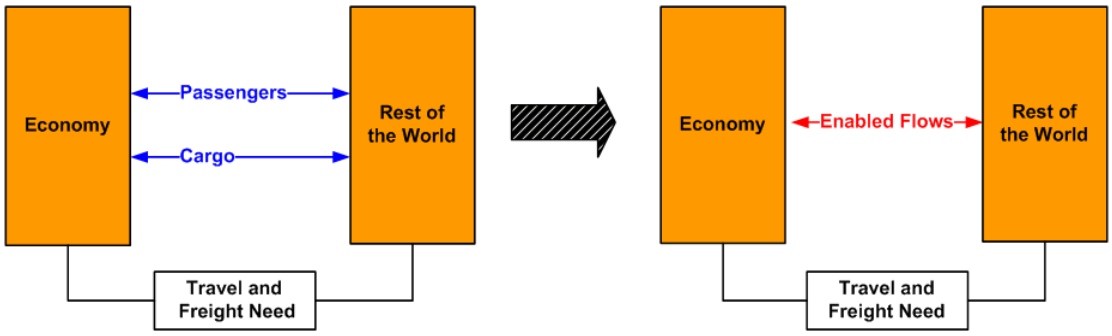


Figure 1-5: Observable Air Transportation Flows of Passengers and Cargo give rise to Enabled Flows which directly affect the Economy.

Air transportation enables economic activity by providing linkage between economies. In general, a given

Economy can represent a country, a region, or a city depending on the analysis scope. In this work, an Economy represents an individual country. The enabling impact of air transportation is defined as the total economic impact on employment and income generated by the economic activities which are dependent on the availability of air transportation services. The enabling impact of air transportation is achieved through air transportation flows of passengers and cargo which occur between an Economy of interest and other economies. The total enabling impact on a particular Economy is defined as that produced by Passenger and Cargo flows between that Economy and the Rest of the World as shown in Figure 1-5.

The Air Transportation Flows result in Enabled Flows which are defined as flows that directly impact an Economy. Specifically, the Enabled Flows impact a set of Attributes which are used to characterize a given Economy. The Economic Attributes consist of (1) factor conditions: land, labor, natural resources, capital, infrastructure and institutions, (2) the business conditions in the nation governing how companies are created, organized and managed, (3) the economy's demand conditions, and (4) presence of related and supporting industries [2]. The enabling impact of air transportation varies between different Economies. As a result, different Enabled Flows dominate in different Economies. For example, some economies rely on air transportation to gain access to the enabled tourism flows, while in others enabled goods flows may play the dominant role. During the course of the analysis in this work different types of Enabled Flows have been identified and categorized.

As the Enabled Flows change the Economic Attributes, the Travel and Freight Need, or air transportation demand, between the Economy and the Rest of the World changes as well. The changes in potential demand affect the Air Transportation System Supply which is set by the airlines whose decision to operate a particular route and pricing and scheduling of flights are influenced by their assessment of passenger and freight demand for the origin-destination market, their assessment of the route's profitability as part of the overall network, the capability of airport and navigation infrastructure, and the available airline resources. The internal supply and demand relationship between airlines and the potential passenger and freight need between the economies results in the physical Air Transportation Flows of passengers and cargo which take place between an Economy of interest and the Rest of the World.

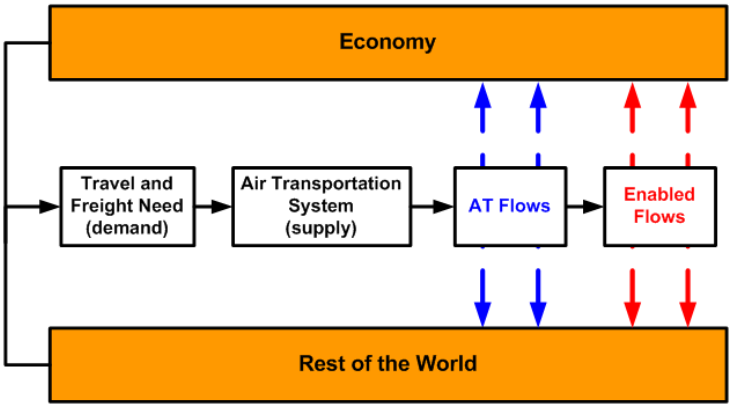


Figure 1-6: This feedback model describes the relationship between air transportation and economic activity.

[2]This description of an Economy is based on the concepts from the economic development literature and Porter's theory of competitive advantage of nations [156, 164].

The feedback model in Figure 1-6 has been developed to frame further discussion of the relationship between air transportation and economic activity. In particular, for each economy studied in this work the following has been performed:

- Identified and described the types of Enabled Flows which take place between a given Economy and the Rest of the World.
- Identified how these Enabled Flows affect the Economic Attributes and the resulting air transportation demand.
- Identified which factors stimulated or suppressed local Air Transportation System development and its enabling impact. These change factors can affect the development directly by changing parameters internal to the Air Transportation System or indirectly by changing the Economic Attributes which are used to characterize a given Economy.

The model, the enabled flows, the enabling mechanisms, and the change factors are described in detail in Chapters 5 and 6.

1.4 Research Approach

This research uses an iterative process to understand and systematically describe the interaction between air transportation and economic activity. The iterative process combines both inductive and deductive research methods to develop a descriptive model of the interaction between air transportation and economic activity [38]. The inductive part of the research method consists of three stages: observation, category identification, and development of a general descriptive model. In social sciences, the inductive research method is called grounded theory or exploratory research [38]. The deductive part of the research method seeks to test the hypotheses which have been formed inductively by improving the descriptive model following identification of anomalies which the current model does not yet support.

Ideally, one would like to do exploratory research in laboratory-like settings. For example, it is best to isolate the impact of aviation by comparing economies with identical socioeconomic and geographic conditions and differing aviation policies. However, no two economies are alike and therefore confounding factor differences will always exist. It is also sometimes believed that the only way to prove a general model developed using case-study analysis is by undergoing a comprehensive analysis which includes all of the possible cases [47]. However, this approach is often not practical due to the limiting time constraints.

Because of these considerations, in order to develop a comprehensive understanding of the interaction between air transportation and economic activity, this research used a combination of literature review, aggregate data analysis and case study analysis. The following steps were taken in the approach:

- Reviewed literature relevant to economic impact modeling of air transportation and evolution of air transportation systems worldwide.
- Reviewed data sources for variables pertaining to air transportation and economic development to assess their quality and limitations.
- Performed cross-sectional analysis of air transportation passengers and GDP for 139 countries to identify the major interaction behaviors between air transportation and economic development.

- Used the results of cross-sectional analysis to identify a set of complementary case studies which span a range of possible interaction behaviors, geographies and income categories.
- Used case study analysis to identify which factors suppressed or stimulated air transportation system development.
- Used case study analysis to develop a conceptual feedback model which describes the enabling impact of air transportation.
- Developed a quantitative model to describe the temporal evolution of an enabling impact of air transportation in one economy.

1.4.1 Literature Review

As part of topic exploration, an analysis of the available literature relevant to economic impact modeling of air transportation was performed. The literature review is presented in Chapter 2. Two types of impact studies were reviewed: the studies evaluating the employment impact of air transportation and studies evaluating the enabling impact of air transportation. Several studies which describe air transportation system evolution and factors which affect air transportation supply were reviewed as well. These studies were used to help understand the relationship between air transportation and economic activity and some of the findings were incorporated into the description of the enabling mechanisms and the model in Chapter 6.

1.4.2 Country-Level Data Analysis

In addition to the literature review, a comprehensive worldwide analysis of air transportation and economic development data was performed. The two major statistics used in this work are air passenger traffic and GDP data. The complete data set consists of 139 countries over a thirty-year time period of 1975 to 2005 (with some omissions). These data were used both at the individual country level and at the aggregate regional level. The data sources and limitations are described in Chapter 3.

The available data were used to explore and better understand the relationship between air transportation and economic activity. Two types of data analyses were performed to identify the major types of behaviors between air passengers and GDP. First, the correlation coefficients between air passengers and GDP were computed for each country to understand the general relationship between the two variables and identify outliers. Second, the temporal data trends were used to identify long-term growth behaviors between the two variables.

During the analysis of growth behaviors, categories were developed for different types of interaction which may occur between air transportation and economic development. In addition, the analysis helped identify countries where air transportation development has been stimulated or suppressed. In this work, air transportation development is considered to be stimulated if the country's air passenger growth rate is at least twice the world's average growth rate over that time period. Air transportation development is considered to be suppressed if the country's air passenger growth rate is negative for a period of at least three consecutive years. Analysis of temporal data also helped identify countries that had discontinuities in the air passenger data.

1.4.3 Case Study Analysis

The relationship between air transportation and economic activity was explored further through case study analysis. In particular, case study analysis was used (1) to identify the stimulating and suppressing factors which affect air transportation development and its impact on economic activity, (2) to elaborate on a conceptual feedback model which describes the enabling impact of air transportation, and (3) to identify limitations in the air transportation data.

A total of twenty-two countries were reviewed. For each case study, the feedback model in Figure 1-6 was used to frame the discussion. These case studies were then used (1) to provide a comprehensive description of factors which stimulate and suppress air transportation system development in Chapter 5 and (2) to provide a description of the enabling mechanisms in Chapter 6.

1.4.4 Quantitative Model Analysis

The exploratory research in this work was primarily based on case-study analysis and was used to understand the relationship between air transportation and economic activity. In particular, the relationship between the two systems was explored by investigating the individual economy's economic attributes, the impact of air transportation through the enabled flows, and factors which affect air transportation system development. This analysis was performed on a quasi-static basis. However, the relationship between the systems is dynamic and changes over time as the systems' characteristics evolve. Therefore, this work also used quantitative modeling tools in order to explore the dynamic nature of the relationship between air transportation and economic development.

Air transportation is particularly important for geographically isolated economies because it is often the only means of linking the economy to the rest of the world. For geographically isolated regions, such as island economies, it is reasonable to assume that none of the visitors would have come in the absence of air transportation services. In such a case, one can more easily isolate the impact of air transportation from other transportation modes. For example, the tourism statistics for these economies account directly for the visitors coming there by aircraft.

Some of the island economies, such as Fiji, Antigua and Barbuda, Jamaica, Malta, Seychelles, and Mauritius, are dependent on the availability of air services for economic growth. In these economies, tourism receipts from international leisure passengers account for more than 10% of the country's GDP [213]. In this work, a quantitative system dynamics model which describes the interaction between the demand for leisure travel to Jamaica and the resulting enabling impact of tourism on Jamaica's economy is presented in Chapter 7.

The purpose of this quantitative dynamic model is two-fold: to model quantitatively the evolution of the enabling impact of air transportation in an economy and to illustrate the feasibility of the modeling approach. The scope of the quantitative model developed in this work has been primarily limited by data availability. However, the method can be extended to include additional mechanisms and other economies given time and resources.

1.5 Thesis Outline

The dissertation is organized as follows. The literature review and analysis of data limitations are presented in Chapters 2 and 3. These are followed by the worldwide analysis of both aggregate and country-level data in Chapter 4. Chapter 4 also presents a summary of the case studies which are described in detail in Appendix A. The information gathered during the case study analysis is then synthesized in Chapter 5 to describe the change factors which stimulate or suppress air transportation system development and in Chapter 6 to describe the enabling impact of air transportation. Chapter 7 describes the dynamic feedback model of the enabling impact of leisure passengers in Jamaica. The conclusions are presented in Chapter 8.

Chapter 2

Literature Review

Even though it is generally believed that transport infrastructure plays an important role in defining a region's competitiveness, there is no consensus in the literature as to how to model the relationship between transport investment and economic development [216, p. 24]. According to the literature review done for the UK Department for Transport [216], the research on transportation impact modeling focuses on several categories: (1) the macroeconomic approach using production and cost functions, (2) the macroeconomic approach using computable general equilibrium and land use models, (3) the regional level approach using the cost benefit and employment effects analysis, (4) the microeconomic approach using property and land values, (5) and the microeconomic approach using regression and other statistical methods. One of the difficulties that arises while modeling the transportation impact is explaining the causality of the relationship between the rate of transport infrastructure investment and economic growth. Since the statistical methods cannot explain the nature of causality, most of the modeling methodologies include both quantitative and qualitative methods in an attempt to better interpret the statistical results.

Most of the studies, according to the analysis published by the World Bank, conclude that transport infrastructure contributes to economic development [166]. Over the years, air travel has come to play a more prominent role in economic development as air transportation usage increased worldwide. In fact, historical analysis of transportation trends by Schafer and Victor shows that the role of air travel as a transportation mode will keep increasing in the future since people tend to shift to faster and more expensive transportation modes, such as air transportation, as their income increases [170]. As a result of the increase in air transportation usage, the number of studies describing the relationship between air transportation and economic activity has been increasing in recent years as well.

Presently, the literature is lacking a comprehensive way of describing the relationship between air transportation and economic activity because the analysis is usually performed on a case by case basis and ignores some interaction effects. There are two major types of studies evaluating the impact of air transportation. First, are studies evaluating the impact of employment and income generated by the airports, airlines and airspace manufacturers using Input-Output analysis. Second, are studies which attempt to evaluate the enabling, or catalytic, impact of air transportation using a combination of quantitative and qualitative techniques enumerated above. Below, a selection of these studies is presented along with the description of the advantages and limitations of the corresponding research methods.

2.1 Studies Evaluating Impact of Aviation Using Input-Output Analysis

The majority of the air transportation impact studies use multipliers derived from Input-Output analysis. The foundation of Input-Output analysis is a set of accounts that describe transactions and dependency relationships between aviation and other economic sectors [163]. In particaulr, these accounts can be used to evaluate how changes in the demand for aviation services affect other sectors through inter-industry linkages. Three sorts of impacts are typically measured:

- *Direct* – employment or economic output affected by the business activities or a proposed development of the industry. For aviation, direct impacts are employment and output in the aviation sector.
- *Indirect* – employment or economic output caused by inter-industry purchases of goods and services as they respond to changes in industry activity. For aviation, indirect impacts include employment and activity generated in the industry's supply chain.
- *Induced* – employment or economic output created through household spending of those employed directly and indirectly through the industry's business activities.

For example, if demand for aviation services increases, one can assume that the output of aviation services increases as well as airlines react to meet the increased demand: this is the direct impact. As the airlines increase the number of flights, this results in an increase of the demand on their suppliers and so on down the supply chain: this is the indirect impact. As a result of the direct and indirect impacts, the household income throughout the economy will increase through increased employment. A proportion of this increased income will be re-spent on final goods and services: this is the induced impact. Using Input-Output analysis, one can quantify these multiplier effects to evaluate the economic impact of aviation sector changes on the rest of the economy. The analysis may also include multiplier effects obtained from construction employment following changes in regional airport infrastructure investment.

Input-Output impact modeling is best applied to specific regions or airports since it relies on regional accounting matrices. Therefore, most of the multilplier studies, such as a Minnesota Airport Economic Impact calculator [90] and Washington's Boeing Field Airport Impact Study [22], are typically commissioned by regional departments of transportation. In addition to academic studies, several consulting firms offer tools for evaluating the economic impact of airport infrastructure by combining Input-Output and land use techniques. Examples of such tools include the *Airport Benefit Cost System: ABC* from The Economic Development Research Group and models developed by Jacobs Consultancy. Representative country-wide and regional aggregate studies include the United Kingdom study based on the 1998 data [54], the European study from 2003 [1] and ICAO (International Civil Aviation Organization) worldwide civil aviation impact study using the data from 1998 [113, 115]. The majority of these studies have been done only for the developed economies since their analysis relies on data-intensive regional Input-Output matrices which are rarely available for the developing countries.

Even though most of the studies evaluate only the direct, indirect and induced employment impacts of air transportation, it has been long acknowledged, at least as far back as 1948 [19], that in addition to indirect and induced impacts, air transportation services create wider socioeconomic benefits thorough their potential to *enable* certain types of activities, such as tourism and trade, in a local economy. The

enabling impact of air transportation is defined as the total economic impact on employment and income generated by the economic activities which are dependent on the availability of air transportation services. The multiplier studies based on Input-Output analysis do not typically capture the enabling impacts and hence underestimate the total impact of air transportation services.

2.2 Studies Evaluating the Enabling Impact of Aviation

The enabling impact of air transportation is more difficult to quantify because it is difficult to isolate the impact of air transportation from other uncontrolled variables, such as globalization or institutional effects. Therefore, even though the wider socioeconomic benefits of air transportation are usually acknowledged in many air transportation studies, only a limited number of studies attempted to evaluate this impact. These enabling impact studies typically combine quantitative econometric modeling and qualitative techniques such as surveys of firms in the airport catchment area. Two of the most comprehensive studies of the enabling impact are described below. They are the Eurocontrol [46] study from 2005 of the enabling impact of air transportation in the European Union, and the worldwide enabling impact study published in 2005 by the Air Transport Action Group (ATAG) [3]. Both of these studies were undertaken by Oxford Economic Forecasting on behalf of the two organizations. At the foundation of these studies lies econometric analysis which links air transport usage to activities that are believed to be enabled by air transportation: tourism, trade, local investment and productivity improvement. An overview of other econometric studies available in the literature follows.

2.2.1 Eurocontrol Study

The goal of this study was to develop a robust methodology for measuring the economic catalytic impacts of air transportation in twenty-five European Union (EU-25) countries. The study used the following definition of the catalytic, or enabling, impact of air transportation: The net economic effects (e.g., on employment, incomes, government finances, etc.) resulting from the contribution of air transport to tourism and trade (demand-side effects) and the long-run contribution to productivity and GDP of growth in air transport usage (the supply-side performance of the economy).

The study divided the enabling impact of air transportation into two categories: the demand-side and supply-side catalytic impacts. The demand-side catalytic impacts were defined as those which operate through the use of air services to transport tourists and goods. The supply-side catalytic impacts were defined as those which change the economy's supply side and hence have long-run implications on productivity and GDP. The supply-side impacts considered in the study are summarized in Figure 2-1. These impacts consists of impacts on investment, labor supply, productivity, market structure, and congestion. However, only the enabling impact of tourism, trade, investment and total factor productivity were evaluated quantitatively. The table in Figure 2-2 summarizes the study's findings.

Impact on Tourism and Trade

The impact of tourism was computed by calculating the net spending of all inbound foreign visitors by air minus that of outbound visitors by air. Using this basis, the net tourism spending of air visitors was found

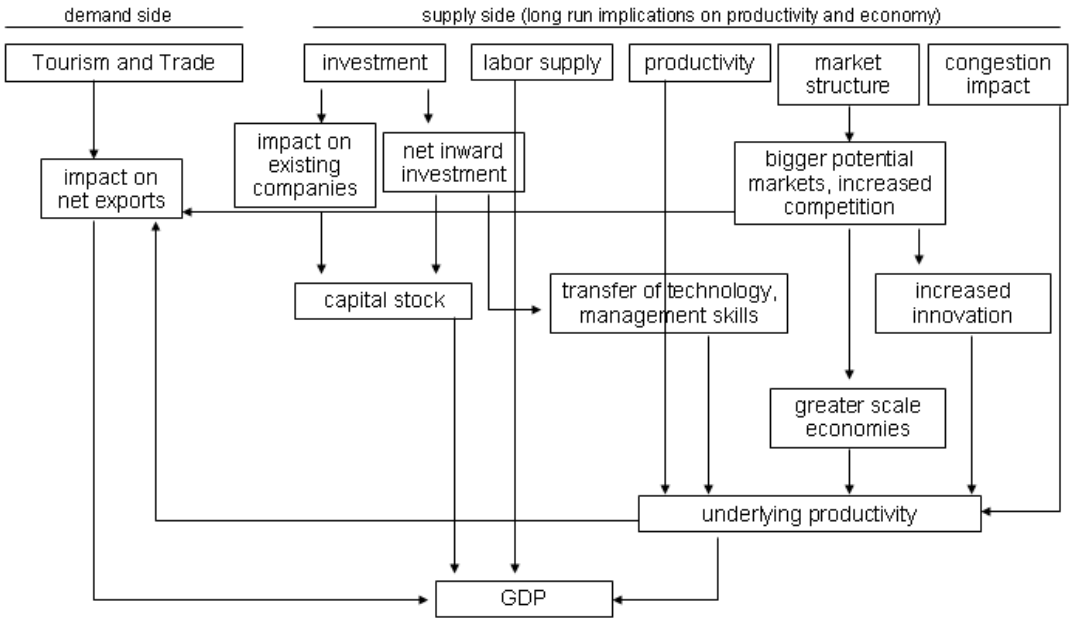


Figure 2-1: Economic catalytic impacts of air transport: Figure 3-2 from the Eurocontrol study [46].

	EU-25		EU-15		EU-10	
Demand-side effects ***(impact of net outbound tourism and trade flows by air on GDP)***						
	2003	**2025**	**2003**	**2025**	**2003**	**2025**
Tourism	**-0.3%**	**-0.2%**	**-0.4%**	**-0.2%**	**+0.4%**	**+0.1%**
Trade	**+0.6%**	**+1.5%**	**+0.6%**	**+1.7%**	**-0.4%**	**-0.7%**
Supply-side effects ***(contribution of growth in air transport usage)***						
	2003	**2025**	**2003**	**2025**	**2003**	**2025**
Impact on GDP of location and investment decisions, %	**+2.0%**	**+1.2%**	**+1.8%**	**+1.1%**	**+4.8%**	**+1.7%**
Impact on underlying productivity, %	**+2.0%**	**+0.6%**	**+1.8%**	**+0.6%**	**+4.6%**	**+1.0%**

Figure 2-2: Catalytic effects of air transportation in Europe [46]. Demand-side effects over the decade leading up to 2003 have been small, while supply-side effects have contributed up to 4% of the European Union GDP. *Notes:* Air transport usage variable equates 10 air passengers to 1 metric ton of air freight. The data set consisted of 24 European countries over 10 years.

to be negative for the fifteen original members of the European Union (EU-15) and positive for the ten accession economies. In other words, the EU-15 residents spend more on tourism abroad than the inbound visitors to their home countries.

Similarly, the trade impact was computed by taking the net (exports minus imports) value of goods carried by air. Using this basis, trade by air was found to make a small positive contribution to GDP across the EU-25. However, trade by air contributed negatively to GDP in the ten accession economies and this contribution was projected to get more negative in the future. This difference in the enabling impact of trade between economies was attributed to the fact that at the time of the analysis the accession economies have had a deficit on the current account of the Balance of Payments and hence were the net borrowers, while the EU-15 have had a surplus and were the net savers.

It should also be noted that the current accounting practices and quantitative methods used in this study do not capture some of the less tangible benefits of trade such as the ability to have more choices. For example, purchasing a good from a different country when it is not available in one's own country negatively contributes to the country's GDP because it is an import, while, arguably, it has a positive impact from a consumer's point of view. Similarly, quantitative estimates of tourism impact do not provide a comprehensive picture since they do not capture the positive effects of improving people's welfare through widening their choices and enriching the lives of those undertaking the leisure trips.

Impact on Investment

The enabling impact of investment was evaluated using statistical analysis of cross-sectional data across twenty-four European countries over a ten year period through 2003. In particular, a correlation coefficient was obtained between air transport usage and business investment[1]. To reduce the effect of confounding factors on the final results, the authors controlled for the effects of other drivers, such as local interest rates, capital stock and inflation. The results of the statistical analysis showed that historically the annual growth in business investment would have been 0.6% lower over the decade of 1994 to 2003 if air transport usage grew no faster than GDP. Over that time period, GDP increased around 2% a year while air transport usage increased by 5.1% a year. The analysis also showed that if air transport usage were to increase by 10% (relative to GDP) then business investment would increase by 1.6% in the long run.

The authors also noted that qualitative analysis is often the preferred method for evaluating the impact of air transportation on investment and business location decisions. Unfortunately, qualitative survey work is expensive and time consuming. In their work, in order to supplement the quantitative assessment of the enabling impact, the authors also conducted a survey of business and their investment decisions. The survey showed that more than half of the respondents reported that access to transport links with other cities and internationally (by all modes including air) were an absolutely essential factor for locating a business.

Impact on Productivity

Similarly to model the enabling impact of air transportation on investment, econometric analysis was performed to determine the effect of air transport usage on total factor productivity while controlling for the effects of other drivers, such as R&D intensity and tertiary education share. Total factor productivity was

[1]The study used air transport usage metric to combine the effect of air passengers and freight. In particular, for quantitative modeling the study assumed that 10 air passengers were equivalent to 1 metric ton of air freight.

defined in this study as a measure of the efficiency with which various factors of production, such as capital and labor, can be combined to produce output. So, for example, given the same quantities of capital and labor, a 1% increase in total factor productivity would result in a 1% increase in output. To analyze the impact of air transportation usage on total factor productivity, the authors used a Cobb-Douglass production function of the following form $Y = AK^{\alpha}L^{\beta}$, where Y was the value added, K was the value of the stock of fixed capital, L was the quantity of labor, α and β were parameters that captured the marginal products of capital and labor, and A was the total factor productivity. For estimation purposes, the authors assumed constant returns to scale, i.e. $\alpha + \beta = 1$ where α represented a share of profits in total value added and equaled to 0.35. Using these parameters, the model estimated that the impact of overall air transport usage over the decade of 1994 to 2003 raised the level of productivity by 2.0% in the EU as a whole, and by 4.6% in the ten accession economies. The model also estimated that if air transport usage were to increase by 10% then the total factor productivity would increase by 0.56% in the long run.

2.2.2 Air Transport Action Group (ATAG) Study

The goal of this publication was to provide an executive summary of the economic and social benefits of air transport both at the aggregate worldwide and regional levels. Specifically, the study used econometric tools developed by Oxford Economic Forecasting to provide quantitative assessment of both the employment and the enabling impacts of air transportation for Africa, Asia-Pacific, Europe, the Middle East, Latin America & the Caribbean, and North America. In addition to the quantitative assessment, a qualitative description of the enabling impact of air transportation on trade, tourism, investment, labor supply, productivity, consumer welfare and environment was also included in the document. Unfortunately, the publication does not contain any specifics regarding the quantitative model used to produce the following results. In all, the study estimated that air transport industry generates a total of 29 million jobs globally through direct, indirect and induced jobs in aviation, civil aerospace manufacturing and tourism. The global economic impact was estimated to be around 8% of world GDP.

2.2.3 Additional Enabling Impact Studies

Several difficulties arise while quantitatively evaluating the enabling economic impact of air transportation. First, it is difficult to isolate the impact of air transportation from other uncontrolled variables, such as globalization or institutional effects. Second, the nature of the relationship is ambiguous—that is, it is unclear if the observed interaction is a correlation or a causation mechanism. Finally, economic data on investment and productivity are often incomplete and very difficult to obtain, particularly for developing countries. Nonetheless, the academic literature contains a number econometric studies which attempt to explain the relationship between the availability of air transportation services and the resulting enabling impact on a local economy. A representative sample of studies describing the enabling impact of air transportation in the United States, Europe and Southeast Asia is presented below:

- Irwin and Kasarda studied air passenger linkages and employment growth in U.S. cities using regression analysis with data spanning a 30-year period [120]. The analysis showed that expanding the airline network serving a metropolitan area has a significant positive impact on regional employment, particularly in the service sector.

- Button et al. described the relationship between high technology employment and hub airports [32]. In particular, they showed that traffic at hub airports has a positive effect on creation of high-tech employment in the surrounding areas. This effect, when controlled for population and other characteristics, is greater than that of non-hub airports. The study also used the Granger causality test to support the claim that airport traffic in fact causes the employment growth.
- A study by Button and Taylor described the relationship between the availability of European international services and *new economy* employment in U.S. metropolitan areas [33]. Their econometric analysis showed that increasing passenger enplanements by a thousand results in an additional 44 to 73 *new economy* jobs in the metropolitan area. Since the economic benefits of additional services and destinations diminish as the international services provided by an airport increase, the impact of additional destinations is relatively smaller in more mature markets like Miami and Boston. Another study linking employment and airline traffic concluded that a 10% increase in passenger enplanements in a metro area leads to approximately a 1% increase in employment in service-related industries [26]. The statistical analysis also showed that airline traffic has no effect on manufacturing and other goods-related employment, suggesting that air travel is less important for such firms than for the service-related businesses.
- A University of Barcelona study linked the role of airports and the resulting availability of intercontinental flights to the location of headquarters in European cities [20]. In particular, their analysis showed that a 10% increase in the supply of intercontinental flights resulted in a 4% increase in the number of headquarters in major European urban areas. In addition, their analysis showed that headquarters of knowledge-intensive sectors, which rely more on information exchange, are much more influenced by the supply of direct intercontinental flights than are those of sectors which are not knowledge-intensive.
- Miller and Clarke [141] evaluated the socioeconomic impact of rural airports in Costa Rica. They used an expert-based rating system to assess the aviation need of twenty-five regional airports. The aviation need depended on such factors as tourism potential of the destination, accessibility of destination by other transport modes, and environmental concerns. These factors were then combined with the quality and capacity of the available airport infrastructure to rank the airports to determine the appropriate level of investment and maintenance.
- Researchers at the University of North Carolina published several papers describing the mutual-causality relationship between air cargo usage, trade and gross domestic product. In addition to these analyses, the authors used statistical tools to show that aviation liberalization and customs quality positively correlate with freight volume, trade, GDP, and foreign direct investment, while corruption has a negative effect on these variables [125, 124].
- Another study of the enabling effect of air cargo on employment and earnings in the U.S. was done by P. Cech [40]. The statistical analysis showed that air cargo services have a generally positive effect on employment and earnings. However, the effect is not generalizable since it varies widely from airport to airport and from region to region.

In general, the results of these studies support the hypothesis that there is a feedback relationship between air transport usage and economic activity. In particular, air transport usage positively correlates with GDP, trade, investment, productivity and employment in service-related industries. However, the magnitude of air transportation contribution to economic activity varies from one study to another based on the methods

used and the analysis scope. The inconsistencies in terminology and methodology result in large variability of impacts on jobs and economic output for similar-sized airports in developed countries as can be observed in Figure 2-3. For example, while a similar number of annual passengers uses the airports in Geneva and Auckland, the studies report a ten-fold difference in the amount of regional employment generated by air transportation. The differences are also exemplified by other comparisons. For example, according to the Airports Council International European study, 1,100 direct jobs are created for every million passengers, 1,100 indirect and induced jobs, and 1,800 catalytic jobs, i.e. a total of 4,000 jobs are created per million passengers [6]. In comparison, according to the International Civil Aviation Organization worldwide civil aviation impact study, 2,600 direct jobs are created for every million passengers, 10,500 indirect and induced jobs, and 5,700 catalytic jobs, i.e. a total of 18,800 jobs are created per million passengers [113].

	Passengers	Employment	Output	Source
Des Moines, 1998	1.7 million	2,352	$182 million U.S.	Des Moines International Airport
Newcastle, NSW 2005	.76 million	3,336	$540 million AU	Newcastle Airport Limited
Cincinnati, 2004	22 million	89,536	$5 billion U.S.	University of Cincinnati
Reykjavik, 1998	1.8 million (2006)	1,156	11.4 Billion IKr	University of Iceland Institute of Economic Studies
Geneva, 1999	7 million	24,000	9.0 Billion SFr	Aéroports Internationale Geneva
World Aviation, 2005	2 billion	29 million	$2.96 trillion U.S., 8% of world GDP	Air Transport Action Group
U.K. Airports, 2004	229 million	580,000	£22.2 billion gross value added	Airport Operators Association, 2005
Toronto, 2001	28 million	138,000	$14 billion CD	Greater Toronto Airports Auth.
Auckland, 2001	8.5 million	235,780	$14.2 billion NZ	Auckland International Airport
All United States, 2005	746 million	12.3 million	$1.37 trillion U.S.	Air Transport Association
Inverness Airport, 2005	.5 million	2,297	£ 120 million	Inverness and Nairn Enterprise, Highlands and Islands Enterprise and Highlands and Islands Airports Limited
U.K. Air Freight Industry, 2000	2,526,266 tonnes	80,000-100,000	£ 4.99 billion	U.K. Air Freight Study Report, U.K. Department of Transport

Figure 2-3: Economic impact of commercial aviation from [117]: inconsistencies in terminology and methodology result in large variability in impacts for similar-sized airports.

2.2.4 Proprietary Models

Since the majority of the academic studies evaluating the enabling impact of air transportation have limited scope and cannot be easily applied to regions and economies not considered in a study, proprietary models are often used by governments and airport authorities to evaluate the enabling impact of air transportation. For example, the two comprehensive studies described above — the Eurocontrol and ATAG studies — were both undertaken by a consulting firm. One of the most popular models for evaluating air transportation impact has been developed by Regional Economic Models, Inc. (REMI). This model incorporates techniques of Input-Output modeling for inter-industry transactions, Computable General Equilibrium modeling for long run estimation, and econometric analysis using time series panel data for parameter estimation. In addition, the

model accounts for labor and industry agglomeration effects by using the *effective distance* parameter. This parameter is used to adjust the geographic distance between two centers of economic activity based on the efficiency of multi-modal transportation between them: improvements in the transportation infrastructure reduce effective distance between the two locations and, consequently, increase their interaction in terms of the flows of labor, intermediate inputs, and end-use commodities. In other words, REMI applies the gravity model — an empirical model used by regional economists — to describe the level of interaction between two geographic locations. The gravity model assumes that the level of interaction between a pair of locations is proportional to their respective populations (or some other attributes) and inversely proportional to the distance between them, i.e. $I_{ij} = k\frac{P_i P_j}{d_{ij}^b}$. In particular, REMI uses the effective distance metric to capture the enabling impact of air transportation on trade and productivity.

Generally speaking, this type of a proprietary model is particularly useful for policy makers who would like to evaluate monetary impacts of specific policies or projects, such as an impact of an infrastructure investment of particular magnitude. However, since the model is ultimately a black box, it is difficult to validate the results and assess the feasibility of the employed methods. It is also important to note that this type of model relies on availability of large quantities of data and hence can be used to do impact analysis only in locations where data collection is done on a regular basis, such as the United States and a few select regions globally.

2.3 Studies Evaluating the Impact of Changes in Air Transportation Supply

The enabling impact studies described above are usually based on the time-series analysis of aggregate air transportation usage and relevant economic parameters. There are also studies available in the literature which specifically evaluate the impact of changes in air transportation supply following changes in specific policies and regulations. Domestic deregulation and international liberalization are two of the most commonly studied regulatory changes in air transportation system development. The majority of the studies of changes in air transportation supply analyze the impact of these changes on parameters related to air transportation, such as evaluating the effect of liberalization on changes in the traffic volume, the impact on prices, and number of destinations [125, 124, 208]. Some of the findings from these studies will be referred to in the discussion of changes in air transportation system supply in Chapter 5.

However, very few studies attempt to relate the changes in the traffic volume between a given economy-pair to socioeconomic and other variables. A study produced in 2006 by Inter*VISTAS*–ga^2 Consulting, Inc. on behalf of several organizations related to air transportation is an exception [117]. This study provided a comprehensive description of variables which can influence the traffic between a given economy-pair and used this knowledge to analyze the changes in traffic volumes between countries following changes in bilateral air services agreements. Specifically, this study used cross-sectional econometric analysis to derive a mathematical model which can estimate the passenger air traffic between any particular country-pair depending on a vector of geographical and socioeconomic variables in addition to the regulatory variables affecting the air transportation supply.

The analysis used the following independent socioeconomic and geographic variables to derive the passenger traffic model:

1. Gross Domestic Product (GDP),
2. moment of inertia variable to represent likelihood of domestic versus international travel opportunities,
3. distance between the countries,
4. gravity model-type relationship to describe the flows of services between each country-pair,
5. variable accounting for the intervening opportunities based on the respective GDPs and distances between countries.

These variables were chosen because their magnitude is presumed to have a strong influence on the level of passenger traffic. Other exogenous variables were considered: cultural affinities, tourism dependency, quality of air service, price, merchandise imports and exports, distribution of income, population, and degree of urbanization. However, since these variables did not demonstrate any significant value as exogenous variables while adding complexity and multicollinearity issues, they were not included in the final model.

Since the purpose of the model was to estimate changes in traffic patterns following changes in bilateral air services agreements, the model used five variables pertaining to the international aviation agreements:

1. permitted number of airline designations,
2. capacity controls,
3. pricing controls,
4. fifth freedom rights[2],
5. restricted route definitions.

					95% Confidence Interval	
	Variable	Coefficients	Standard Error	"T" Statistic	Lower	Upper
1.	Intercept	-0.42345	0.277463	-1.52615	-0.96809	0.121191
2.	Single Designation	-0.02101	0.011204	-1.87533	-0.043	0.000981
3.	Predetermined Capacity	-0.03687	0.01397	-2.63921	-0.06429	-0.00945
4.	Bermuda Capacity	-0.02578	0.014781	-1.74384	-0.05479	0.003239
5.	Single Disapproval Pricing	-0.03629	0.015276	-2.37542	-0.06627	-0.0063
6.	Fifth Freedoms	-0.00036	0.003121	-0.11385	-0.00648	0.00577
7.	Authorized Points	-0.05866	0.027313	-2.14783	-0.11228	-0.00505
8.	GDP Product	0.240543	0.040627	5.920825	0.160796	0.32029
9.	Commercial Flows	0.14279	0.033162	4.305882	0.077696	0.207884
10.	Intervening Opportunities	-0.05739	0.005125	-11.1966	-0.06745	-0.04733

Figure 2-4: Regression results for the passenger model from [117]. The endogenous variable is the country-pair origin-destination traffic. Pertinent statistics: multiple R = 0.67, R-Sq = 0.45, Adjusted R-Sq = 0.44, Standard Error = 0.1, Observations = 810.

The econometric analysis was performed using ordinary least squares on a double-log specification regression. The regression analysis used a cross-sectional method which in theory should involve a minimum

[2]The right to enplane traffic in one foreign point and deplane it in another foreign point as part of continuous operation also serving the airline's homeland (USDOT definition: http://ostpxweb.dot.gov/aviation/Data/freedoms.htm).

of two, but ideally many thousands, of country-pair aviation relationships at the same point in time. The analysis was based on the assumption that by using a large sample which involves different regions of the world, nations in all stages of development, and countries with a wide range of approaches to international aviation regulation, the process should yield a robust estimate of the impacts for any arbitrary country-pair. This approach, however, was limited in this study by data quality and availability issues. In particular, out of more than 40,000 country-pairs identified in the study, the data could only be obtained for 1,400 country-pairs. The table in Figure 2-4 summarizes the results. The values in the table indicate that passenger traffic between economies was positively correlated with GDP and commercial flows between a given country-pair. At the same time, the traffic was negatively correlated with the constraints imposed by bilateral service agreements (variables 2 through 7) and economies' geographic location which was captured by the intervening opportunities variable. The magnitudes of coefficients in Figure 2-4 indicate that GDP, the level of trade in services, and geographic variables were by far the most important determinants of traffic between a given country-pair. In comparison, the restrictions due to bilateral agreements played a smaller role in defining traffic volume, but their importance should not be underestimated since they are the only policy variables which can be quickly changed at a relatively low cost.

2.4 Limitations of Statistical Analysis

The type of econometric model developed in the Inter*VISTAS*–ga[2] study is based on the assumption that a large and varied data sample of many countries of varying sizes and economic conditions produces random variations in every variable and therefore yields a robust estimate of the liberalization impacts for an arbitrary country-pair. Specifically, this type of analysis provides a rigorous generic framework which is able to quantify the total number of passengers traveling between any country-pair following changes in liberalization agreements. However, this analysis is unable to account for individual nuances of each case and be calibrated to a specific market. For example, as the authors note, generic regression-based methods provide little value when compared to a case-study approach for markets which are situation specific, such as the air cargo traffic patterns. In comparison, the advantage of case-study approach is that the effects of liberalization can be evaluated *ceteris paribus* by comparing the "before" and "after" traffic levels between the countries. The case-study approach can also effectively incorporate other important elements responsible for the resulting dynamics. For example, these may include socioeconomic and geographic conditions, prior history of traffic growth and the type of liberalization agreement. The disadvantage of the case-study method is that the case-specific results are difficult to generalize to other countries. Therefore, the method is not applicable for building a general quantitative model which can be applied to an arbitrary country-pair. However, it may be used to calibrate the generic statistical model before applying it to a specific market.

The cross-sectional approach can only be applied effectively if the sample contains a sufficient number of cases covering a breadth of possible dynamics. However, the data are often incomplete and hence the analysis is limited by the available data. The data are usually the least available for small developing economies which means that the results of the econometric analysis are mostly based on the data for high-income countries and hence may lead to erroneous conclusions if generalized to developing economies.

The cross-sectional regression analysis typically yields low correlation coefficients between the variables. In other words, the low correlation coefficients mean that the regression model poorly approximates the real

data. For example, the model in the liberalization study above had an R-squared value of 0.45 implying that the regression model aprroximated the real data rather poorly. In fact, cross-sectional models have typically low R-squared values when compared to the time-series models whose R-squared values are usually near one. This is due to the fact that local economic and social factors vary widely and affect commercial aviation in different ways making generic cross-sectional modeling very difficult. Incidentally, time-series approach is used by most of the econometric studies described in Section 2.2.3. While the two approaches are different, data availability is a major limiting factor in time-series regression analysis as well.

In addition, both cross-sectional and time-series regression analyses suffer from multicollinearity concerns. Multicollinearity arises when some of the independent variables are related and therefore measure essentially the same thing. For example, many of the economic variables, like trade and exports, are correlated strongly with the GDP. Therefore, when these variables are included in the regression analysis, it is difficult to isolate the impact of each individual variable on a dependent variable, such as the air traffic growth.

These statistical difficulties, in addition to the ones mentioned in Section 2.2.3, make it difficult for policy makers to accept the validity of the results. The results are also often questioned because many of these studies are commissioned by organizations advocating air transportation use. In particular, because of the inherent bias, these studies do not typically consider some of the possible adverse effects of air transportation infrastructure investment. Some examples of detrimental effects include environmental, both due to air transportation (noise and emissions) and the activities enabled in that economy (pollution in large tourist resorts), or long-term effects on income and welfare distributions in regional economies.

Summarizing, despite the fact that statistical methods are widely used, some of the interaction effects are difficult to capture using statistical methods due to the lack or limitations of suitable data and modeling tools. First, cross-sectional statistical methods can only be applied effectively when there are sufficient data available in the sample to cover the breadth of possible dynamics. However, the data are rarely available for developing economies so the results are often biased because only high-income economies are well represented in the sample. Second, both time-series and cross-sectional statistical analyses are complicated by the presence of confounding factors which can mask the relationships between variables. Third, data recording conventions may result on atypical relationships between the variables. Since disregard of these data limitations in statistical analysis may lead to erroneous conclusions about the relationship between the variables, it is often useful to check the validity of data-driven methods by doing the supporting case-study analysis.

Chapter 3

Data Description

Many data sources are available for both air transportation and economic data. The available air transportation data include airline, airport and passenger origin-destination traffic statistics. Economic data are more diverse and include statistics on GDP, population, investment, trade, industry earnings and employment. The data sources are reviewed in detail in Appendix B.

Two variables were chosen for the country-level data analysis in this work: GDP data at constant 2000 US$ from the World Bank national accounts and air passenger data from the International Civil Aviation Organization (ICAO). While additional data sources were not appropriate for general worldwide analysis of temporal trends because of issues with data quality and availability, they were used to supplement more detailed case-study analysis at the level of each individual economy.

A complete dataset consisted of 139 countries over a thirty-year time period between 1975 and 2005 with an average of 25 data points available for each country. The data and charts for individual countries are summarized in the appendices.

3.1 Economic Data

The Gross Domestic Product is a statistical measure for the national income or output. It represents the sum of gross value added of both goods and services by all resident producers in the nation. The data presented in this work are in constant 2000 U.S. dollars: they have been converted by the World Bank from domestic currencies using 2000 official exchange rates and adjusted accordingly for those countries where official exchange rates do not reflect the actual foreign exchange rates. According to the World Bank, GDP measured in constant, local currency units provides the basis for estimates of overall economic growth of a country. In this work, since the GDP data have been converted to the universal currency, they are used to compare the level of economic activity between countries. Because the yearly GDP data have been adjusted for inflation, they are also used to describe the temporal evolution of economic development at the individual country level.

3.2 Air Transportation Data

The air transport data represent the total (international and domestic) scheduled passenger traffic carried by the air carriers registered in a country. These data are used in this work at the individual country level to analyze changes in the amount of travel performed by the people living in the country. These data can also serve as a reasonable proxy for the actual amount of both domestic and international travel because in many of the world's regions (1) domestic services are only operated by the airlines registered in that particular country and (2) the majority of international operations are regulated by bilateral aviation agreements which apply only to a particular country-pair implying that the traffic between a given pair of countries is shared proportionally by the airlines registered in these two countries.

3.2.1 Air Passenger Data Limitations

However, there are instances where these assumptions do not hold and hence the data may misrepresent the amount of actual traffic taking place at the individual country level. In particular, the usefulness of the data is limited by the fact that

- the data represent only scheduled passengers carried on airlines registered in a country, and
- the data between countries vary in quality due to accounting issues.

The lack of understanding of these limitations may lead to potential misinterpretation of the data and result in erroneous conclusions about the relationship between air transportation and economic development. The data generally misrepresent the amount of actual traffic taking place at the individual country level under the following circumstances.

First, in small countries where the majority of the traffic is international, an addition or discontinuation of a home-based air carrier may cause significant changes in the data while the actual traffic may not change significantly because foreign airlines continue providing international services. In other words, the national carrier data may under-represent the actual traffic levels because the majority of international routes are served primarily by the foreign carriers instead of the airlines registered in that country. In such a case, instead of using the airline passenger data, other data sources, such as airport passenger data, should be used.

Second, the data for countries where airlines operate under liberalized aviation frameworks effectively represent the growth of international networks of particular airlines instead of the growth of domestic and international traffic to and from that particular country. This is especially true of countries where fully liberalized markets allow cabotage rights, that is where airlines can operate within other member states while the traffic is attributed to the carrier's country of registration. In other words, the national carrier data may over-represent the actual traffic levels. In such a case, the passenger data should not be used to analyze the absolute traffic levels taking place to and from a particular country. However, these data are still appropriate for analysis of the country's air passenger growth rates because the data still reflect the changes in the realized air passenger demand.

Third, the airline data for many small developing countries often under-represent the actual traffic levels because the countries are unable to maintain national airlines and hence their aviation needs are often served by foreign carriers. In addition, the airline data for countries with small aviation markets tend to exhibit

greater volatility because they effectively reflect the operational statistics of a few select carriers. In such a case, an addition or discontinuation of a home-based air carrier, change in the airline growth strategy, or lack of capital funds may cause significant changes in the data misrepresenting the actual air passenger demand levels. The analysis showed that these issues are endemic in countries whose airlines carry fewer than one million passengers annually. For such countries, alternative data sources, such as airport statistics, need to be used to analyze the air passenger flows to and from the country.

Last, changes in accounting practices and definitions may introduce both data availability and reliability issues.

It is also important to note that due to the data issues described above, purely statistical analysis on the whole dataset should not be performed to avoid erroneous conclusions about the relationship between air transportation and economic development.

3.2.2 Air Passenger Data Limitations: Examples

The ICAO national air passenger data were used in this work to represent the amount of air travel performed by people living in the country. This data usage is limited by the fact that the data represent only scheduled passengers carried on airlines registered in a country. The types of conditions and countries where the data misrepresent the actual traffic flows are reviewed in detail below.

Changes in National Carrier Data After Bankruptcy

The reported national statistics contain only the data for carriers registered in that country. While the majority of domestic traffic worldwide is carried by airlines registered in that country, the international routes are served both by domestic and foreign airlines. This implies that for those countries where the majority of the traffic is international, an addition or discontinuation of a home-based air carrier may cause significant changes in the data while the actual traffic may not change significantly because foreign airlines continue services.

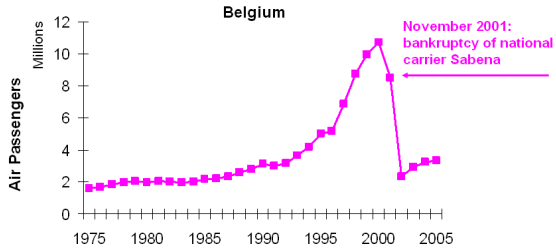


Figure 3-1: Airline Bankruptcy: The discontinuity in the data reflects the bankruptcy of the national carrier Sabena in 2001.

For example, the bankruptcy of Sabena in 2001 decreased the overall number of passengers traveling on Belgium's airlines as reflected in Figure 3-1. Even though the collapse of the national carrier caused some activity loss at the nation's airport, several foreign carriers increased their presence in Brussels. In particular, in 2001 a rapidly growing Ireland's low-cost carrier Ryanair established their first continental European base at Brussels Charleroi Airport [34]. In other words, the total passenger traffic to and from Belgium after

Sabena's collapse did not decrease as significantly as the data in Figure 3-1 seem to imply. In order to prove this hypothesis one would need to research the airport passenger trends during the time period following the bankruptcy. Unfortunately, the airport data for Belgium during those years are not available in the ICAO airport database.

Changes in National Carrier Data in Liberalized Markets

In fully liberalized markets airlines with cabotage rights can operate routes within other member states while the traffic is attributed to the carrier's country of registration. Therefore, the data may misrepresent the country's actual passenger traffic because the airlines registered in the country may operate extensive networks outside of their country of registration.

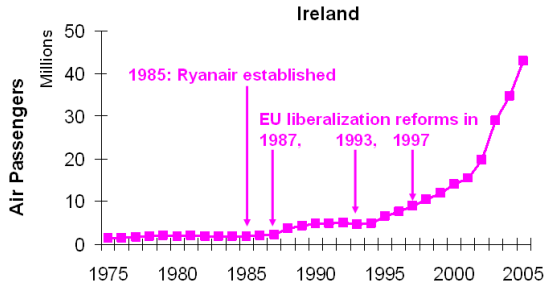


Figure 3-2: Airline Strategy: Ireland's air passenger growth since the 1990s reflects the success of Ryanair's expansion strategy to become an intra-European carrier after EU liberalization reforms.

For example, Figure 3-2 shows that Ireland's traffic grew from 7 to 43 million passengers between 1995 and 2005. However, this increase in traffic was not due to the increase in the number of passengers traveling domestically or to and from Ireland. In fact, over that time period there was only a two-fold increase in the number of passengers at Dublin airport. Instead, the growth in passenger traffic in Figure 3-2 was due to the growth of Dublin-based low-cost carrier Ryanair. Ryanair's traffic grew from 2 to 30 million passengers between 1995 and 2005 as the airline pursued an aggressive expansion strategy. The airline was able to grow its network in twenty-six European countries under the provisions of the multilateral aviation framework introduced in 1990s. The European liberalization reforms were initiated in 1987, the freedom to provide services within the EU was added in 1993, and cabotage rights were added in 1997. In other words, the data in Figure 3-2 reflect the growth of an airline registered in Ireland as opposed to the growth of the actual passengers in Ireland.

Data Volatility in Small Countries

As was described above, the data for countries with only a few registered airlines exhibit substantial variations following the bankruptcy of a major carrier. In general, the data for countries with small aviation markets and/or a few airlines exhibit large volatility because the data reflect the dynamics of a particular airline, such as financial and capacity issues, and may not be representative of the actual passenger traffic to and from the country.

For example, Jamaica's airline passenger data in Figure 3-3 effectively include only the national carrier Air Jamaica. These data exhibit greater volatility compared to the passenger data at the country's two

international airports in Montego Bay and Kingston [1]. The airport data represent the traffic transported by both Air Jamaica and foreign carriers serving the island.

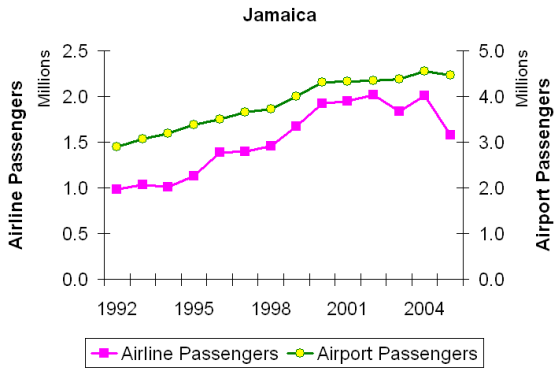


Figure 3-3: Airline passenger data effectively represent the traffic carried by Air Jamaica. Airport data account for the traffic transported both by Air Jamaica and foreign carriers.

In countries with only small carriers, changes pertaining to airline operations may be responsible for the largest changes in the growth rates. In particular, in small countries significant growth rate changes sometime follow a purchase of a single aircraft by an airline which is pursuing an expansion strategy. For example, a purchase of one 70-seat aircraft by Lao Airlines resulted in a two-fold increase in the air passenger data for Laos in 1990. Therefore, care should be taken when comparing growth rates between countries worldwide. For those countries where airlines have been growing from a very small base, it is best to compare the air passenger growth both on a relative and an absolute basis.

Some small developing countries are not able to maintain a national carrier and rely on foreign carriers for their international air transportation access. For example, the data in Figure 3-4 show the airline and airport passenger data for the island nation of Maldives. The figure shows that the number of passengers carried by the airlines registered in Maldives is almost a magnitude smaller than the number of passengers using the country's international airport. In addition, the figure shows that the airline data are more volatile than the airport passenger data.

The airline passenger data for Maldives reflect the statistics for several small domestic operators and a national flag carrier Air Maldives. Until the 1990s, the Maldives' airlines supported only domestic operations between the islands. Air Maldives pursued an expansion strategy and began flying to international destinations. This is reflected in the substantial increase in the number of air passengers in the 1990s. However, the airline declared bankruptcy in 2000 which is reflected in the abrupt decline in the number of air passengers in Figure 3-4. Following the bankruptcy of Air Maldives, the air transportation network of airlines registered in Maldives was again reduced to domestic operations. Meanwhile, the island's air transportation needs were continuously served by several foreign carriers. As the airport data show, the actual air passenger traffic to and from the island was increasing during this time period because foreign airlines were the primary providers of air transportation services to and from the country. In other words, when the airline passenger data reflect the statistics of small domestic operators, they may misrepresent the actual number of passengers

[1] Airport data represent the passengers embarked + disembarked at a particular airport. The primary data sources are ICAO airport statistics and official airport websites.

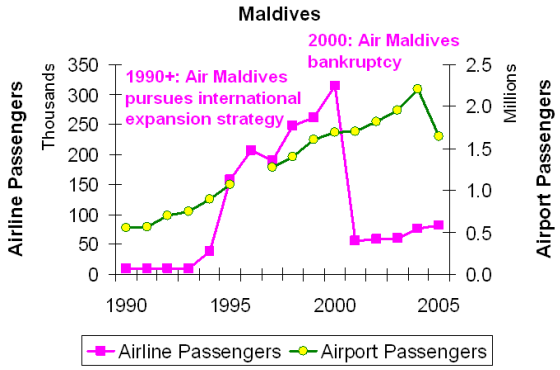


Figure 3-4: Airline passenger data effectively represent the traffic carried by Air Maldives. Airport data account for the traffic transported both by Air Maldives and foreign carriers.

visiting the country. In such a case, it is better to use airport passenger data. Unfortunately, these data are rarely available.

Changes in Accounting Practices

Changes in political environment often introduce data accounting and availability issues. For example, the data are usually not collected for countries involved in geopolitical conflicts, such as Afghanistan, Iraq, Myanmar, and Rwanda. As Figure 3-5 illustrates, the World Bank database does not contain Afghanistan's GDP data while air transport passenger data are missing for the years following the 2001 U.S.-led invasion.

Figure 3-5: Accounting Issues: The data are typically not collected during geopolitical conflicts such as the airline data during the military conflict in Afghanistan after 2001. The economic data for Afghanistan are not available.

The accounting is often complicated by the dissolution of countries into successor states. For example, the abnormally high values for years 1991 and 1992 for the Europe & Central Asia aggregate in Figure 3-6 are due to the addition of Russia in 1991 and other successor states in 1992 to the aggregate and possible double-counting of some operations following the dissolution of the USSR's Aeroflot into 300 regional airlines in December 1991. Neither the ICAO nor the World Bank collected any data for these countries until the early 1990s.

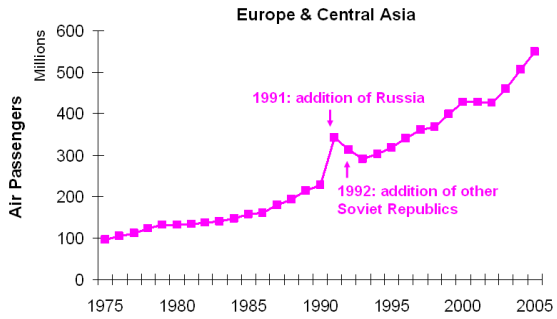


Figure 3-6: Accounting Issues: The increase in the data for years 1991 and 1992 is due to the addition of new countries to the aggregate following the dissolution of USSR and Aeroflot airlines.

The accounting may also be complicated by cross-border mergers and acquisitions which may occur between privatized airlines in liberalized environments. In particular, following a cross-border acquisition, the data might be submitted only by the major carrier in its country of registration. For example, it is not clear how the accounting has changed following the 2005 acquisition of Swiss by Germany's Lufthansa.

Changes in Definitions

Since the data cover the air passenger traffic carried on scheduled services, changes in air transport regulations make it difficult to classify traffic as scheduled or non-scheduled. Therefore, some discrete changes in the data could be due to differences in classification.

For example, prior to liberalization in the 1990s, European leisure travelers relied on charter services by integrated tour operators for access to many vacation destinations. In fact, prior to the first liberalization in 1987, up to 40% of all air passengers within geographical Europe were carried by charter airlines [17]. Most likely, these charter services were not included in the ICAO dataset because ICAO reports only scheduled passengers. Following liberalization, the charter services were replaced in some regions with scheduled services by the low-cost carriers. As a result, these services were now included in the ICAO dataset. In other words, some of the growth in air passenger traffic in Europe can be attributed to the fact that prior to the 1990s the ICAO data under-represented the total passenger traffic in Europe.

3.2.3 Cargo Data

Freight data are also available in the ICAO database. However, freight markets are generally more liberalized when compared to the passenger markets. Therefore, national carrier data do not accurately depict the cargo flows taking place to and from a particular country due to the dominance of only a few major international cargo carriers such as DHL, FedEx and UPS. In addition, aggregate freight data may misrepresent the traffic flows for a particular country because they do not capture the asymmetry which is often present in cargo flows between economies. In other words, the national cargo carrier data are not representative of the freight flows to and from a particular country. As a result, air passenger traffic data were found to be the most representative of traffic patterns for individual economies and were used for further analysis.

3.3 Data Usage

In this work, the entire dataset was used to perform aggregate worldwide analysis of air passenger growth trends. This analysis helped identify different air passenger growth patterns. As was describe above, growth rate analysis circumvents some of the data limitations because, to first order, the data reflect the changes in the realized air passenger demand even though the absolute numbers may misrepresent the actual traffic levels. In fact, the analysis of the growth rates was the primary method for identification of stimulated and suppressed air passenger growth rate behaviors.

Then, the individual country-level case study analysis was used to understand if the changes in the growth rate patterns were primarily due to the accounting issues or due to the changes in the actual traffic levels. In particular, alternative data sources were used in the case study analysis to help identify the data quality issues described in this chapter.

Chapter 4

Analysis of Air Transportation and Economic Development Data

During the exploratory research phase a comprehensive worldwide analysis of air transportation and economic development data was performed. As part of the analysis a dataset of annual country-level statistics was compiled. A complete dataset consisted of 139 countries over a thirty-year time period between 1975 and 2005 with an average of 25 data points available for each country. These data are used in this chapter to identify major types of behaviors between air passengers and GDP both at the individual country and at the aggregate levels.

First, an aggregate worldwide analysis of regional growth trends is presented. Then, cross-sectional country-level data for year 2005 are used to explore the relationship between mobility and income. Next follows the analysis of correlation coefficients between the number of air passengers and GDP based on the temporal country-level data between years 1975 and 2005. This analysis is performed to understand the general relationship between the two variables and identify outliers. In addition, temporal data trends are used to identify long-term growth behaviors between the two variables. These analyses are then used to identify countries which need to be explored further using case-study analysis in order to achieve the research objectives. While the individual case studies are reviewed in detail in Appendix A, the major findings are summarized at the end of this chapter. These findings are then synthesized in Chapters 5 and 6 to describe the change factors which stimulate or suppress air transportation system development and to describe the enabling impact of air transportation.

4.1 Worldwide Trend Analysis

Figure 4-1 shows that air passenger travel on average increased in every region worldwide since the 1970s. Between 1970 and 2005, the world's passenger traffic grew at an average annual growth rate of 5.6% and increased from 300 million to 2 billion passengers. Even though North American and European airlines still dominate the world's passenger traffic, due to the fast-paced air transportation development of several economies, certain regions came to play a more dominant role in worldwide air transportation usage. This shift in regional players can be observed in Figure 4-2 where passenger traffic is aggregated by geographic

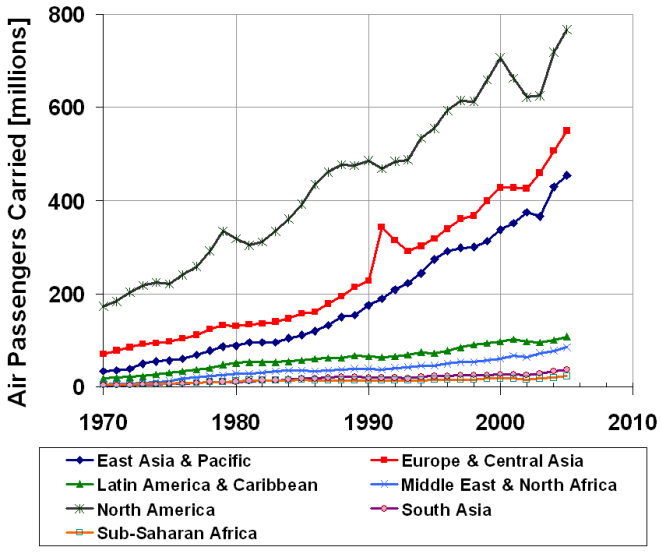


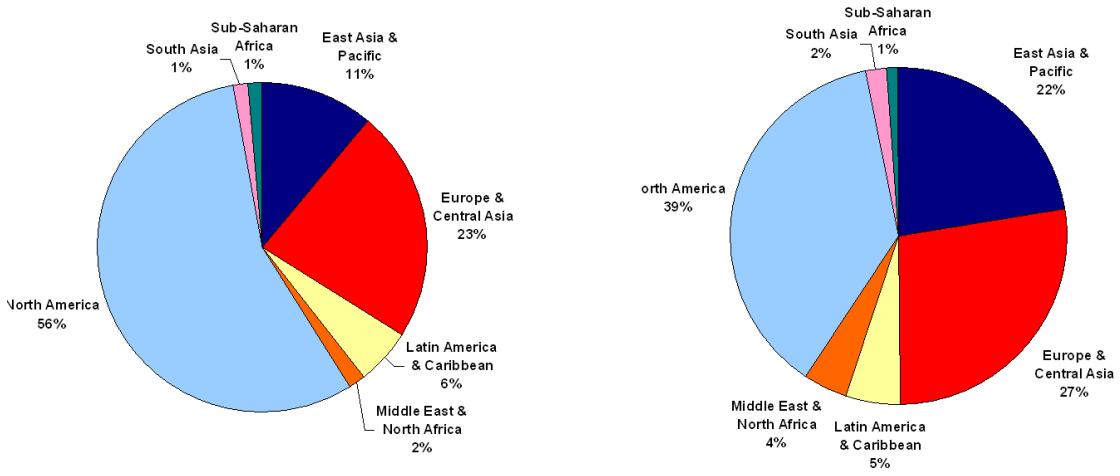
Figure 4-1: The number of air passengers has been growing in most regions over the last several decades.

region. The figure illustrates a dramatic shift toward a more prominent role of East Asian & Pacific passengers whose share rose from 11% in 1970 to 23% in 2005. This growth was dominated by the growth of China's air traffic which, growing at an average annual growth rate of 19% over the last twenty years, accounted for a third of the Asian regional passengers in 2005 at 137 million passengers.

Similar to East Asia, South Asia and the Middle East exhibited two-fold increases in their respective shares of the world's passenger traffic. Their shares increased from 1 to 2 percent for South Asia and from 2 to 4 percent for the Middle East. In 2005, South Asia's traffic was dominated by India's airlines which accounted for more than 70% of the region's passenger traffic after increasing substantially since 2003. According to the Centre for Asia Pacific Aviation, domestic Indian traffic had 40% year-on-year growth since 2003 due to the dramatic increase in the number of services offered by the low-cost airlines. Only the first two years following the proliferation of low-cost domestic carriers can be observed in Figure 4-1.

The growth of the Middle East traffic, though still a small share of the world's total passenger traffic, can in large part be attributed to the growth of Dubai's network carrier Emirates Airline which was launched in 1985. That year, the United Arab Emirates passenger share of the total Middle East traffic was 2%, or 700,000 passengers, while by 2005, following the growth of Emirates, the UAE share rose to 16 million passengers, or 19% of the regional total. Over these years, Emirates expanded its international network to become one of the major carriers of traffic between Southeast Asia and Europe through its hub in Dubai. According to International Air Transportation Association (IATA) estimates, the traffic between Middle East and Asia and Middle East and Europe accounted for 1.5 and 1.2 percent of all scheduled passengers in 2006 compared to only 0.5 percent shares a decade earlier [109].

The aggregate Latin American and Sub-Saharan African passenger traffic grew at or less than average growth rates. In 2005, Brazil accounted for 35% of Latin American regional traffic, followed by Mexico (20%) and Colombia (9%). During the last twenty years, the air traffic in these countries grew near or below the world's average annual growth rate of 5.0%: Brazil's traffic grew at 5.6%, Mexico at 2.5%, and Colombia



(a) Regional passenger shares in 1970.

(b) Regional passenger shares in 2005.

Figure 4-2: Changing patterns in regional traffic shares.

at 2.9%. Sub-Saharan Africa is the world's poorest region characterized by inadequate infrastructure and political instability in many of its countries. In 2005, more than half of region's passengers were carried by airlines registered in South Africa, followed by Kenya (11%) and Ethiopia (7%). Several smaller countries both in Latin America and Sub-Saharan Africa had above-average growth rates but their impact is difficult to observe at the regional traffic level because of their small shares.

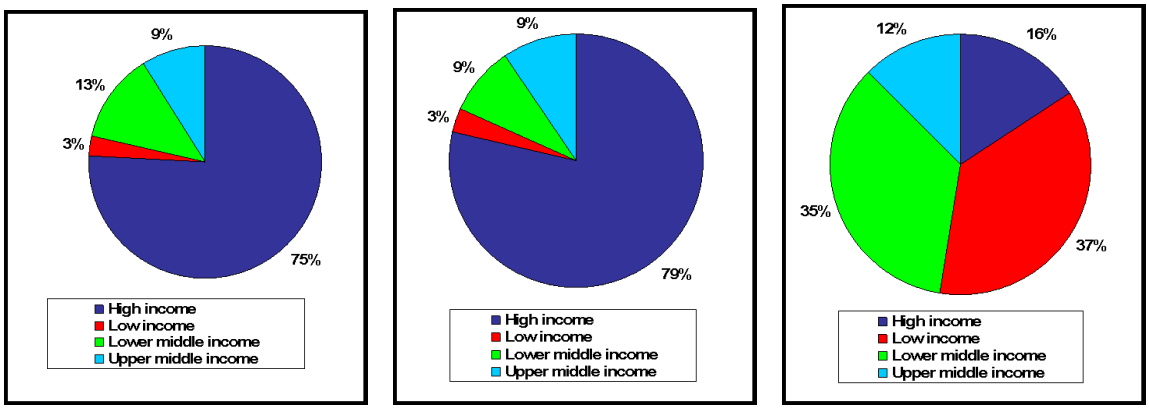
The European & Central Asian passenger traffic shares did not change significantly (from 23% in 1970 to 27% in 2005) even though there was an increase in the air passenger growth rate. In 2005, United Kingdom and German airlines each carried more than 15% of the region's passengers, followed by France and Spain with 9% shares. In the 1990s, Europe's air transportation industry underwent significant changes which culminated in the creation of the multi-lateral liberalized operating environment called the Single European Aviation Market and growth of the intra-European low-cost carriers. Because of these developments, the European countries data have several limitations which were described in detail in Chapter 3. Therefore, additional data sources were used during the case study analsysis to avoid misrepresentation of the actual traffic at the individual country level.

4.2 Mobility and GDP

The analysis in this section begins to explore the relationship between air transportation passengers and GDP. Historical analysis of transportation trends across many countries by Schafer and Victor demonstrated that time and income shares allocated to travel are stable over time and space [170]. On average, a person spends 1.1 hours per day traveling and devotes a predictable fraction of income to travel. In other words, as people's income increases, people's mobility [1] increases as they shift to faster, more expensive transportation modes such as air transportation.

[1] Schafer and Victor use the term "mobility" to denote traffic volume, measured in passenger-kilometers.

As a result of these trends people from high-income countries account for the largest share of air passengers worldwide. Figure 4-3 shows the passenger, GDP and population shares of the world's countries aggregated by income. The list of countries in each aggregate is available in Appendix B. Since GDP and air passenger shares are very similar when countries are aggregated by income, the data in Figure 4-3 corroborate the mutual causality relationship between the two variables. High-income countries as a group dominate the air passenger traffic and GDP while accounting for a relatively small percentage of the world's population. For example, in 2005 high-income countries accounted for almost 80% of all air passengers and world's GDP while accounting for only 16% of the world's population. Among these high-income countries, the United States has the largest air transportation system: its airlines carried 36% of the world's air passengers in 2005. It is followed by Japan, United Kingdom and Germany at around 5% market share each. China, at almost 7%, is the only developing country among the top ten world passenger traffic contributors. However, despite the fact that China's passenger share is comparable to that of some of the European countries, individual Chinese people on average travel a lot less when compared to the other countries using per capita basis. The average number of trips taken by Chinese people [2] in 2005 was 0.1 trips/person/year, while Germany's average trip rate, for example, was 1.1 trips/person/year.



(a) Air passengers carried. (b) GDP (constant 2000 US$). (c) Total population.

Figure 4-3: Passenger, income and population shares when countries are aggregated into different income categories using the 2005 data.

The cross-sectional data in Figure 4-4 illustrate the relationship between the number of trips taken per year and the country's population. The data corroborate the trend identified by Schafer and Victor [170]: the average number of trips taken by people on airline's registered in their home country increases with income. Note that to improve legibility the graph includes only countries with population greater than 1 million and the vertical axis is logarithmic. The size of each individual point in the graph corresponds to the relative population size of each country. So, for example, an average number of trips per year taken by Chinese people is smaller compared to other countries using per capita basis. However, due to the large size of China's population, in 2005, the Chinese airlines carried 7% of the world's total air passengers. In comparison, even though the New Zealanders on average took 3 trips per person in 2005, the total number

[2]The average number of trips per year is calculated by taking the total number of passengers carried by the airlines registered in the country and dividing it by the country's population.

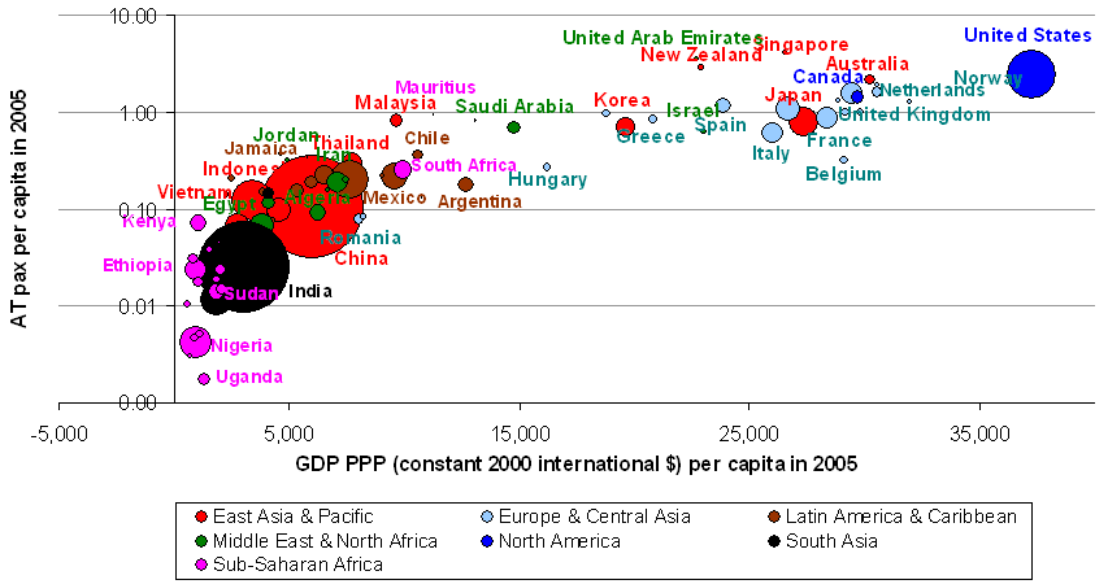


Figure 4-4: Air transportation mobility increases with income: Passenger traffic and GDP PPP (Purchasing Power Parity) per capita for countries with population greater than 1 million. *Notes:* (1) the size of each individual point denotes the country's population; (2) y-axis is log-scale; (3) Ireland ($34,600, 10.3) is excluded from the chart; (4) only select countries with population greater than one million are shown for clarity.

of passengers carried on airlines registered in New Zealand accounted for only 0.5% of the world's passengers because of the country's small population.

Geographic location, a country's size and distance to the main markets play an important role in the country's mobility needs. European countries, due to the relative proximity of key economic partners and well-developed surface transport infrastructure, have lower than average air transportation needs. On the other hand, countries which are isolated either geographically or economically, such as New Zealand, Singapore, Bahrain, and the United Arab Emirates, have higher than average air transportation needs. Other island economies, not shown in Figure 4-4 because of their small size, are notable outliers: Antigua and Barbuda ($11,500, 9.4), Seychelles ($14,600, 5.9), Malta ($17,000, 3.4), Bahrain ($19,000, 3.0), and Iceland ($33,000, 5.2). It is interesting to note that in Antigua and Barbuda, Seychelles and Malta tourism spending represents a substantial share of the countries' total exports and GDP. For example, in 2005 tourism receipts accounted respectively for 38%, 28% and 13% of each country's GDP [76]. Even though air transportation plays a particularly important role in island economies, the high air passenger mobility numbers for these countries do not necessarily reflect the mobility of the local population but rather the air travel demand of inbound leisure passengers from high-income economies. In other words, the data for these island economies may not accurately represent the traffic originating in those countries.

The data in Figure 4-4 may also misrepresent the traffic actually originating in a particular country if the air transportation services have been extensively liberalized or if national carriers have ceased operations. For example, as was explained in Chapter 3 the majority of passengers carried by Ireland's airlines are not transported to and from Ireland. Similarly, the high mobility coefficients of Singapore and the United Arab

Emirates are in part a reflection of the growth of their airlines: both Singapore Airlines and Emirates operate extensive international networks through their respective hubs in Singapore and Dubai airports.

4.3 Country-Level Data Analysis

This section describes how the available data were used to further explore the relationship between air transportation passengers and GDP. In particular, since correlation coefficient is one of the usual metrics used for analysis of interaction behavior between two variables, the correlation coefficients were computed for each country in the dataset. In addition, different growth behaviors between air transportation passengers and GDP were analyzed using temporal data trends. These analyses were then used to choose several countries to explore the relationship between the two variables in detail through case study analysis. The countries covered by the 139-country dataset are shown on the map in Figure 4-5 [3].

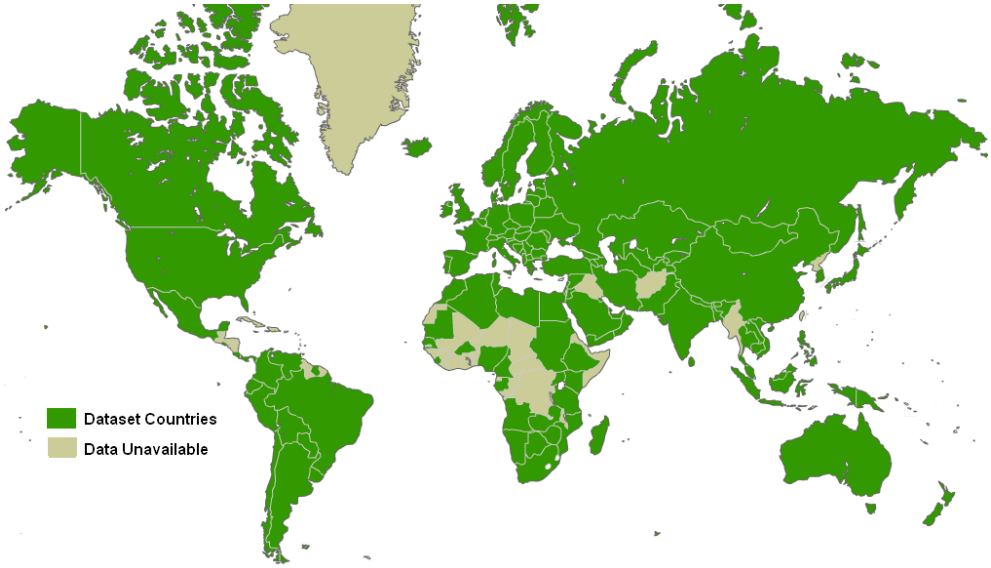


Figure 4-5: The map of 139 countries studied in this work.

4.3.1 Correlation Analysis

The high correlation coefficients between the number of air passengers and GDP observed both in the aggregate time-series and cross-sectional data in Chapter 1 and the literature support the hypothesis that there is a mutual causality relationship between the two variables. Correlation coefficient measures the degree of linear association between two variables and can vary in value between -1 and +1. The closer the correlation coefficient is to -1 or +1, the stronger is the linear relationship between the two variables. The correlation coefficient of +1 implies an increasing linear relationship between the variables where two variables grow simultaneously. A correlation coefficient of -1 implies a decreasing linear relationship. If the variables are independent, then the correlation coefficient is 0.

[3]The figure was generated using *http://edit.freemap.jp/en/trial_version/edit/world*.

Even though high correlation coefficients were observed in the aggregate data, it was also instructive to see if the relationship holds across countries when the correlation coefficients are computed at the individual country level using time-series data.

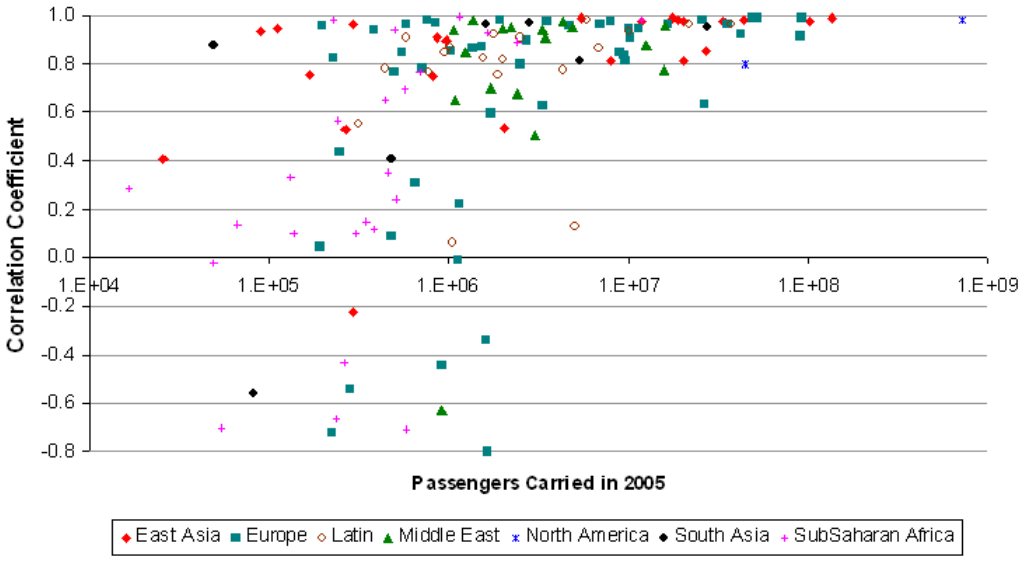


Figure 4-6: Each point represents a correlation coefficient between air transport passengers and GDP for an individual country based on the temporal data during the 1975–2005 time period.

Correlation coefficients were computed between air passengers and Gross Domestic Product for each individual country based on the available temporal data during the 1975–2005 time period. Figure 4-6 provides a summary and explores the variability in the correlation coefficients[4]. Specifically, Figure 4-6 captures the relationship between the correlation coefficients and the number of passengers carried by the country's airlines: the correlation coefficients are plotted on the vertical axis while the number of passengers is plotted on the horizontal axis.

Even though the correlation coefficients show large variability, several trends can be identified in Figure 4-6. First, the correlation coefficients for countries with smaller aviation markets generally exhibit greater variability. Second, many of the countries have correlation coefficients exceeding 0.8. In fact, the histogram in Figure 4-7 shows that eighty-two countries, or 59% of the countries in the dataset, exhibited correlation coefficients greater than 0.8 indicating that there is a strong linear relationship between air transportation passengers and Gross Domestic Product. Among the countries whose airlines transported more than one million passengers in 2005, the following had correlation coefficients lower than 0.8: Macao, Venezuela, Peru, Bolivia, Trinidad and Tobago, Saudi Arabia, Algeria, Kuwait, Jordan, Yemen, Belgium, Romania, Iceland, Russian Federation and several former Soviet Republics. The majority of these countries have discontinuities, or large year-on-year changes, in the temporal data.In this work, case study analysis was used to explore the reasons behind the variability in the correlation coefficients for countries with both small and large aviation markets. In particular, as part of the analysis, the airline data were cross-checked with other aviation data sources including tourism and airport statistics. In particular, according to the case study analysis detailed

[4]The correlation coefficients for each individual country are listed in the appendices.

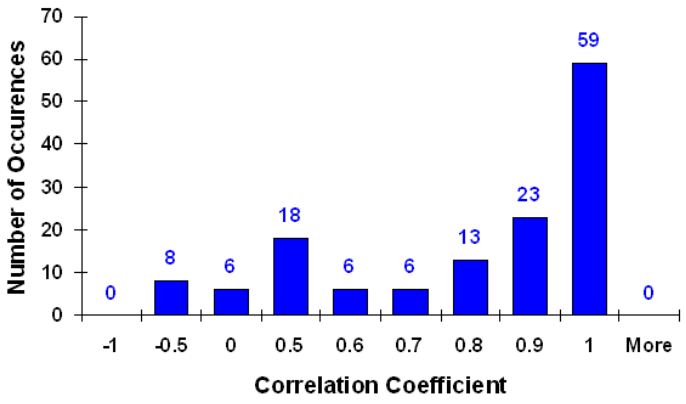


Figure 4-7: Histogram of correlation coefficients for the entire dataset.

in Appendix A, data issues were in part responsible for the low correlation coefficients for countries both with small and large aviation markets.

4.3.2 Analysis of Growth Behaviors between Passengers and GDP

In addition to computing the correlation coefficients between air passengers and GDP, temporal data trends were used to identify long-term growth behaviors between the two variables. Four types of behaviors were identified and are summarized in Figure 4-8.

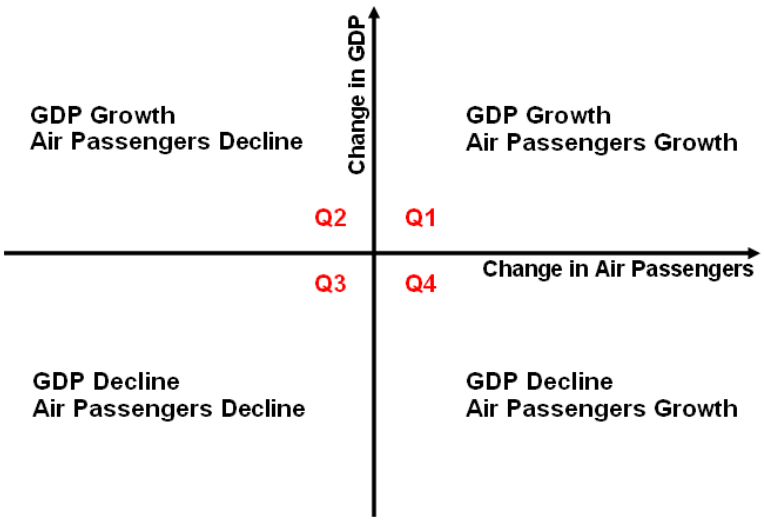


Figure 4-8: Air transportation and GDP have four major interaction behaviors. Stimulating factors result in increased positive passenger growth rates behaviors in quadrants Q1 and Q4. Suppressing factors result in negative passenger growth rates behaviors in quadrants Q2 and Q3.

Description of Growth Behaviors

The first type of behavior is the mutual growth behavior which is captured in quadrant Q1 in Figure 4-8. This behavior is characterized by positive growth rates for both air passengers and GDP which result in the growth of both variables over time. The second type of behavior is the mutual decline behavior which is captured in quadrant Q3 in Figure 4-8. This behavior is characterized by negative growth rates for both air passengers and GDP which result in the decline of both variables over time. Looking at these behaviors from the point of view of correlation coefficients computed in the previous section, one can observe that mutual growth and decline behaviors correspond to positive correlation coefficients between air passengers and GDP.

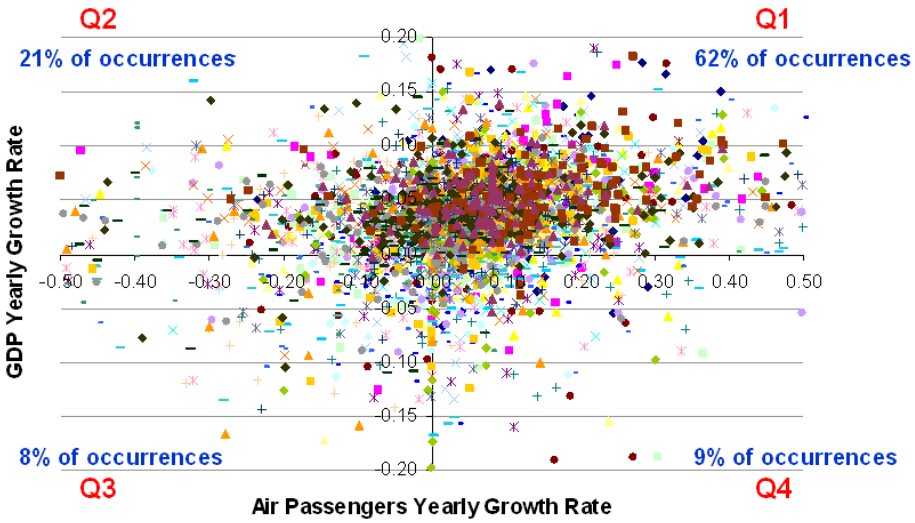


Figure 4-9: Each point represents a yearly growth rate for air transport passengers and GDP for each country in the dataset between two consecutive years from 1975 to 2005. The mutual growth and decline behaviors in quadrants Q1 and Q3 account for 70% of all points.

To investigate air passengers and GDP growth patterns and identify the commonality of different behaviors, yearly growth rates for individual countries were computed. The data are summarized in Figure 4-9. Each point in Figure 4-9 represents a change from one year to the next for air passengers and GDP for 139 countries between two consecutive years from 1975 to 2005. Since 70% of the points in Figure 4-9 lie in quadrants Q1 and Q3, the mutual growth and decline behaviors account for the majority of the growth behaviors between air transportation passengers and GDP. In fact, the most common type of behavior is that of the increasing air transportation usage and GDP which is captured in quadrant Q1.

The rest of the points in Figure 4-9 lie in quadrants Q2 and Q4 and represent behaviors when air passenger and GDP growth rates have opposing polarities or negative correlation coefficients. The behavior in quadrant Q2 occurs when the country's GDP is growing while air transportation usage is declining. The behavior in quadrant Q4 occurs when the country's GDP is declining while air transportation usage is increasing. As Figure 4-9 shows, about 30% of the points lie in these two quadrants.

The different growth behaviors can be analyzed further to identify factors which stimulate or suppress air transportation system development — one of the research objectives of this work. Air transportation

development is suppressed when the air passenger growth rates are negative, that is the behaviors described in quadrants Q2 and Q3. Air transportation development is stimulated when the air passenger growth rates are higher when compared to the world's growth rates, that is the high-growth behaviors described in quadrants Q1 and Q4.

Long term vs. Yearly Growth Patterns

Even though yearly growth rates in Figure 4-9 contribute to an understanding of the general growth patterns, analysis of temporal behaviors showed that yearly growth rates capture behaviors which change quadrants on a yearly basis and hence may be inappropriate for analysis of long-term interaction behaviors. For example,

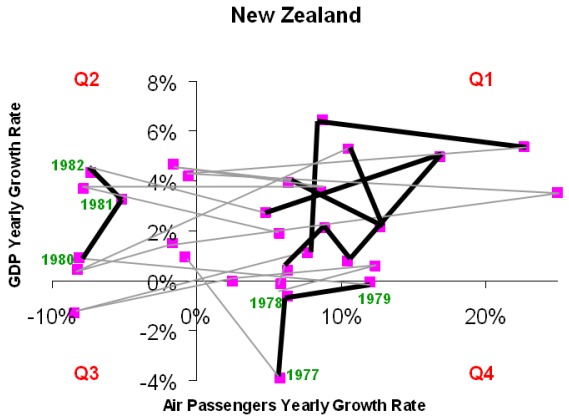


Figure 4-10: Volatility of yearly growth rates. Each point represents a yearly growth rate. Each line connects the data for two consecutive years. Bold lines are used to illustrate long-term behaviors that last at least three years. The years are marked on the chart for two long-term behaviors in quadrants Q2 and Q4.

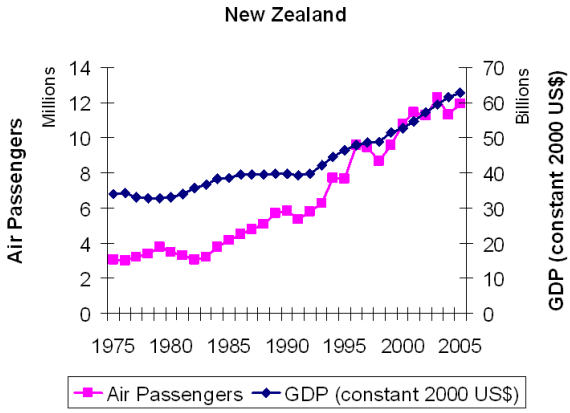


Figure 4-11: Temporal data for air passengers and GDP do not exhibit large volatility.

Figure 4-10 shows the yearly growth rates for air passengers and GDP. Each point represents a corresponding yearly growth rate, while each line connects the points for two consecutive years. Even though nine points lie in quadrant Q2 and five points lie in quadrant Q4, there are only two long-term behaviors lasting at least three years. The Q2 and Q4 long-term behaviors can be identified using the temporal data in Figure 4-11: quadrant Q4 behavior between 1977 and 1979, and quadrant Q2 behavior between 1980 and 1982. These two long-term behaviors are outlined using bold lines in Figure 4-11. In other words, despite the large number of points in quadrants Q2 and Q4, only two longer-term behaviors could be identified. Similarly, while 10% of all points lie in quadrant Q4 in Figure 4-9, only a few countries in the dataset exhibit quadrant Q4 behavior for a period longer than three years.

In order to eliminate concerns over the yearly fluctuations in the data, temporal trends for each country were used to identify different cases of sustained behavior. The growth behaviors were considered sustained if the yearly growth rates remained in the same quadrant for at least three years. Temporal trends analysis was also used to identify if and when previously suppressed air transportation usage returned to its former level. For example, the analysis of data in Figure 4-11 shows that, after the three-year decline in the traffic

in the early 1980s, the number of air passengers carried by the airlines registered in New Zealand returned to the 1979 level only in 1985. The temporal data trends for each country in the dataset are presented in the appendices.

To reduce the scatter in the yearly growth rates and capture long-term interaction behaviors, the growth rates were also computed using the three-year moving average basis. As Figure 4-12 shows, the growth rates in such a case reflect the longer-term behaviors present in the temporal data. For example, in the case of New Zealand, the three-year growth rates then capture the quarter Q2 behavior in the early 1980s and the quarter Q4 behavior in the late 1970s.

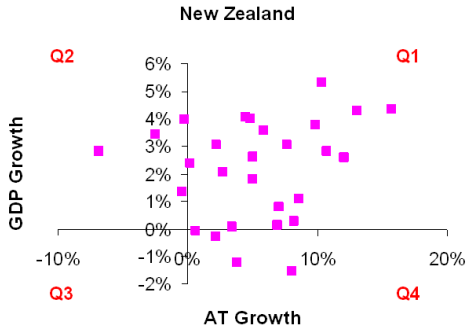


Figure 4-12: Growth rates using three-year moving average basis exhibit less volatility and capture longer-term behaviors.

These growth rates were then compared to the world's growth rates in order to identify cases of stimulated and suppressed air passenger development. In particular, the relative growth rate analysis helped to account for global trends in aviation and economic development. For example, in Figure 4-13, the three-year moving average growth rates for New Zealand are compared to the world's. Each point in Figure 4-13 represents the difference between the country's growth rate and the world's growth rate for that year. This type of comparative analysis showed that air transportation and GDP development in New Zealand grew at rates comparable to the world's growth rates over the thirty year period between 1975 and 2005. The analysis also led to an observation that both air transportation and economic development experienced sustained periods of below-average growth compared to the world's.

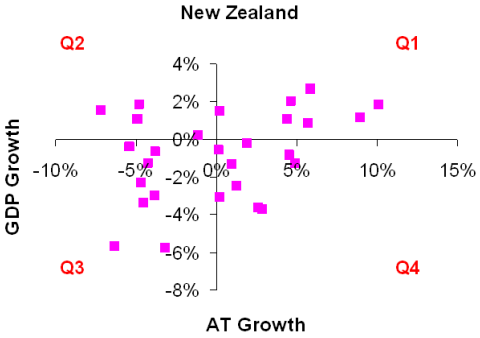


Figure 4-13: Comparing growth rates to the world's: each point in the figure represents the difference between the country's and the world's three-year moving average growth rates for a particular year.

Stimulated and Suppressed Air Transportation Development

The temporal trends and adjusted growth rates, such as those for New Zealand in Figures 4-12 and 4-13, were then used to identify cases of stimulated and suppressed air transportation development. To identify countries with stimulated air transportation development, or high air passenger growth rates, air passenger growth rates for individual countries were compared to the world's growth rates. These high-growth behaviors are captured by quadrants Q1 and Q4 in Figure 4-8.

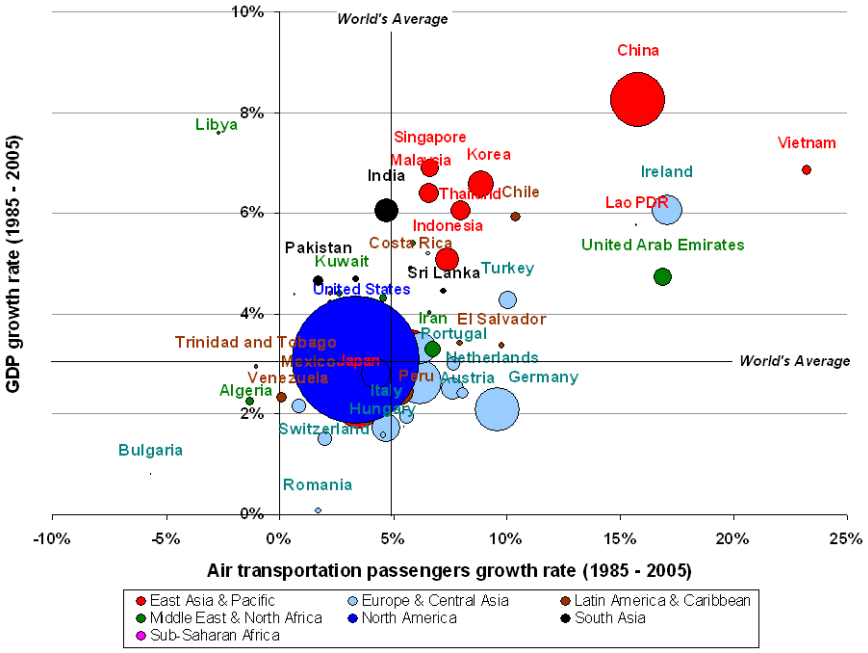


Figure 4-14: Compound annual growth rate of air transportation passengers and real GDP in constant 2000 US$ between years 1985 and 2005. In this time period, the world passenger traffic grew from 800 million to 2 billion passengers. *Notes:* (1) the size of each individual point denotes the country's share of passengers compared to the world's total in 2005; (2) only select countries are shown for clarity: the complete set is available in the appendices; (3) world's air passenger and GDP growth rates were 4.9% and 3.0%, respectively.

High positive growth behaviors were identified by computing the growth rates between years 1985 and 2005 for each country in the dataset. Two types of growth rates were computed. The first, plotted in Figure 4-14 is the compound annual growth rate, also referred to as the annual growth rate in this work. The compound annual growth rate is calculated by taking the n^{th} root of the total percentage growth rate, where n is the number of years in the period being considered. The second is the average annual growth rate which is calculated by taking the average of annual growth rates over n years. Even though the two growth rates produced different numerical values, they did not change significantly the ranking of countries based on the highest rate of growth.

The air passenger travel in the following economies grew at more than twice the world's rate over the last twenty years: Vietnam, Ireland, United Arab Emirates, China, Laos, Vanuatu, Chile, Turkey, El Salvador. The historic growth-rate analysis showed that no countries in North America, South Asia and Sub-Saharan Africa regional aggregates exhibited high-growth behaviors.

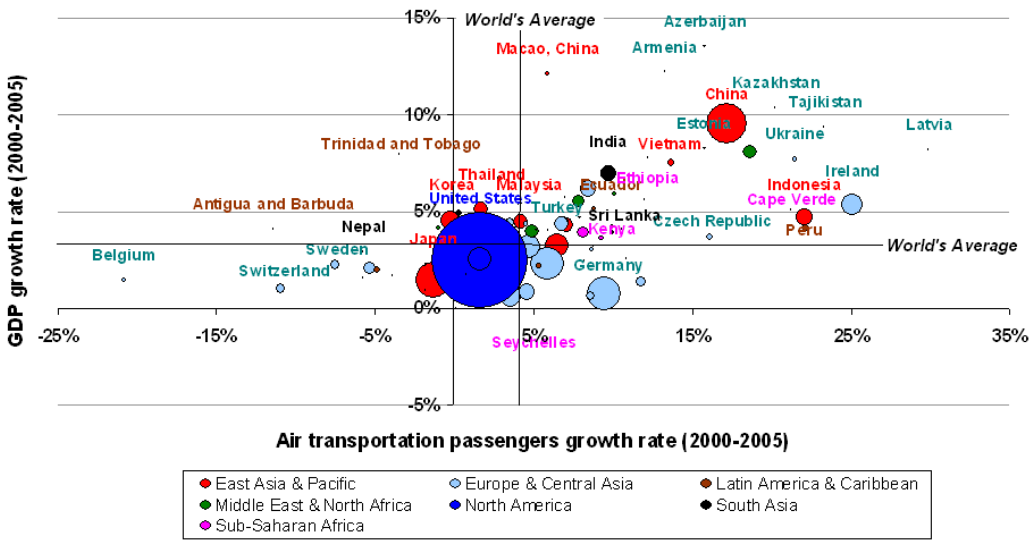


Figure 4-15: Compound annual growth rate of air transportation passengers and real GDP in constant 2000 US$ between years 2000 and 2005. *Notes:* (1) the size of each individual point denotes the country's share of passengers compared to the world's total in 2005; (2) only select countries are shown for clarity: the complete set is available in the appendices; (3) Slovakia is at (66%, 4.6%); (4) world's air passenger and GDP growth rates were 3.9% and 2.8%, respectively.

To capture the most recent changes in air passenger growth patterns, the compound annual growth rates over the five-year period between 2000 and 2005 were also computed. Some of these countries are shown in Figure 4-15. Over this time period, several countries in the former Soviet Bloc achieved very high passenger growth rates. For example, Slovakia had a growth rate of 66%, followed by Latvia at 30% and Tajikistan, Ukraine and Kazakhstan with growth rates above 20%. The incomplete list of the fastest growing nations in other regions included Indonesia and China in East Asia, Peru in Latin America, United Arab Emirates in the Middle East, Sri Lanka and India in South Asia, Senegal, Cape Verde and South Africa in Sub-Saharan Africa.

Analysis of growth rates was also used to identify countries with suppressed air transportation development, or countries with negative air passenger growth rates. These long-term behaviors correspond to those in quadrants Q2 and Q3 in Figure 4-8. Between 1985 and 2005, the traffic levels decreased in Bulgaria, Trinidad and Tobago, Algeria, Libya, and several countries in Sub-Saharan Africa which included Zimbabwe and Nigeria. Comparing the air passenger data between 2000 and 2005, the traffic level decreased in many countries. The traffic levels decreased the most for the following countries in each regional category: Japan and Papua New Guinea in East Asia; Macedonia and Belgium in Europe, Argentina and Antigua and Barbuda in Latin America; Israel and Morocco in the Middle East; Nepal and Maldives in South Asia; Burkina Faso and Zimbabwe in Sub-Saharan Africa.

The complete set of countries and their growth rates are presented in the appendices. To cover the breadth of interaction dynamics and investigate which factors helped stimulate and suppress air transportation development over the years, several high-growth and negative growth cases were chosen both in the twenty-year and five-year categories for further case study analysis.

4.4 Case Study Selection Criteria

The relationship between air transportation and economic activity was explored further through case study analysis. In particular, case study analysis was used to identify the stimulating and suppressing factors which affect air transportation growth and its impact on economic activity. In order to ensure that the cases selected for further analysis capture a variety of enabling mechanisms cover the breadth of possible interaction dynamics, the following case study criteria were used.

First, cases were selected to be representative of different growth behaviors. In particular, analysis of temporal data trends in the previous section was used to choose several countries with stimulated and suppressed air passenger growth behaviors both in historic and recent growth categories. Second, in order to provide broad-spectrum analysis of the relationship between the variables, the countries were selected in different geographic and income categories. In particular, since most of the enabling impact studies in the literature have been done for high-income countries, the majority of the countries studied in this work were low- and middle-income economies.

4.4.1 Countries with Stimulated Air Passenger Growth Rates

Several countries with high air passenger growth rates were chosen to identify factors which may stimulate air transportation development. The cases of stimulated behavior, or high-growth cases, studied in this work included China, Laos and Vietnam in East Asia; Ireland, Slovakia and Turkey in Europe; Chile in Latin America; Qatar and United Arab Emirates in the Middle East; India in South Asia; and South Africa in Sub-Saharan Africa. All of these countries had some of the highest growth rates in their respective geographic regions. In addition, as of 2005, China, United Arab Emirates, India, and South Africa accounted for the largest share of air passenger traffic in their respective geographic regions.

All of the high-growth cases listed above exhibited quadrant Q1 long-term behavior, that is positive air passenger and GDP growth rates. The United Arab Emirates was one of the most interesting cases of high-growth behavior because, in addition to the long-term Q1 behavior, the country exhibited quadrant Q4 behavior in the early 1980s, that is positive air passenger growth with declining GDP.

4.4.2 Countries with Suppressed Air Passenger Growth Rates

Due to the international nature of air transportation, political stability and political and economic sanctions play an important role in the number of passengers visiting a particular nation. In fact, the data are usually not collected for countries involved in geopolitical conflicts, such as Afghanistan, Iraq, Myanmar, and Rwanda. In addition to geopolitical conflicts, some countries have insufficient resources to collect the data and hence lack credible statistics. As a consequence, it is often difficult to obtain quantitative data for countries with negative air passenger growth rates and identify the growth-suppressing factors.

Several countries with negative air passenger growth rates were chosen to identify factors which may suppress air transportation development. Case study analysis was used to identify factors which resulted in the overall decline in the total number of air passengers between 1985 and 2005 for Bulgaria, Algeria, Libya and Zimbabwe. In addition to these cases of suppressed air transportation development, the traffic development was studied in depth for Belgium, Switzerland and Maldives. These three countries exhibited similar growth patterns in recent years: the traffic first grew at high rates for several years and was then

followed by negative growth rates. These growth patterns resulted in the decrease in the total number of air passengers between 2000 and 2005. While further case study analysis identified several change factors which suppressed air transportation system development, as was described in Chapter 3, data issues were found to be responsible for some of the most significant changes in the growth patterns for several economies.

Air transportation development in Indonesia exhibited high-growth behavior if the air passenger data are compared between 2000 and 2005. However, the majority of this growth occurred in a discontinuous jump between 2003 and 2004 while in other years the traffic grew at below-average growth rates and had negative air passenger growth rates between 1996 and 1999. The case study analysis was used to further explore the suppressed air passenger development between years 1996 and 1999 and the increase in air transportation usage since then. In particular, a discontinuous change in the growth rate in 2004 was investigated further to rule out data accounting issues.

The cases of negative passenger growth rates covered the behaviors in quadrants Q2 and Q3. Indonesia, Bulgaria, Belgium, Switzerland, Maldives, Algeria and Libya case studies represented Q2 behaviors, that is negative passenger growth rates with increasing GDP. For example, between 1985 and 2005, the average air passenger growth rate for Libya was -2.7% while the country's GDP was growing at 7.6% [212]. The mutual decline in air passengers and GDP, or quadrant Q3 behavior, was captured by case studies of Bulgaria and Zimbabwe.

4.4.3 Countries with Average Air Passenger Growth Rates

In the previous section, air passenger growth rates were compared to the world's to identify cases with stimulated and suppressed air transportation development. Specifically, stimulated behaviors were represented by the countries where air passenger growth rates grew at least twice as fast as the world's average and suppressed behaviors were represented by the countries with negative air passenger growth rates. Several representative countries with average growth rates were also chosen for case study analysis.

The United States was chosen for further case study analysis because it has the world's largest air transportation system and because it fulfills the geographic scope requirement by representing the North American geographic region. The other two countries were Jamaica and Kuwait. The number of air passengers carried by the airlines registered in these countries grew at or below the world's average growth rates over the last twenty years. Jamaica was included in case study analysis because the country's air passenger and GDP trends exhibited quadrant Q4 behavior despite the relatively low average growth rates in air transportation. In other words, Jamaica had positive air passenger growth rates while the country's GDP was declining. Kuwait was included in case study analysis to compare local air transportation development to the high-growth behavior exhibited by two other high-income economies in the Gulf region: Qatar and the United Arab Emirates.

4.4.4 The List of Case Studies

Table 4.1 gives an overview of the cases and their distinctive attributes. Income and regional categories are standard categories used by the World Bank and are described in detail in Appendix B. The geographical distribution of countries studied in this work is shown on the map in Figure 4-16 [5].

[5]The figure was generated using *http://edit.freemap.jp/en/trial_version/edit/world*.

Table 4.1: The list of case studies.

Country	Air Passenger Behavior	Regional Category	Income Category
China	Stimulated	East Asia & Pacific	Lower middle income
India	Stimulated	South Asia	Low income
South Africa	Stimulated	Sub-Saharan Africa	Upper middle income
Turkey	Stimulated	Europe & Central Asia	Upper middle income
UAE	Stimulated	Middle East & North Africa	High income
Qatar	Stimulated	Middle East & North Africa	High income
Vietnam	Stimulated	East Asia & Pacific	Low income
Laos	Stimulated	East Asia & Pacific	Low income
Ireland	Stimulated	Europe & Central Asia	High income
Slovakia	Stimulated	Europe & Central Asia	Upper middle income
Chile	Stimulated	Latin America & Caribbean	Upper middle income
USA	Average	North America	High income
Jamaica	Average	Latin America & Caribbean	Lower middle income
Kuwait	Average	Middle East & North Africa	High income
Libya	Suppressed	Middle East & North Africa	Upper middle income
Algeria	Suppressed	Middle East & North Africa	Lower middle income
Zimbabwe	Suppressed	Sub-Saharan Africa	Low income
Indonesia	Suppressed	East Asia & Pacific	Lower middle income
Belgium	Suppressed	Europe & Central Asia	High income
Switzerland	Suppressed	Europe & Central Asia	High income
Bulgaria	Suppressed	Europe & Central Asia	Lower middle income
Maldives	Suppressed	South Asia	Lower middle income

The case studies representing the different growth behaviors are also listed in the four quadrants in Figure 4-17. The four quadrants capture the relationship between air passenger and GDP development. Even though many countries exhibited more than one type of temporal behavior over the thirty year time period, the individual case studies reviewed in detail only the behaviors listed in the four quadrants of Figure 4-17. In particular, the countries with high positive air passenger growth rates exhibited either quadrant Q1 (positive change in GDP) or quadrant Q4 (negative change in GDP). The countries with suppressed air transportation development exhibited either quadrant Q2 (positive change in GDP) or quadrant Q3 (negative change in GDP) behaviors. The following behaviors were explored for countries with average air passenger growth rates: quadrant Q1 and Q2 behaviors for USA, quadrant Q1 and Q3 behaviors for Kuwait, quadrant Q4 behavior for Jamaica. Belgium, Switzerland, Indonesia and Libya also exhibited quadrant Q1 behavior (positive air passenger and GDP growth rates) in addition to exhibiting a long-term decline in the overall number of air passengers over the years.

For example, even though the total number of air passengers carried on Libya's airlines decreased between 1985 and 2005, Libya had a positive air passenger growth rate between 2002 and 2005. Therefore, both suppressing and stimulating change factors were identified in that case study. The analysis also helped identify factors which may have had or may have in the future a negative impact on air transportation development by constraining air transportation development in several countries despite the overall positive growth of air passenger traffic. For example, the case study of China primarily describes the factors which helped stimulate the country's air transportation system development since the early 1980s. However, the analysis

also identified several suppressing factors which affected China's air transportation development during that time period. In addition to long-term behaviors and potential suppressing factors, the analysis identified several change factors which resulted in short-term decreases in the rate of growth of air transportation passengers.

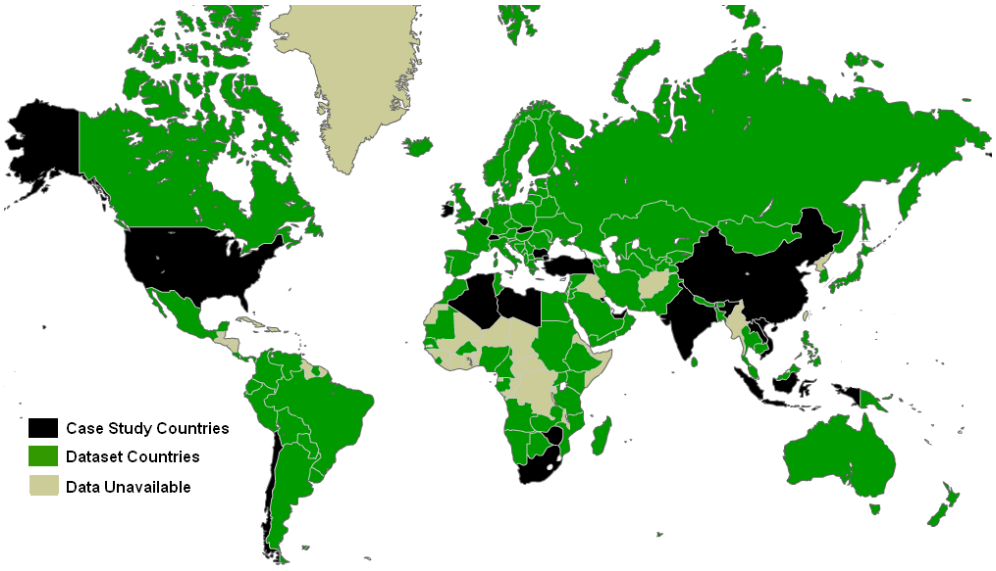


Figure 4-16: The geographical distribution of twenty-two case study countries.

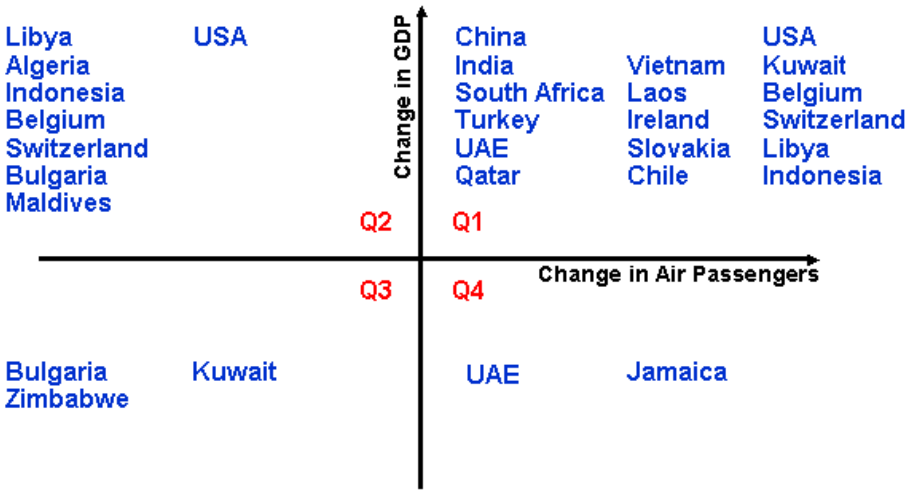


Figure 4-17: The interaction behaviors captured by each country-level case study.

4.4.5 Data Sources for Case Study Analysis

Case study information was obtained from both quantitative and qualitative data sources. The major quantitative data sources included the on-line database *World Development Indicators* maintained by the World

Bank Group, the ICAO air passenger statistics accessed through the World Bank website, the World Tourism Organization statistics accessed through the Euromonitor International website, and country statistics gathered by the Economist Intelligence Unit, *Background Notes* from the U.S. Department of State, and *The World Factbook* from the U.S. Central Intelligence Agency. Additional data sources included technical reports by trade organizations, airport and civil aviation authority websites, country studies published by the World Bank, technical journals and major news publications.

The original air transport data source is the International Civil Aviation Organization (ICAO) Civil Aviation Statistics of the World and ICAO staff estimates. The air transport data represent the total (international and domestic) scheduled passenger traffic carried by the air carriers registered in a country. In addition to using the national air passengers data, the analysis was supplemented by using airport and airline traffic data from additional ICAO publications [110], airport and airline websites. The time-series air transportation data are available for select countries, with omissions, starting in 1970.

As was described in Chapter 3, freight data are also available in the ICAO database. However, the national carrier data are not representative of the freight flows to and from a particular country. As a result, the national air cargo data were not used to in the analysis. Instead, other data sources were used in the case studies. They included individual carrier data pertaining to specific markets and market analysis publications.

The original source for economic data is the World Bank national accounts. The time-series economic data are available for select countries, with omissions, starting in 1970. The completeness and accuracy of economic data vary between countries. The data are generally less reliable for countries which have poor economic and political information dissemination, small developing countries and those with unstable political regimes.

The World Tourism Organization, which is the United Nations agency, is the primary data source for international visitor statistics. Annual statistics on tourism expenditure, visitor arrivals by originating region, mode of transport and purpose of visit have been collected for many countries starting in 1993. The purpose of visit statistics are broken down into leisure, business, and other categories. These are only available at the aggregate level which combines all transportation modes. However, these data, in addition to the data from secondary sources, can be used to approximate the type of interaction a particular economy has with the rest of the world. As with any data sources, the developing countries have the most incomplete data.

These sources were used to gather factual information pertaining to air transportation and economic development. Specifically, air transportation data included information on traffic, airlines, aviation infrastructure and the country's regulatory framework. Economic data included information about the country's economic attributes including information about the country's geography, socioeconomic conditions, economic composition, supporting physical infrastructure investment, capital investment and institutional reforms. These data were then used to infer the enabled flows which take place between the country and the rest of the world and the change factors affecting air transportation system development.

4.5 Case Studies Summary

Twenty-two representative countries were identified in the previous section for case study analysis. These countries cover the four major interaction behaviors between air transportation and economic growth. The

countries also cover the three major trends present in air transportation development: stimulated growth, suppressed growth and average growth.

The individual case studied are reviewed in detail in Appendix A. In particular, case study analysis at the individual country level was used to describe air transportation development and identify change factors affecting its growth and impact on economic activity. The case study analysis was also used to describe in detail the relationship between air transportation and enabled economic activity at the individual country level. As was discussed in Chapter 1, the enabled flows presented in the feedback model in Figure 1-6 is one way of evaluating the enabling impact of air transportation. These enabled flows directly impact the country's economic activity by changing the economic attributes and hence affect the air passenger travel and freight need between that economy and the rest of the world. As a result, in this work the enabling impact of air transportation at the individual country level is described by identifying the major types of enabled flows which take place between a given economy and the rest of the world.

The key enabled flows and the change factors affecting air transportation system development identified during the case study analysis are summarized below. The implications are reviewed in detail in Chapters 5 and 6 which provide a detailed description of the change factors that stimulate or suppress air transportation system development and describe the enabling impact of air transportation.

4.5.1 Case Studies Summary: The Enabled Flows

As was described in Chapter 1 and will be described further in Chapter 6, analysis of the enabled flows is one way of evaluating the enabling impact of air transportation. These enabled flows directly change the country's economic attributes and hence affect passenger travel and freight need, or air transportation demand, between economies. The following enabled flows were identified in the case studies: goods, services, knowledge, tourism, investment, remittances and labor. Detailed analysis of the enabled flows and their relative magnitude was performed for several countries studied in this work. Figure 4-18 lists the enabled flows which played a major role in these economies. The detailed description of the flows at the individual country level is provided in Appendix A.

	Goods	Services	Knowledge	Tourism	Investment	Remittances	Labor
China	x		x	x	x	x	
India		x	x	x	x	x	
South Africa				x			
Turkey				x		x	
UAE	x	x	x	x	x		x
Chile	x			x			
USA	x	x	x	x	x		x
Jamaica				x		x	
Libya							x

Figure 4-18: The key Enabled Flows identified during the case study analysis.

4.5.2 Case Studies Summary: The Change Factors

The case study analysis was used to identify the change factors which are responsible for changes in the air passenger growth rates for different economies. These change factors belong to two general categories: (1) those which affect the Air Transportation Supply, (2) those which affect the Air Transportation Demand.

The air transportation supply change factors consist of the regulatory framework, infrastructure capability, vehicle capability and airline strategy. The following regulatory mechanisms affecting air transportation system development have emerged during the analysis: domestic deregulation, international liberalization, privatization and ownership restrictions, safety and environmental restrictions, and geopolitical and security restrictions. The infrastructure capability is affected by airport capacity, availability and incentivization of secondary airports, and the capability of the air traffic management system which includes the availability of qualified aviation personnel. Vehicle capability and the resulting fleet capacity and perceived airline safety can be changed through fleet modernization. Airline strategy is affected by the airline business models and business factors. In particular, low-cost carrier development, airline alliances, airline expansion strategy and government support of the national carrier were found to affect airline development in the countries studied in this work.

The air transportation demand change factors fall into two categories. First, are those which directly affect the demand: exogenous demand shocks, economic downturns, political and economic sanctions, competition from other transportation modes and civil unrest. Second, are those which affect the demand indirectly by changing the country's economic attributes through economic and institutional reforms, supporting infrastructure investment, exchange rate fluctuations, political and macroeconomic stability, and growing consumer demand. In addition to these indirect factors, other general factors helped stimulate air passenger development worldwide. They included changes in management practices and liberalization and globalization of trade in manufacturing and services.

The factors are described in detail in Chapter 5. Meanwhile, Figures 4-19 and 4-20 summarize the stimulating and suppressing change factors identified in the case studies.

4.5.3 Case Studies Summary: The Interaction Behaviors

The four quadrants in Figure 4-17 capture the four interaction behaviors between air passengers and GDP. The mutual growth behavior in quadrant Q1 was captured by the analysis of the countries with stimulated air passenger growth rates and also USA, Kuwait, Belgium, Switzerland, Libya and Indonesia. As can be seen in Figure 4-19, both air transportation supply and demand change factors affect the interaction between the two variables for countries with positive air passenger growth rates. In the majority of these countries significant changes were observed both in the air transportation supply, such as changes in the regulatory framework and infrastructure capability, and the air transportation demand, such as economic liberalization reforms and supporting infrastructure investment. In particular, airline strategy had a significant impact on air transportation development in several countries with stimulated air passenger growth rates. Airline expansion strategies were enabled by changes in the regulatory framework and infrastructure capability in Turkey, UAE, Qatar, Ireland, Slovakia, Kuwait, Belgium and Switzerland. In several countries changes in the regulatory framework enabled the growth of low-cost carriers and the demand stimulation effect which will be described in detail in Chapter 5. Specifically, international liberalization in Europe enabled the

	China	India	South Africa	Turkey	UAE	Qatar	Vietnam	Laos	Ireland	Slovakia	Chile	USA	Jamaica	Kuwait	Libya	Algeria	Zimbabwe	Belgium	Switzerland	Bulgaria	Maldives	Indonesia
Air Transportation Supply																						
Regulatory Framework																						
Domestic Deregulation	O	O	O	O								O										O
International Liberalization	O	O		O	O				O	O	O	O						O	O			
Privatization and Ownership		O									O								O			
Infrastructure Capability																						
Airport Capacity Expansion/Construction	O			O	O	O									O							
Availability and/or Incentivization of Secondary Airports	O								O	O		O										
Airline Strategy																						
Low-cost Carrier Development		O	O	O					O	O		O										O
Airline strategy				O	O	O			O	O				O				O	O		O	
Government Support of the National Carrier			O	O	O	O	O	O					O		O						O	
Airline Alliances																						O
Vehicle Capability																						
Fleet Modernization							O	O						O	O							
Air Transportation Demand																						
Indirect Factors																						
Supporting infrastructure investment	O	O			O	O	O	O							O							
Economic liberalization		O	O	O			O				O											
Institutional and political reforms	O	O	O		O	O	O								O							
Growing consumer demand	O	O		O																		O

Figure 4-19: These change factors stimulated air transportation development in the twenty-two countries studied during the case study analysis.

	China	India	South Africa	Turkey	UAE	Qatar	Vietnam	Laos	Ireland	Slovakia	Chile	USA	Jamaica	Kuwait	Libya	Algeria	Zimbabwe	Belgium	Switzerland	Bulgaria	Maldives	Indonesia
Air Transportation Supply																						
Regulatory Framework																						
Ownership Restrictions	X	X										X										
Safety and Environmental Restrictions													X									X
Geopolitical and Security Restrictions			X												X	X				X		
Infrastructure Capability																						
Airport Infrastructure Capacity		X										X										
Air Traffic Management (ATM) Capability	X							X														
ATM: Shortage of Qualified Aviation Personnel	X	X										X										
Airline Strategy																						
Airline Business Factors												X						X	X	X	X	
Vehicle Capability																						
Perceived Airline/Fleet Safety							X	X									X					X
Insufficient Fleet Capacity due to Lack of Capital		X						X									X			X	X	
Insufficient Fleet Capacity due to External Factors														X	X							
Air Transportation Demand																						
Direct Factors																						
Exogenous Demand Shocks	X			X			X					X									X	X
Economic Downturn												X					X			X		X
Economic Downturn (non-domestic)				X							X		X					X	X			X
Political/Economic Sanctions			X												X							
Competition from Other Transportation Modes																		X	X			
Civil Unrest and/or War														X		X	X					
Indirect Factors																						
Political and/or Macroeconomic Instability			X	X									X			X	X			X		
Exchange Rate Fluctuations													X									

Figure 4-20: These change factors suppressed air transportation development in the twenty-two countries studied during the case study analysis.

low-cost carriers registered in Ireland and Slovakia to pursue an international expansion strategy and grow their international networks. Changes in the regulatory framework also enabled the development of domestic low-cost carriers in India, South Africa, Turkey, USA and Indonesia.

As will be described in detail in Chapter 5 many of the change factors both on the air transportation supply and demand sides are directly controlled by the government. In particular, direct government intervention and support of the national carriers resulted in positive air passenger growth rates in the United Arab Emirates and Jamaica while the countries had negative GDP growth rates.

The mutual decline behavior in quadrant Q3 was captured by the case studies of Bulgaria, Zimbabwe and Kuwait. The interaction between air passengers and GDP in these countries was characterized by several factors which negatively affected air transportation demand: economic downturns, civil unrest, macroeconomic and political instability. These economic factors also affected the air transportation supply. In particular, it was observed that in each of these countries air transportation development was suppressed by the insufficient fleet capacity which prevented the airlines from maintaining and modernizing their aircraft. In Bulgaria and Zimbabwe the fleet capacity was reduced due to the lack of capital while in Kuwait the fleet capacity was reduced after the Iraqis destroyed the airline's fleet following the invasion.

Several change factors were found to be responsible for the negatively-correlated behaviors between air passengers and GDP in quadrant Q2. These change factors varied between the countries listed in quadrant Q2 in Figure 4-17. Airline business factors and the resulting airline bankruptcy were primarily responsible for suppressed air passenger growth rates in Belgium, Switzerland, Bulgaria and Maldives. At the same time, the actual traffic flows to and from those countries did not decrease as much as the airline data seem to imply because the countries' air transportation needs continued to be served by airlines not registered in those countries. Airline business factors also played a role in the negative air passenger growth rates in the United States. These air transportation supply factors were exacerbated by the air transportation demand factors which included the terrorist attacks of September 11 and the economic downturn at the turn of the century. Meanwhile, the country's diversified economy continued to grow. Air transportation usage in Libya and Algeria was constrained for many years by geopolitical sanctions and security concerns which restricted the operations of both domestic and foreign carriers and reduced the demand for air passenger services. Meanwhile, the countries' GDP continued to grow because of the growing revenues from the hydrocarbons sector which accounted for more than quarter of the GDP in these two countries. The negative air passenger growth rates in Indonesia were primarily a result of the exogenous demand shocks which affected the number of international passengers traveling to and within the country. In particular, the demand was affected by the terrorism threats and changes in the perceived airline safety which decreased significantly in the 1990s with an increase in the number of aviation fatalities. Meanwhile, the country's economy and GDP continued to grow except for a short-term economic downturn following the Asian financial crisis of 1997.

Chapter 5

Air Transportation System Change Factors

This chapter describes in detail how various change factors, which were identified during the case study analysis and summarized in Chapter 4, may stimulate or suppress air transportation system development. These factors belong to two general categories: (1) those which affect the Air Transportation System supply, and (2) those which affect the Air Transportation Demand, or passenger travel and freight need between an Economy and the Rest of the World. Because these change factors affect both the air transportation supply and demand, they affect the resultant Air Transportation Flows between an Economy and the Rest of the World and hence the resulting enabling impact of air transportation.

The air transportation supply change factors are described first. They consist of changes in the regulatory framework, infrastructure capability, vehicle capability and airline strategy. The air transportation demand change factors are described next. These fall into two categories: those which directly affect the demand and those which affect the demand indirectly by changing the country's economic attributes. The description of change factors is followed by the description of the government's role in influencing these change factors and the resulting air transportation system development.

5.1 Air Transportation Supply Change Factors

The following air transportation supply change factors were identified during the analysis: regulatory framework, infrastructure capability, vehicle capability and airline strategy.

5.1.1 Regulatory Framework

Changes in the regulatory framework affect the airlines' operational environment and define the scope of competition for both domestic and foreign carriers. Deregulation of domestic services and liberalization of international services are two of the main regulatory mechanisms responsible for changes in air transportation supply. Other regulatory mechanisms consist of privatization and ownership restrictions, safety restrictions, environmental and noise restrictions, political and economic restrictions, and security restrictions.

Domestic Deregulation

Economic deregulation refers to the removal of government controls of the industry which include control of capacity, fares, network structure, the number of carriers allowed on a particular route, entry and exit restrictions, and ownership restrictions. Previous studies have shown that there are numerous examples across the world in which market forces following the deregulation have generally benefited the consumer by enabling lower costs and stronger competition among airlines[173, 29]. In other words, deregulation often results in higher traffic growth rates because of availability of new services, increased capacity and lower airfares for passengers. However, there are also examples of city-pairs where competition following deregulation has been short-lived and unsustainable [208]. Among the countries studied in this work the changes in the airline industry following domestic deregulation reforms played a major role in stimulating air passenger traffic in China, India, South Africa, Turkey, the United States and Indonesia.

United States was the first country in the world to deregulate its domestic air transport sector in 1978. Since then, due to the overall perceived success of U.S. deregulation, many countries have pursued either full or partial deregulation. For example, China and India underwent partial domestic deregulation in the 1980s resulting in substantial growth in domestic air passenger traffic. The passenger traffic also increased in Turkey and South Africa after domestic deregulation reforms. In India, Turkey, South Africa and Indonesia the largest share of newly generated traffic has been carried by the low-cost carriers which were formed following the deregulation. The effect of low-cost carrier demand stimulation will be discussed in detail in Section 5.1.4.

International Liberalization

International traffic flows between economies are regulated by bilateral air service agreements between nations. The case study analysis showed that liberalization of these agreements have resulted in substantial changes in traffic flows between countries. These countries included China, India, Chile and the United States. International liberalization also enabled the airlines registered in Turkey, United Arab Emirates, Ireland, Slovakia, Belgium and Switzerland to pursue aggressive international expansion strategies.

The regulatory framework for international aviation was established during the Chicago Convention of 1944. The Convention specified that two nations would negotiate the terms of operating commercial air services through concluding a bilateral air service agreement. The Convention also identified the "Freedoms of the Air" — summarized in Appendix B — that defined the terms for future aviation negotiations. The bilateral agreements typically include provisions on capacity, fares, and fixed market access and entry, i.e. city-pairs to be served and number and ownership of airlines. Liberalization refers to the removal of the restrictive provisions in the bilateral agreements to encompass additional freedom rights.

Figure 5-1 summarizes the three levels of international aviation agreements found today. First, there are the traditional bilaterals which include most of the existing agreements worldwide. Second, there are agreements modeled after the 1992 U.S. "Open Skies" agreements with Netherlands and Singapore. These agreements remove the majority of the restrictions found under the traditional agreements. Third, there are fully liberal Open Aviation Area agreements which include removal of ownership restrictions and allow cabotage, i.e., the right for an airline of one Member State to operate a route within another Member State [154]. To date, European Union is the only market in the world which uses a multilateral framework

Type of agreement	Open service capacity and frequency ?	Freedom in setting fares ?	Extended traffic rights (e.g. onward 5ths)? (see Note 1)	Foreign ownership and control allowed ?	"Cabotage" (see Note 2)
Traditional Bilaterals	x	x	x	x	x
"Open Skies"	✓	✓	✓	x	x
Open Aviation Area (OAA)	✓	✓	✓	✓	✓

Note 1: 5ths are the right to pick up passengers from a foreign country (B) and fly them to another foreign country (C).
Note 2: "Cabotage" is the right of a foreign carrier to operate purely domestic services in another country.

Figure 5-1: Comparison of restrictions in traditional bilateral, "Open Skies" and Open Aviation Area (OAA) agreements. Source: The United Kingdom Civil Aviation Authority [154].

with cabotage rights for its Single European Aviation Market as opposed to the bilateral agreements between nations. The European liberalization reforms were initiated in 1987, the freedom to provide services within the EU was added in 1993, and cabotage rights were added in 1997 [1].

Even though the individual post-liberalization traffic patterns vary between countries, the studies show that on average traffic growth rates following liberalization usually increase when compared to pre-liberalization levels [117, 125, 124]. In fact, following examination of 190 countries and 2,000 bilateral air service agreements, the study by Inter*VISTAS*–ga[2] Consulting, Inc. found that traffic growth following liberalization tended to exceed pre-liberalization growth rates by 12 to 35 percent. In particular, the creation of the Single European Aviation Market in 1993 led to a doubling of traffic growth rate in years 1995 to 2004 when compared to the growth in the years between 1990 and 1994 [117].

European liberalization reforms in the 1990s had a significant impact on traffic levels in several countries documented in this work. For example, the rapid air transportation growth in Ireland and Slovakia reflects the growth of international networks of their airlines. In Ireland, a low-cost carrier Ryanair established itself as an intra-European carrier in the early 1990s. In Slovakia, a low-cost carrier SkyEurope has been one of the fastest growing airlines in Europe since its founding in 2002. The liberalization also helped the now-defunct carriers Sabena and Swissair to pursue international expansion strategies in the 1990s.

Liberalized aviation agreements also helped the Dubai's national carrier Emirates Airline grow its international network. From the carrier's inception in the 1980s, the government supported its network growth through liberalized bilateral air service agreements. Many foreign governments readily signed the bilateral air service agreements with Dubai since, according to Maier [137], in the 1980s Emirates was still a new airline without a sizable fleet and therefore was not perceived as a threat to the local carriers. The liberalized provisions in these agreements allowed Emirates to grow its international network which by the early 1990s included Europe, Singapore and other East Asian nations.

In Chile, air transport liberalization reforms were initiated in 1979 and helped establish the linkages to international markets for Chilean exports. The country's international air transport policy was traditionally

[1]The time-line and summary of European Air Service Liberalization reforms are available at the European Commission's Air Transport Portal: *http://ec.europa.eu/transport/air_portal/internal_market/competition_en.htm*

based on the principles of free market entry, freedom of pricing, open skies and minimum government intervention [81]. Some of the current provisions include absence of foreign ownership restrictions, absence of barriers to market entry for carriers, and a public auction for allocation of international traffic rights. As part of further liberalization reforms in the early 1990s, Chile signed several open skies agreements including those with Argentina, Brazil, Spain and the U.S. According to a study of liberalization impacts by Villena et al., these reforms had a positive effect on Chile's air traffic growth rates [203].

The analysis showed that the majority of the countries with stimulated air transportation development pursued some form of international liberalization. For example, partial liberalization of the bilateral air services agreements took place in China at the beginning of the century. As a result of these changes, several foreign low-cost passenger carriers were successful at establishing new international networks in China [188]. In addition to the passenger reforms, China relaxed some of the ownership restrictions and pursued liberalization reforms for all-cargo flights. These changes stimulated the development of international air freight flows to and from China. In fact, between 1990 and 2005 China's air cargo market experienced 19.6% average annual growth [100]. These regulatory reforms also helped develop China's new air cargo hubs. Prior to the liberalization Chinese exports from the mainland had to be consolidated in Hong Kong for transport overseas [186]. Following changes in the regulatory framework, three other major shipping centers have emerged in Beijing, Guangzhou and Shanghai [207].

While the liberalization of bilateral agreements often stimulates traffic development, restrictive agreements between some markets have been shown to suppress traffic growth. For example, Jamaica traditionally relied on leisure passengers from the U.S. to sustain its tourism sector. To support the competition between air services providers the Jamaican government officially supports air services liberalization. However, studies show that the U.S.–Jamaica bilateral agreements are more conservative when compared to air services agreements between the U.S. and other tourism-dependent economies in the Caribbean [206]. In particular, a study by Warnock-Smith et al. showed that because the agreements have entry and fare restrictions, low-cost carriers have been avoiding certain city-pairs between the U.S. and Jamaica while establishing routes and stimulating the demand between the U.S. and other Caribbean destinations [206].

Similarly, low-cost carrier expansion on international routes from Turkey has been hindered by Turkey's bilateral agreements which implicitly or explicitly favor the national carrier Turkish Airlines. In particular, despite the liberalization of its international bilateral agreements, some of the agreements still explicitly allocate routes only to the national carrier. The growth of other airlines is also implicitly restricted by slot allocation and tariff policies which are controlled by the national carrier. These implicit restrictions make it difficult for other carriers to compete on some of the international routes even in fully-liberalized markets [177].

Even though traditional bilateral agreements specify capacity and frequency of the services, the routes are usually operated only if they are profitable to the airlines and if the airlines have sufficient capacity to allocate to those routes. For example, many of Africa's airlines lack the fleet capacity and competitiveness to operate in the global market. As a result of these deficiencies, over 70% of the African traffic is transported by foreign carriers [111]. This arrangement means that continued aviation provision in these countries is susceptible to the changes in foreign carrier strategy. In particular, the country's air transportation linkage to the global economy can be terminated at any time if the foreign carriers decide that the routes become unprofitable. For example, because of the declining geopolitical climate, which resulted in low visitor numbers

and increase in the operating costs due to fuel shortages, several international carriers including Quantas, Lufthansa and British Airways suspended their services to Zimbabwe suppressing air transportation supply development [135, 140]. Meanwhile, the country's national carrier, Air Zimbabwe, had to cut its network as well because of financial difficulties [155].

Foreign carriers also play a central role in providing air transportation access for the island nation Maldives because the country's national airline lacks sufficient capital to support international operations. Similarly, even though India's international markets are regulated by the bilateral agreements, India's airlines lack the capacity to accommodate an equal share of demand on most of the routes. As a result, the majority of international traffic in India is transported by international carriers, such as the airlines based in the Middle East which alone carry up 53% of the traffic between India and the UK[152]. In fact, prior to changes in the regulatory framework, India's restrictive bilateral agreements suppressed international air traffic development because India's airlines did not have sufficient capacity to operate the routes but, at the same time, the agreements restricted the number of routes which could be offered by the foreign carriers.

Privatization and Ownership

Privatization of airline, airport and other aviation infrastructure was one of the major trends in the air transportation industry over the last twenty years. Privatization occurs when the government sells some or all of the shares of a government-owned and government-operated enterprise to the private sector. Privatization can also occur with transfer of some ownership rights, such as rights to residual income and management control, through leases and concessions to public-private enterprises [49, p. 101]. While privatization transfers management of the enterprises to the private sector, the government usually remains responsible for regulating the standards of operational efficiency and safety. The motives for privatization range from purely economic considerations, such as the government's desire to raise capital and avoid the need to obtain financing for capital investment, to improving operating efficiency and competitiveness [116]. However, there have been no studies to date which successfully evaluate the impact of privatization on efficiency, employment or profitability because of other confounding factors [143, p. 148].

Historically, the national governments controlled the country's major commercial airports in most of the world's regions [49, p. 96]. In comparison, in the United States the majority of the commercial airports were traditionally owned and operated by individual cities, counties and state agencies. Specifically, the airports in the U.S. were operated by the units called "authorities" which were established by state governments and legislatures. While these authorities were typically controlled by the government politically, they financed themselves independently with bonds sold to private investors[49, p. 95]. Privatization of airport infrastructure in other regions commenced in the 1980s when the United Kingdom privatized its major airports in 1987. Since then, many airports outside of the United States were sold to private investors or turned over to private operators in nations as diverse as Argentina, Australia, Austria, Bolivia, Canada, Chile, Colombia, Denmark, Ecuador, South Africa, and Turkey [50]. Over the years there emerged a variety of regulatory structures available for investors to participate in air transportation infrastructure development. Among these are public enterprises, banks loans, development grants, public-private partnerships, build-operate-transfer models, infrastructure investment funds, and land sales [49]. Among the countries studied in this work airport privatization played an important role in India because India's development of aviation and airport infrastructure was suppressed until recently in part due to the lack of capital funds. In

order to obtain financing and promote airport development, the Indian government decided to allow private investment into the aviation infrastructure. The public-private partnership was first used to build a new airport in Cochin in 1999. The strategy was also used to build new international airports in high-tech hubs of Hyderabad and Bengaluru. These two airports were opened respectively in March and May of 2008. The government is also planning to pursue public-private partnership to upgrade Delhi and Mumbai's airports and build a second international airport to serve the Mumbai catchment area.

Airline privatization followed deregulation reforms in many countries since the 1990s. For example, by the year 2000, about half of the Western European airlines were privatized [49]. Some of the airlines fully or partially privatized since 2004 include Air China, Air France, Air Lithuania, Alitalia, China United Airlines, El Al, Kyrgyzstan Airlines, Mexicana and Turkish Airlines [116]. The analysis in this work showed that privatization enabled traffic growth in India, Chile and Switzerland because it enabled airlines to pursue different business strategies. The strategies, however, were enabled by other additional changes in the regulatory framework: domestic deregulation in India and international liberalization in Chile and Switzerland.

While privatization has been a common trend around the world, some countries experienced difficulties privatizing their national carriers because under-performing national carriers rarely provide a good investment opportunity for private investors. For example, it was difficult for the Belgian government to find private investors for their national carrier Sabena because the carrier was mostly unprofitable throughout the 1990s. The national carrier was eventually bought by Swissair in 1995 and became insolvent when Swissair ran into financial difficulties in 2001. Similarly, it was difficult for the Bulgarian government to privatize their struggling national carrier Balkan Bulgarian Airlines which was eventually sold to an investor in 1999 and declared bankrupt in 2002 [146]. Some of the African governments had difficulty privatizing their carriers as well because many of these airlines were not as attractive to foreign investors as their counterparts in other regions partly because the countries' institutional framework lacked adequate legal guarantees.

While some governments have difficulty attracting private investment into the air transportation sector, foreign ownership restrictions in other countries prevent the potential investors from pursuing lucrative investment opportunities. For example, foreign ownership rules currently limit foreigners to 25% of voting equity in the United States airlines. Removal of these ownership restrictions has originally been part of the negotiations for Phase 1 Open Skies agreement between the U.S. and EU [2]. Several carriers, including Virgin, Lufthansa and Air France-KLM, have already expressed interest in trans-Atlantic purchases or mergers [172]. However, in a protectionist move the United States withdrew from the negotiations until the second phase talks scheduled for 2010. Similarly, slow privatization reforms and foreign ownership restrictions have been preventing foreign investors from investing into the air transportation sector in China and India. For example, bureaucratic hurdles still prevent foreign airlines and investors from gaining access to the Chinese freight markets even though privatization and ownership reforms have been in place since 2002 [186, 86].

Airline privatization usually follows deregulation reforms which result in increased volatility of the industry. In particular, the competition associated with the restructured industry often leads to the disappearance of airlines through mergers and bankruptcies [49, p. 113]. For example, once prominent international carriers Belgium's Sabena, Bulgaria's Balkan Airlines and Switzerland's Swissair all declared bankruptcy shortly

[2]The Open Skies agreement of 2007 between the U.S. and EU liberalized the trans-Atlantic market by allowing airlines based in the United States and Europe to fly across the Atlantic between any two airports in each region [172].

after privatization. Privatization does not guarantee improvements in efficiency or profitability. In fact, the uncertainties surrounding the privatization process have resulted in a small counter trend of renewal, usually as a temporary measure, of government ownership as a national interest response to the potential demise of a privatized airline.

Many developing nations view air transportation as a strategic issue and sovereignty responsibility. As a consequence, some governments effectively underwrite their national airlines. Air Jamaica, Air Moldova, Air New Zealand, BWIA West Indies Airways, Malaysia Airlines, LOT Polish Airlines, Pakistan International Airlines and South African Airways are examples of airlines in which the governments raised their shareholdings after initial privatization [116]. For example, South African Airways was initially privatized in 1999 when Swissair purchased 20% of the airline's shares. However, the shares were bought back by the government when Swissair declared bankruptcy in 2001. As of 2008, the majority ownership in South African Airways was held by the government [182]. Similarly, Air Jamaica was privatized in 1994, but it was re-nationalized in 2004 following financial difficulties which were in part attributed to reduced tourism demand from the U.S. following the 9/11 attacks and high fuel prices [131, 143]. The government underwrites the carrier to maintain Jamaica's linkage to the global economy since without the national airline Jamaica's air access would be solely dependent on foreign carriers.

Despite the trend toward privatization over the last two decades, many of the high-growth airlines in the world are still government-owned. Some of these airlines were reviewed in this work: Vietnam Airlines, Qatar Airways, Dubai's Emirates Airline and Turkish Airlines. It emerged during the course of the analysis that the growth of these airlines was directly supported by their respective governments primarily through capital investment and supporting regulatory changes. Vietnam Airlines was transformed from a relatively small airline operating primarily Soviet-made aircraft to a modern international airline following a shift in the government's strategy in 1993. The government's strategy included fleet modernization and growth of international networks to support Vietnam's tourism development. In order to support the development of the national carrier Qatar Airways, the government withdrew its shares from Bahrain-based Gulf Air and invested capital into airport and national airline development. The growth of Dubai's Emirates Airline was supported by the government through provision of capital, infrastructure development, liberalized Open Skies framework which helped Emirates become a hub carrier, and timely changes in bilateral agreements. Similarly, Turkey's government helped Turkish Airlines grow as a hub carrier by pursuing more liberal bilateral agreements with other countries and by investing into airport infrastructure.

Alternatively, as was described above, there are examples of national airlines struggling to survive: Sabena, Bulgarian Airlines, Air Jamaica, South African Airways. As the analysis of these airlines showed, change in airline's ownership does not guarantee profitability while poor management decisions guarantee the loss of revenue. As was discussed above, the governments pursue different strategies for privatized national carriers which become insolvent: Sabena and Bulgarian Airlines were subsequently dissolved and new smaller airlines were formed by their respective governments, while Air Jamaica and South African Airways were bought back by the government to ensure their continued operation. The following state-owned carriers studied in this work also had difficulty sustaining profitability and lacked the capital resources necessary to improve the airline fleet safety and capability: Air Maldives, Air Zimbabwe and Lao Airlines.

Safety and Environmental Restrictions

Airlines flying to international destinations need to conform with the necessary technical elements and requirements prescribed by the applicable international (e.g., International Civil Aviation Organization which is a specialized agency of the United Nations) or local (e.g., the U.S. Federal Aviation Administration) safety standards. Those airlines with inadequate air safety records can be banned from operation by other countries. For example, according to the Air Transport Portal of the European Commission, carriers from North Korea, Sudan, Afghanistan, Rwanda, Angola, Ukraine, Democratic Republic of Congo, Equatorial Guinea, Indonesia, Kyrgyz Republic, Republic of Gabon, Sierra Leone, Swaziland were banned from operations within the EU community as of April 2008 [3]. The majority of these countries are developing economies which may not have the resources to upgrade their aircraft and aviation infrastructure to satisfy the international standards. In fact, according to the analysis performed by Button et al., economic factors play a key role in influencing the countries' compliance with ICAO safety oversight obligations [31].

In addition to the direct regulatory mechanism of banning the airlines with inadequate safety records from operations in a particular country, the international travel demand for those airlines may be directly suppressed by recent accidents and government-issued travel advisories because they may negatively impact the perceived airline safety. For example, both Lao Airlines and Vietnam Airlines were notorious because of their poor safety record. In the early 1990s, both airlines were involved in several aviation accidents while operating their Russian and Chinese-built aircraft. As a result of these accidents, international tourists were advised to not use these airlines on routes with non-Western aircraft. In late 1990s, to improve the airlines' image and promote international tourism flows into their economies, both Lao and Vietnam governments modernized the fleet of their state-owned airlines. As of 2007, Vietnam Airlines fleet consisted of exclusively Western-built aircraft and the majority of the airline's profits came from its international airports. Meanwhile, Lao Airlines restricted non-Western aircraft to domestic operations. These fleet modernization programs improved the airlines' image and stimulated international demand. Accidents due to safety oversight have been known to suppress demand in Indonesia and several African countries as well.

Negative publicity may have an impact on a perception of airline safety as well. Zimbabwe's international travel demand, particularly its tourism industry, contracted sharply after 1999 due to the country's declining international image [192]. In particular, the political and economic instability resulted in general security concerns which prompted several Western governments to issue adverse travel advisories on Zimbabwe to their nationals resulting in suppressed travel demand [140]. Between 1998 and 2005 the number of air passengers carried by Zimbabwe's airlines fell from 790,000 passengers to 243,000 passengers [212]. Air Zimbabwe's acting chief executive blamed this decline on negative publicity of economic and political turmoil in the country and unfounded airline safety concerns [155]. In fact, the airline had an excellent safety record and did not have any fatal aviation accidents since 1979 [13]. However, some international travelers were wary of traveling on Air Zimbabwe's aircraft which, according to Flight International, have an average age of 20.3 years.

Because of the structure of some international regulations, some airlines can be restricted from operating in other countries even though the airlines themselves have never been involved in any aviation accidents. For example, the U.S. Federal Aviation Administration safety assessment program examines the quality not of individual foreign carriers but of the civil aviation authorities and, as a result of the assessment, may

[3]The list of banned airlines is available at *http://ec.europa.eu/transport/air-ban/*

restrict or ban the airlines from the United States until the aviation standards are improved at home [139]. For example, Air Jamaica has traditionally operated an extensive network to the United States and was listed under Category 1 by the U.S. FAA international aviation safety assessment program for abiding to proper civil aviation standards. However, in 1996 FAA placed operating restrictions on Air Jamaica by downgrading the country to Category 2 for partial compliance with FAA safety standards. The restrictions were removed in 1998 following the upgrading of Jamaica's Civil Aviation Authority oversight procedures and maintenance management controls [2]. During the two-year period of operating restrictions from the U.S. Air Jamaica could continue to fly to the United States, but it had to keep to its existing fleet and could not open new routes [2]. Because of these restrictions, the carrier's network development and potential profits were suppressed. Meanwhile, Air Jamaica has never been involved in an aviation accident [12, 13].

In addition to the safety restrictions, local environmental and noise restrictions can effectively subject carriers to an operating ban in some airports. For example, in 1999 the EU banned operations by older aircraft equipped with noise-reducing engine mufflers known as "hush-kits". This regulation was considered to be discriminatory by the Americans and a formal complaint was filed in 2000 by the U.S. administration with the International Civil Aviation Organization (ICAO). As a result of the proceedings, the new EU law was adopted in 2002 as a replacement for controversial legislation. The new law, which was compliant with the norms agreed by the ICAO, regulated aircraft noise levels as opposed to the technology. Under the new law, aircraft that were only marginally compliant with the global aircraft noise standards were denied access to large airports and allowed to land only at smaller airports in less-densely populated areas [74].

Environmental restrictions regulating aircraft emissions are currently a contested topic in international negotiations. In 2006, the EU proposed to extend its cap and trade program for CO_2 emissions called Emissions Trading System (ETS) to aviation. As a result of this scheme, all aircraft operators would have to comply with the ETS in order to continue flying to the EU. With exemptions granted for state aircraft, small private aircraft, and VFR aircraft [145]. While the EU believes that they can legally impose their scheme on international carriers, the U.S. and other countries believe that it violates the Chicago convention [145]. As a result of these differences, the scheme may result in a trade dispute with the U.S. and would have to be resolved in international court. The scheme is also opposed by the African countries who fear that their airlines would be marginalized because the additional loss of revenue will not sustainable while airline fleet modernization is not going to be feasible in the nearest future due to the lack of capital funds [204].

Geopolitical and Security Restrictions

Due to the international nature of air transportation, political stability and political and economic sanctions play an important role in the number of passengers visiting a particular nation. In fact, the statistics are usually not collected for countries involved in geopolitical conflicts, such as Afghanistan, Somalia, Rwanda, and Myanmar. Political instability played an integral part in many African countries over the last thirty years. For example, low or negative air transportation growth rates in Algeria, Libya and Zimbabwe reflect in part the unstable political climates in those countries.

In some cases, the negative growth rates were due to the security concerns at the destination which resulted in travel advisories and suppression of international demand discussed in the previous section. In others, the negative growth rates were the result of direct political or economic sanctions which directly affected the air transportation supply. Among the countries studied in this work, air transportation system

development was suppressed by the geopolitical and security sanctions in Algeria, Libya and South Africa. Geopolitical restrictions also played a role in suppressing the development of the Middle Eastern network for the Bulgarian carrier Balkan Airlines.

Air travel demand to Algeria was suppressed in the 1990s both due to the security concerns and to the operating ban of several foreign carriers. Air transportation demand was suppressed by the unstable political climate and the ensuing civil unrest during the Algerian Civil War from 1991 to June 2002. In addition, air transportation supply was constrained by the suspension of flights by foreign carriers and operating restrictions placed on Algeria's national carrier. Specifically, in 1994, all foreign airlines suspended flights to Algeria following the hijacking of an Air France plane on December 24, 1994 by radical Islamic militants [14]. The foreign airline services were suspended until 1999 when several countries, including Turkey, Saudi Arabia, Italy and Germany, resumed operations to Algeria [14]. France resumed its services only in 2002 [14]. In addition to flight suspensions, French aviation authorities banned Algeria's national carrier Air Algerie from operations at Paris Charles de Gaulle Airport between 1995 and 1997 because of the unstable political situation in Algeria and the resulting security concerns [83].

Libya's air transportation system development was framed by economic and political sanctions. First, Libyan Arab Airlines — the nation's flag carrier — could not modernize its fleet because of the US embargo on the export of high-technology equipment placed in the early 1980s [201]. The embargo prevented the airline from buying new aircraft, obtaining spares and other high-tech equipment [71]. Second, all international flights to and from Libya were suspended between 1992 and 1999 as a result of UN sanctions after the bombing of Pan Am flight 103 over Lockerbie, Scotland and UTA Flight 772 which exploded over the Sahara desert in 1989 [64, 192]. The UN sanctions were removed in September 2003 [41].

South Africa was isolated from the global economy during the decades of the apartheid era which ended in the early 1990s. Until then, geopolitical restrictions associated with the apartheid played a substantial role in international operations of airlines in South Africa [160]. These restrictions included revocation of landing and overflying rights of South African Airways, the nation's state-owned national airline, by other African governments in the 1960s. These restrictions were followed by the non-African governments in the 1980s and included suspension of flights between South Africa and other countries including the United States and Australia.

The operations of Bulgaria's Balkan Airlines were limited by the geopolitical restrictions placed on the carrier by several Middle Eastern countries, including Lebanon and Syria, which banned the airline from flying and landing in their airspace because the airline was owned by an Israeli investor [184].

Geopolitical conflicts, including wars, may also directly impact the airline's operating capacity. For example, the Iraqi invasion of Kuwait affected the fleet capacity of the state-owned carrier Kuwait Airways. In particular, the airline's premises and 15 of its aircraft were destroyed during the invasion.

Geopolitical favoritism may also play a role in the country's air transportation development. For example, both Bulgaria's economy and the air transportation sector contracted dramatically after 1989 following the loss of the Soviet support and trading partners. During this time, both domestic and international air travel demand declined because of domestic decline in the standard of living and political instability which deterred international tourists and investors. The country's GDP started growing only after a series of economic reforms were initiated in 1997 which helped align Bulgaria's economy and air transportation networks with Western Europe [192].

5.1.2 Infrastructure Capability

The traffic growth is possible only if there is sufficient infrastructure present. Two major components of air transportation infrastructure are airports and air navigation infrastructure.

Airports and air navigation infrastructure are at different stages of development around the world. Several strategies have been adopted to increase airport capacity: capacity expansion of existing airports; development of multi-airport systems through promotion of underutilized secondary airports near the urban centers; development of new greenfield airports; and improving the efficiency of operations. If these means of capacity expansion are not available, the congestion at major airports can be reduced through demand management strategies, such as congestion pricing and slot allocations. As in any system with several stakeholders, there exists no optimal demand management, or capacity allocation, strategy, so regulatory frameworks vary around the world [136].

The analysis in this work showed that airport capacity and expansion helped stimulate air passenger growth in China, Turkey, United Arab Emirates, Qatar and Libya while availability and incentivization of secondary airports stimulated the traffic growth in China, Ireland, Slovakia and United States. In comparison, lack of adequate airport infrastructure capacity negatively affected air transportation development in several major cities in India and United States and lack of adequate air traffic management infrastructure suppressed aviation development in China and Laos. The analysis also showed that the shortage of air traffic controllers temporarily suppressed air traffic growth in the United States in the early 1980s while further system growth in China and India can be hindered by the lack of qualified aviation personnel.

Airport Capacity Expansion

Many of the world's major airports are currently operating at nearly full capacity due to the long history of traffic growth while limited land availability and environmental constraints hinder further expansion. Figure 5-2 is a simple system dynamics model of an airport evolution [4]. Several loops dominate the dynamics of airport capacity expansion. First, there is a balancing *Capacity Adjustment* dynamic which adjusts the investment to obtain the desired level of congestion at an airport. Second, there is a reinforcing *Airport Growth* dynamic. Airport's attractiveness to passengers is increased with an increase in the number of frequencies and destinations. As the demand increases, airlines adjust their capacity thereby increasing the number of destinations at the airport. This results in the reinforcing growth dynamic for airport traffic until a balancing *Limits to Growth* restricts further airport expansion due to the presence of limiting physical constraints. When simulated, the system in Figure 5-2 exhibits the *S-shaped growth* typical of many constrained systems. In the *S-shaped growth*, the growth is exponential at first, but then gradually slows because the system becomes constrained by the available resources. Examples of *S-shaped growth* behavior include adoption of new technologies and population growth models in ecology where resources are constrained by the fixed carrying capacity [180].

Airports traditionally have been built near major metropolitan areas and, as the urban areas grew, they often enclosed airport infrastructure within their boundaries limiting their further growth. Many of the most important airports are currently operating at nearly full capacity as a result of a long history of traffic growth, limited land availability and environmental constraints. In particular, there is evidence that some

[4]Detailed models are available in the literature which investigate in detail the factors influencing the interaction between airlines, passenger and cargo demand and airport capacity [24]

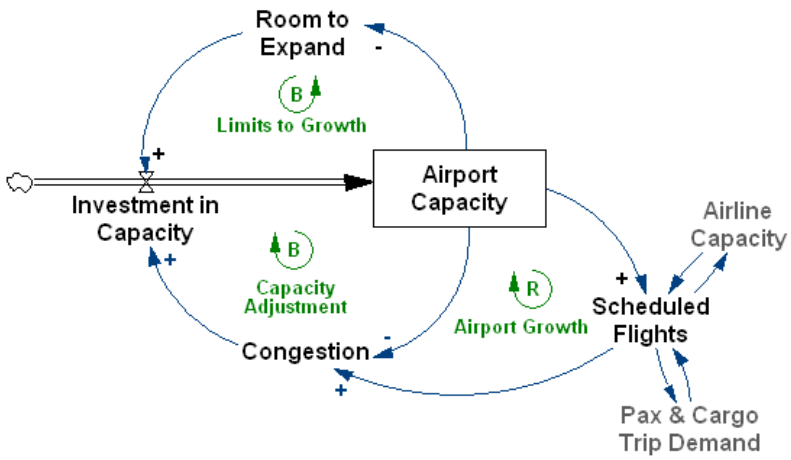


Figure 5-2: Simplified system dynamics model of airport evolution.

major airports are reaching the saturating phase of the *S-shaped growth* and are suppressing further air transportation development. For example, because of the capacity constraints at both the New York's JFK and London's Heathrow airports, the airlines cannot currently take full advantage of the new opportunities provided by the 2007 EU-US Open Skies agreement. In particular, even though the agreement liberalized the trans-Atlantic market by allowing airlines based in the United States and Europe to fly across the Atlantic between any two airports in each region, the only way to gain access to Heathrow is to buy landing and take-off slots or acquire an airline which already operates there [172]. These capacity constraints and the resulting delays also have an adverse affect on air transportation demand because they decrease the quality of service. For example, in 2007 almost 40% of gate arrivals were delayed in New York's major capacity-constrained airports: La Guardia (LGA), Newark (EWR) and Kennedy (JFK) [5]. Similarly, according to the survey done by the Association of European Airlines, nearly half of London Heathrow's flights, which currently operates at 98.5% capacity, for the first three months of 2008 were at least 15 minutes late [11]. While the airports authorities are aware of the problems caused by the capacity constraints, they are unable to pursue further infrastructure investment. In the case of Heathrow, the airport capacity is constrained by its two runways, so the only way to expand the airport is to develop a new runway in a densely-populated area. This proposal, however, is usually met with critical public opposition [11].

While airport capacity expansion and construction helped stimulate air passenger growth in some of the countries studied in this work, airport capacity expansion alone does not guarantee an increase in air travel and freight usage. In general, inaccurate demand projections due to the volatility in overall traffic and changing airline strategies are fundamental risks associated with investment into airport infrastructure. For example, airline bankruptcy may significantly impact airport operations and result in superfluous airport capacity. For instance, bankruptcy of Swissair and TWA in 2001 substantially decreased traffic levels at the airlines' former hubs at Zurich and Lambert-St.Louis airports, respectively. Once TWA stopped flying, the passengers flying from the East Coast of the United States to the West Cost went on other airlines bypassing the TWA's hub at Lambert-St.Louis International [49, p. 114]. In the 1980s, however, the airport

[5]Data source: Federal Aviation Administration Airline Service Quality Performance (ASQP) database.

was growing beyond the projected annual rate 5 to 8 percent [6]. For example, in 1986 the airport served 20 million passengers. As a result of the rising demand levels and robust growth, the St. Louis Airport Authority initiated several expansion projects which included construction of a new runway. However, because airport infrastructure projects typically take several years, the new runway was completed only in 2006. By then, the traffic dropped to only 15 million passengers resulting in superfluous airport capacity.

Secondary Airports Availability and Incentivization

Even though the capacity of some individual airports cannot be expanded through construction, the analysis of worldwide airport systems by Bonnefoy showed that in Europe and United States the airport capacity at the system level has been increasing through the usage of under-utilized secondary airports located in the major airports' catchment areas [24]. This mechanism of expanding capacity through promotion and usage of secondary airports resulted in emergence of multi-airport systems in large urban communities in Europe and United States. The growth of multi-airport systems has been made possible by the availability of under-utilized aviation infrastructure which was built many decades ago around major cities. In comparison, in other regions around the world new airport construction has been the major method of expanding the overall system capacity because aviation development in those countries is a relatively recent phenomenon [24].

Since many governments typically perceive air transportation development as beneficial to the overall economic growth of the region, they sometimes provide financial incentives to the airlines in order to promote air services at the under-utilized airports. These incentives are typically provided to the airlines through temporary discounts of landing fees and airport-related charges [24, p. 179]. For example, Brussels' Charleroi airport offered Ireland's low-cost carrier Ryanair financial incentives for the use of the airport which resulted in an ongoing legal debate in Europe. Specifically, following a complaint from the main airport in Brussels, the European Commission found the incentives offered by a publicly-funded airport to be illegal under the EU law. The reason is that these incentives can be perceived to be state aid which is illegal if it distorts competition by favoring particular carriers [16]. However, Ryanair contested the 2004 ruling and, as of 2008, the legal battle between Ryanair and the European Commission had not yet been resolved.

In addition to the occasional direct financial incentives, secondary airports have several other advantages over the major airports. These include lower-cost facilities and less congestion which allows rapid turn-around times and hence more efficient aircraft operations [48]. Because secondary airports are chapter, less congested and are sometimes subsidized by the local government to promote development, there is an association between low-cost carriers and a network of secondary airports both in Europe and the United States [16]. In the United States the relationship between secondary airports and low-cost carriers dates back to the beginning of Southwest when it began operations between Dallas Love Field and Houston Hobby airports in the mid-1970s [48]. In Europe, the relationship dates back to the 1990s with the development of international low-cost airlines such as Ireland-based Ryanair and UK-based easyJet which operate both at major and secondary airports throughout Europe. For example, Frankfurt-Hahn airport, a former U.S. military base, started civil operations in 1993 with only 7,000 passengers traveling through the airport. By 2007 the airport had 10,000 passenger per day mostly due to the operations of low-cost carriers Ryanair, Wizz Air and Iceland Express. More recently, Slovakia's low-cost carrier SkyEurope has been expanding its network by utilizing secondary airports as well.

[6] The primary data source is Lambert-St.Louis International Airport website: *www.flystl.com*

While the growth of traffic at the secondary under-utilized airports has been observed mostly in Europe and United States, in recent years China has began promoting regional aviation development as well. In particular, China has been offering subsidies to small and medium airports and to the airlines running short flight routes in order to balance its airline sector away from big trunk routes and eastern hubs [157].

New Airport Construction

Development of new greenfield airports is one of the mechanisms of expanding the airport capacity in order to meet the rising demand levels. The majority of the new aviation construction over the last two decades has been taking place in East Asia and the Middle East. The countries which opened new airports include Hong Kong, Macau, Singapore, Japan, Korea, China, Thailand, Malaysia, Dubai, Qatar [50]. Several new airports, including those in Munich, Oslo and Athens, were recently completed in Europe while the latest airport to be opened in the United States was Denver International Airport which commenced operations in 1995 [50]. Among the countries studied in this work, construction of new airports and expansion of existing infrastructure helped stimulate air passenger growth in China, Turkey, United Arab Emirates, Qatar and Libya. In particular, aviation expansion projects in Turkey, United Arab Emirates and Qatar allowed the national carriers to expand their international operations from the growing hubs.

The design of greenfield airports usually allows sufficient room for future physical capacity expansion to avoid getting stuck in the balancing *Limits to Growth* loop in Figure 5-2. For example, the greenfield Dallas/Fort Worth International Airport was built in 1974. Future capacity expansion was later accommodated with an extension of the existing runway in 1993, construction of a new runway in 1996 and new terminal and cargo facilities [50]. Similarly, Denver International Airport was built in 1995 to accommodate future expansion plans. The original airport design included an easily expandable midfield terminal and sufficient room to add two new concourses and a sixth runway which was put into service in 2003 [50]. Several new airports in East Asia, including Singapore Changi Airport and Hong Kong International Airport, are both expandable by land reclamation.

While many of the new airports are constructed when the original airports are operating at nearly-full capacity, several major airport construction projects have anticipated the growing demand levels [5]. In particular, several new airports in East Asia and the Middle East, including Singapore International Airport, Kuala Lumpur International Airport, Dubai International Airport, Dubai World Central International Airport, and Doha International Airport in Qatar, were specifically designed to promote air transportation development in their economies. For example, according to the Civil Aviation Authority of Singapore, the development policy of Singapore's Changi airport included making physical upgrades to its existing facilities and building ahead of demand to avoid congestion problems and to maintain high standards of service. This anticipatory expansion of infrastructure increases airport attractiveness to the airlines especially for hub operations. For example, readily available infrastructure allowed Emirates Airlines and Qatar Airways to expand their respective hub operations in Dubai and Doha international airports.

Analysis of investment projects worldwide by Airports Council International showed that successful airport developments which lead the current demand levels are usually backed by airlines, business partners and regional governments [5]. However, as more and more countries promote air transportation development, competition from mature airports may play a decisive role in their success. For example, Malayasia's efforts to promote Kuala Lumpur as a global business and aviation hub have been compromised by the neighboring

mature hubs in Singapore and Bangkok [153]. In fact, the analysis by O'Connor showed that construction of new airports in Kuala Lumpur, Guangzhou and Macau had little affect on the traffic levels in Singapore, Bangkok and Hong Kong airports because the latter were mature hubs with developed international networks and continued timely infrastructural improvements to relieve congestion and gain competitive advantage [153]. Similarly, in recent years, major airport capacity investment projects have taken place in the Gulf region increasing the competition between the airports and the airlines. For example, the governments of Dubai, Abu Dhabi, Qatar all view aviation development as an integral part of their economic diversification strategies. In particular, the governments provide funding for both airport and airline development and for the development of the supporting physical infrastructure to promote the regions' business and tourism sectors. As a result of these investments, by 2010 these three economies will have a total airport capacity of 119 million passengers which will be further expanded by the additional 120 million passengers when the Dubai World Central International Airport is completed in 2017. Geographically, all of these airports are no further than 350 kilometers from each other.

Inaccurate demand projections made during the design phase may result in the construction of an airport in which the final returns do not exceed the construction and operating costs. Volatility in air travel and freight need is a fundamental risk associated with investment in aviation facilities. According to de Neufville and Odoni, the projections are more difficult to do in a deregulated environment because airlines can easily change or cancel operations resulting in large demand fluctuations [49, p. 112]. The fluctuations of traffic for hub airports are particularly great because airlines may decide to shift a base of operations [49, p. 124]. For example, in the 1980s Denver's Stapleton International Airport was the world's fifth busiest and served as a hub for three airlines — United, Continental and Frontier. By 1986 the airport served over 34 million passengers and FAA projected Denver would have 56 million passenger annually by 1995 [50, p. 101]. However, by the time the new Denver International Airport opened in 1995, United Airlines was the only hub airline and the airport served only 32 million passengers resulting in superfluous airport capacity [50, p. 102].

In addition to increasing the handling capacity of air traffic, many of the new airports also allow for larger aircraft, continuous operations, extended hours, and reduced noise restrictions [50]. In particular, different airports may cater toward different types of airlines: network carriers traditionally use major airports, low-cost carriers often operate at secondary airports because of lower costs and greater efficiency, cargo operators prefer airports with good supporting logistics infrastructure, limited noise and night-time flight restrictions. For example, over the last decade the Dubai International Airport emerged as one of the fastest growing logistics hubs. The airport grew as a transshipment hub because cargo carriers were attracted by the following attributes: absence of noise control restrictions, round-the-clock operation, supporting infrastructure investment into the Dubai Airport Free Trade Zone which included investments into the Cargo Mega Terminal and the Flower Center for perishable transit cargo and liberalized aviation framework [137]. As with the passenger traffic, bilateral air service agreements play an important role in emergence of certain airports as cargo hubs. For example, prior to the liberalization of air cargo services at the turn of the century, Chinese exports from the mainland were consolidated in the new Hong Kong International Airport for transport overseas [186]. Following changes in the regulatory framework, three other major centers have emerged in Beijing, Guangzhou and Shanghai while the air cargo growth rate decreased for the Hong Kong airport [207].

Air Traffic Management

An Air Traffic Management (ATM) system is an essential component of the air transportation system. An ATM system is comprised of six components: (1) the procedures and regulations, (2) the human air traffic controllers, (3) the automation systems (e.g., computers) that provide information to controllers and assist them in processing safely the flow of traffic, (4) the communications systems that enable data exchange and sharing, (5) the surveillance systems (e.g., radar) that provide real-time positional information to air traffic controllers, and (6) the navigation systems that provide information to individual aircraft [49, p. 501]. ATM systems around the world differ with respect to technology and level of sophistication. In particular, because of the variability in the ATM systems, airport throughput capacity, safety and ability to operate during inclement weather varies around the world.

The ability to continue operate safely during inclement weather is essential to major airports. The Instrument Landing System (ILS) is the most widely used navigation aid for conducting precision approaches to an airport under low-visibility conditions [49, p. 517]. The ILS can be of three categories: the standard is a Category I system, followed by Category II and Category III systems which can be used in zero-visibility conditions. In order to be approved for ILS approaches, airport runways need to satisfy various requirements with regard to obstacle clearances and parallel taxiways, minimum paved runway length, runway markings, holding position signs and markings, runway threshold location, runway edge lights, and approach lightning systems [49, p. 519]. The requirements are the most stringent for Category III ILS which can only be deployed at sites satisfying certain landscaping requirements and are very expensive. Therefore, despite the fact that better ILS capability increases system throughput capacity, the investment is often not feasible due to technical or financial considerations.

Lack of sufficient navigation capability affects the system throughput capacity in inclement weather conditions. For example, under low-ceiling and low-visibility conditions Boston/Logan airport may operate with only one arrival runway to accommodate all aircraft. In such conditions, in order to avoid ILS interference, the procedures require that the separations between aircraft landing consecutively on the same runway are typically increased to several minutes [49, p. 390]. These spacing requirements, in addition to only one operational runway, result in dramatic reduction of arrival capacity of the airport during Category II and Category III weather conditions and increase flight delays. However, the system capability cannot be improved because of the current technology levels and physical constraints at the airport.

Inadequate aviation infrastructure is detrimental to the overall air transportation system safety and its perception by the flying public. As a result, it may affect the air travel demand, particularly for leisure passengers from developed countries. In particular, adverse travel advisories are typically issued based on the country's total level of safety of the air transportation system which includes the safety assessment of both airlines and aviation infrastructure. For example, adverse travel advisory for Laos was issued in part because of the inadequate capability of the ATM infrastructure which severely impacted the safety of operations during inclement weather because of the country's difficult terrain. In addition, lack of modern aviation infrastructure, such as the ILS capability in airports, reduces airport attractiveness to passengers who prefer reliable services because of their personal time constraints. Among the countries studied in this work, inadequate ATM capability resulted in unreliable services and negatively affected the traffic levels in Laos, Bulgaria and Zimbabwe.

In addition to physical infrastructure capability, air transportation system development may be hindered

by the lack of a sufficient supply of human air traffic controllers and other qualified personnel. For example, the U.S. aviation industry's decline in the early 1980s was exacerbated by the air traffic controllers strike in 1981 which cut the system's operating capacity to 80% for at least a year [150, p. 155]. Similarly, shortage of qualified personnel, particularly pilots and engineers, may hinder future development of Indian and Chinese aviation industry [181, 86].

In addition to the physical capability of the ATM system, operational restrictions may decrease the overall capacity of the country's aviation infrastructure. For example, China maintains strict control of the airspace with only about 30% of the country's airspace available for civil aviation as of 2006. According to the International Air Transport Association, this policy results in restrictive flight planning for domestic and international air routes over China which ultimately results in delays and increased cost to the airlines due to the waste of time and fuel.

5.1.3 Vehicle Capability

In addition to changes in the regulatory framework and infrastructure capability, vehicle capability is one of the change factors influencing air transportation supply. Aircraft range used to be a limiting factor for development of certain routes and previous studies showed that the worldwide air network structure changed significantly in the 1970s as aircraft technology enabled long-distance flights [153]. For example, the air network structure in Southeast Asia changed significantly in the 1970s with improvements in vehicle capability as Bangkok, Singapore, and Hong Kong emerged as major regional airports, while other airports, including Jakarta, Calcutta, and Kuala Lumpur, fell back to traffic levels needed to meet the local demand [153]. Among the countries studied in this work, the 1978 acquisition of wide-body aircraft by Kuwait Airways enabled the airline to pursue a growth strategy by expanding its network to include the United States and Southeast Asian countries resulting in an increase of the air passenger growth rate in the late 1970s despite the country's declining GDP levels during that time period.

Nowadays, there are many aircraft available to satisfy the desired performance levels provided that the airline has the necessary capital. For the poor developing countries, however, vehicle capability is often a limiting factor since they may not have the resources to modernize their fleet to accommodate the demand and/or to satisfy the international safety and environmental standards. Among the countries studied in this work, air transportation development has been suppressed due to the lack of capital which prevented an increase in the airlines' fleet capacity in India, Laos, Zimbabwe, Bulgaria and Maldives. For example, in 2003 the government of Laos invested into leasing their first jet aircraft, Airbus 320, to service the international routes. However, due to the lack of funds for maintenance, the lease had to be terminated two years later reducing the airline's vehicle capability and the perceived airline safety [4].

Among the countries studied in this work, perceived airline safety negatively affected the air travel demand in Vietnam, Laos, Zimbabwe and Indonesia. For example, the acting chief executive for Air Zimbabwe blamed some of the decline in airline's passenger demand on negative publicity and a perception of airline safety concerns [155]. He believed that these concerns were unwarranted because the airline had an excellent safety record and had no fatal aviation accidents since 1979 [13]. However, some international travelers were wary of traveling on Air Zimbabwe's aircraft which, according to Flight International, had an average age of 20.3 years. Similarly, perceived airline safety concerns previously deterred international tourists from flying on Lao Airlines, the national carrier of Laos. These safety concerns arose after the airline was involved

in several aviation accidents in the 1990s while operating its Russian and Chinese-built aircraft. Because of these accidents, several governments issued adverse travel advisories to warn travelers of flying on Lao Airlines. In an attempt to improve the airline's image and promote tourism development, in recent years the Lao government decided to modernize the airline's fleet. In particular, several French-built ATR-72 vehicles were acquired starting in the late 1990s and a first jet aircraft was leased in 2003. Fleet modernization programs of Vietnam Airlines, Kuwait Airways and Libyan Arab Airlines also helped stimulate air travel demand.

Airlines' fleet capacity can also be reduced by external factors. For example, the growth of Kuwait Airways was suppressed following the 1990 Iraqi invasion and occupation because the invasion lead to the destruction of fifteen of its aircraft. Fleet capacity of Libyan Arab Airlines was also suppressed by external factors. Specifically, the airline could not modernize its fleet for more than 25 years because of the U.S. embargo on the export of high-technology equipment to Libya which was followed by additional economic embargoes from the UN in 1992 [201]. As a consequence of these sanctions, during those years the airline managed to sustain only domestic services with just four airworthy aircraft [71].

5.1.4 Airline Strategy

Air transportation supply is set by the airlines whose decision to operate a particular route and pricing and scheduling of flights are influenced by the individual airline's assessment of passenger and freight demand for the origin-destination market, its assessment of the route's profitability as part of the overall network, the capability of airport and navigation infrastructure, and the available airline resources. Airlines compete for passengers based on frequency of service, price and quality of service. There are three major airline business models for passenger operations: full service network model of traditional carriers, point-to-point model of low-cost carriers and integrated holiday package services of non-scheduled charter airlines. The airline strategy also varies between those airlines which are owned privately or are owned by the state.

Airlines operate in a competitive environment and their survival often depends on the success and adaptability of their business models and management strategies. If an airline becomes unprofitable it may become insolvent because it will have difficulty in raising capital to cover its operating expenses. In such a case, further air traffic development will be suppressed because of the cessation of services. Managerial ineptitude, poor airline strategy and general business factors were found to be responsible for the bankruptcy of several airlines studied in this work: Belgium's Sabena, Switzerland's Swissair, Bulgaria's Balkan Airlines, Maldives' Air Maldives and several carriers in the United States. In addition to airline business factors, the profitability of these airlines was affected by changes in demand for air transportation services. The change factors affecting air travel demand will be explored further in Section 5.2.

Among the countries studied in this work, adoption of new airline business models resulted in the growth of domestic and international air services. For example, low-cost carrier development helped stimulated domestic air passenger growth in India, South Africa, Turkey, USA and Indonesia while international airline expansion strategies helped stimulate air traffic growth in Turkey, UAE, Qatar, Ireland, Slovakia, Kuwait, Belgium and Switzerland. The analysis showed that the airline expansion strategies were supported directly or indirectly by their respective governments in Turkey, UAE and Qatar. In addition, government support played a major role in the operations of several national carriers studied in this work: South African Airways, Vietnam Airlines, Lao Airlines, Air Jamaica, and Libyan Arab Airlines.

Low-Cost Carriers Demand Stimulation

The creation of low-cost carriers often follows changes in the aviation regulatory framework and results in demand stimulation effect and significant changes in the traffic growth rates. Lower fares compared to the traditional network carriers is the primary mechanism behind the demand stimulation effect of low-cost carriers. Low-cost carriers often operate from secondary or underutilized airports and cater toward different demand market segments compared to the traditional hub-and-spoke carriers. In fact, a study done by ICAO in 2003 revealed that around 50% of the traffic carried by low cost airlines is newly generated and does not adversely affect the demand for hub-and-spoke networks of traditional carriers [112].

The analysis in this work showed that introduction of domestic and/or international low-cost carrier services resulted in dramatic changes in the air passenger growth rates both in developed and developing economies. In many developing countries, air transportation needs were historically served by the national flag carriers. Many of these carriers had insufficient capacity and relatively high fares suppressing air transportation development. For example, in India and Thailand domestic markets were controlled by inefficient flag carriers until low-cost carriers were introduced following domestic deregulation reforms. The first low-cost carrier was established in Thailand at the end of 2004. After the introduction of low-cost operations, the domestic market tripled in size between 2004 and 2008 from four million to more than twelve million passengers with low-cost carriers accounting for 8.5 million passengers [175]. India's domestic air passenger demand was constrained until several low-cost carriers began operations in 2003 and were able to offer more destinations at a lower price than the state-owned carriers. Since then, according to the Centre for Asia Pacific Aviation, India's domestic traffic had 40% year on year growth due to the dramatic increase in the number of services offered by the low-cost airlines.

Similarly, low-cost carrier development helped stimulate domestic passenger growth in Turkey, South Africa and Indonesia. Low-cost carriers typically cater toward a different market segment when compared to the traditional hub-and-spoke carriers. In particular, low-cost carrier in Europe and the United States cater toward the leisure passengers by offering cheaper fares and operating from secondary airports. In comparison, in many developing countries business passengers account for a large share of passengers using low-cost carrier services. For example, development of low-cost carrier operations in South Africa enabled inter-regional business travel and trade which was traditionally hindered by the inadequate capacity of the state-owned carriers and poor ground transportation links in the region [88].

The effect of low-cost carriers in developed economies was explored in the case studies of Ireland and Slovakia. In fact, some of the passenger traffic growth in Europe in the 1990s which was observed in Chapter 4 can be attributed to the demand stimulation effect of the low-cost carriers following liberalization reforms which culminated in the creation of Single European Aviation Market in the early 1990s [7]. This multilateral aviation framework allowed low-cost carriers to tap into international demand markets and not be constrained by the local passenger demand. The European low-cost carrier evolution can be observed in the case study of Slovakia. In particular, after establishment of Slovak Republic in 1993, the country's air travel demand could only support one airline with scheduled services: Slovak Airlines. The airline flew scheduled services to two destinations from Bratislava: Brussels and Moscow; and provided charter services, along with several other operators, to destinations in Europe, Middle East and North Africa. Slovakia's low-cost carrier SkyEurope

[7]Some of the passenger growth in Europe in the 1990s was also due to the changes in accounting practices as was described in detail in Chapter 3

started operations in February 2002 with a single 30-seat Embraer 20ER aircraft operating a domestic route between Bratislava and Kostice. Since then, the airline has been pursuing an aggressive international expansion strategy and as of 2008 operated a fleet of fifteen brand new 149-seat Boeing 737s and flew to more than 30 destinations across Europe. Over the years, the airline established bases in Austria, the Czech Republic, Hungary, Slovakia and Poland and became an intra-European carrier [159]. The carrier's growth would not have been possible if it had to rely only on Slovakia's domestic air travel demand.

In addition to the low-cost carriers, several traditional network carriers, including Belgium's Sabena and Switzerland's Swissair, pursued aggressive expansion strategies following the European multilateral liberalization and privatization reforms of the 1990s. However, the carriers' growth was unsustainable and they ceased operations in 2001 and 2002, respectively.

Since low-cost carriers often need flexibility provided by the fairly liberalized operating environment to achieve profits, the low-cost carrier demand stimulation effect is most often observed in the countries which underwent domestic deregulation or international liberalization. For example, the growth of low-cost carriers in India, South Africa, Turkey and Indonesia followed the domestic deregulation reforms while the growth of Ireland's and Slovakia's low-cost carriers was enabled by the liberalized international framework. However, there are also examples of low-cost carriers which were able to operate successfully in restricted regulatory environments. For example, Southwest Airlines in the United States was founded in 1971 while domestic deregulation occurred in 1978. Similarly, several low-cost carriers from other Asian countries currently serve some of China's international routes despite the fact that the operations are regulated by traditional bilateral air service agreements [188].

There are also examples of countries where stringent regulation of the operating environment was inhibiting the development of low-cost operators. In China, for example, extensive government regulation has been a major obstacle to the growth of low-cost carriers. In particular, even though the industry has undergone some deregulation, the government still has control over the prices for jet fuel, which are 20-30% above international rates, landing charges, aircraft purchases, and places restrictions on routes and fares [134, 188]. As a result of these controls several private carriers which attempted to use the low-cost strategy failed to operate profitably and had to adopt a more traditional business model. As another example, low-cost carriers have been avoiding certain city-pairs between the U.S. and Jamaica while establishing routes between the U.S. and other Caribbean destinations because of entry and fare restrictions in Jamaica's bilateral agreements [206].

High-growth of low-cost carriers is not an indicator of profitability: revenue growth does not necessarily result in yield growth. Many startup low-cost carriers are not profitable even though they may have double-digit year-on-year growth rates. For example, SkyEurope, which is based in Slovakia, has been unprofitable since it began operations early in 2002 [175]. Similarly, India's largest low-cost carrier Deccan, which built up a 15% share of the domestic market between 2003 and 2008, incurred nearly $300 million in losses in 2006 and 2007. As a result of these losses, as of 2008, the airline was finding it difficult to raise additional capital despite the airline's restructuring and robust growth of the demand from the Indian middle class [175].

Low-cost carriers operate at unit costs up to 50% lower than the traditional network carriers [57]. Because of their lower unit costs, some of the direct operating costs whose price cannot be negotiated, such as fuel, en-route charges and insurance, represent a larger share of their expenses. Therefore, low-cost carriers are more sensitive to increases in the price of fuel than the traditional network carriers. In particular, since low-cost carriers rely on demand stimulation effect of lower fares, they may find it difficult to pass on fare

increases to consumers without significantly impacting the demand if their operational costs increase. For example, even though the price of fuel almost doubled between 2004 and 2008, many low-cost carriers found it difficult to pass on these fare increases to consumers [175].

Despite the fact that many low-cost carriers have been struggling with profitability in recent years, their impact was beneficial to consumers both in developing and mature markets. In particular, low-cost carriers were able to start providing services in the developing countries where the aviation needs were previously served exclusively by inefficient flag carriers and a few small regional players. Tis development resulted in the demand stimulated effect observed in several of the countries studied in this work. Other studies also showed that the presence of low-cost carriers in mature markets, such as the United States, has a positive consumer benefit. For example, a study of U.S. carriers by Hofer et al. showed that low-cost carriers do not charge price premiums which are charged by the traditional network carriers at airports where they have a dominant market share [102]. Therefore, given that the share of U.S. domestic passengers flying with a low-cost carrier increased from 21% in 1992 to 37% in 2002, the share of passengers using network carriers and subject to price premiums decreased over that time period [102].

Airline Hubs

Network development using a hub-and-spoke as opposed to a linear route system has followed airline deregulation in the United States. Hubbing allows airlines to offer a geometrically increasing array of city-pair products with every additional spoke [50, p. 445]. An airport which serves as an airline hub provides consumers with a wider choice of destinations and frequencies but usually at a price premium. In fact, a number of studies found that airlines charge higher fares in concentrated airports, that is airports where there is a dominant carrier because the carrier can create barriers to market entry [102, 50]. Despite the price premium, Button et al. showed that traffic at hub airports has a positive effect on creation of high-tech employment in the surrounding areas [32]. This effect, when controlled for population and other characteristics, is greater than that of non-hub airports [32].

Shifts in traffic due to changes in the airline's operating strategy have a significant impact on capacity utilization at airports. The effect is particularly noticeable if an airline decides to withdraw its operations from a given hub. In such a case, the airport remains with superfluous capacity. For example, in the early 1990s Raleigh-Durham (North Carolina) airport served as a hub for American Airlines until the airline decided to reorganize its traffic patterns and withdrew many of its services from the airport. Similarly, airport capacity was under-utilized at Baltimore/Washington airport when US Airways shifted much of its international traffic to its hub in Philadelphia in the mid-1990s [49, p. 113]. Other examples detailed in Section 5.1.2 include Lambert-St.Louis and Denver International airports.

International bilateral air service agreements may play a significant role in attracting traffic beyond the local demand for hub airports. This development was identified by O'Connor while analyzing the network evolution in Southeast Asia [153]. Among the countries studied in this work, Turkey, Qatar and the United Arab Emirates are examples of countries where high air passenger growth rates were in part a reflection of the change in strategy of their airlines. For example, as of 2007, both Turkish Airlines and Emirates Airline operated extensive international networks through their respective hubs in Istanbul and Dubai airports. This airline strategy was supported by airport infrastructure investments and an aggressive policy to liberalize the bilateral air services agreements. For example, the Dubai's Emirates Airline was launched under the

liberalized open-skies framework in 1985. That year the United Arab Emirates passenger share of the total Middle East traffic was 2%, or 700,000 passengers, while in 2005, following the dramatic expansion of the Emirates Airlines, the UAE share rose to 16 million passengers, or 19% of the regional total. Over these years Emirates expanded its international network to become one of the major carriers of traffic between Southeast Asia and Europe through its growing hub in Dubai. According to the International Air Transport Association (IATA) estimates, the traffic between Middle East and Asia and Middle East and Europe accounted for 1.5 and 1.2 percent of all scheduled passengers in 2006 compared to only 0.5 percent shares a decade earlier [109].

National Carriers

The airline strategy also varies among those airlines which are owned privately and those which are owned by the state. As opposed to the private carriers, the state airlines can remain on government funding despite profitability if the government perceives air transportation connectivity as a matter of national pride and a necessary strategy for economic development.

Some of the state carriers cannot compete in the global environment because their governments cannot afford the necessary level of investment and maintenance or lack managerial aptitude. Therefore, in order to protect the national carriers, the governments impose restrictions on operations by foreign carriers through bilateral air services agreements [114]. These restrictions, in addition to state funding, subsidies or preferential treatment from the government, inhibit free market competition. For example, the government of Jamaica supports air services liberalization as long as its national carrier Air Jamaica has a sustainable competitive position in its main markets [114]. Therefore, the bilateral agreements include some restrictions to protect Air Jamaica which potentially inhibit the development of low-cost carrier services between the United States and the island [206]. Similarly, while some of Turkey's bilateral air services agreements are fully liberalized, others favor the national carrier, Turkish Airlines, and therefore inhibit expansion of services on most of the profitable international routes for other carriers [191].

As was described in Section 5.1.1, many governments in recent years have attempted partial or complete privatization of national carriers. Some of these carriers became insolvent and were dissolved, such as Belgium's Sabena, Switzerland's Swissair and Bulgaria's Balkan Bulgarian Airlines. Others, such as South African Airways and Air Jamaica, were bought back by the government to avoid bankruptcy and protect national interests. In comparison, several state carriers, including Vietnam Airlines, Qatar Airways, Emirates Airline, and Turkish Airlines, were able to achieve some of the highest growth rates in the last two decades. In more recent years, Libya's government played a major role in supporting the growth strategy of the national carrier. As was detailed in Section 5.1.1, the growth of these airlines was supported by their respective governments primarily through airline investment, improvement of aviation infrastructure capability and supporting regulatory frameworks which favored the growth of the national carriers.

Protectionism is more difficult to achieve in more liberalized environments like the one in the Europe Union. For example, the Italian government is currently under criticism from the European Commission for providing state subsidies to the state-owned flag carrier Alitalia. In particular, these subsidies distort the competition among the European airlines because they prevent Alitalia from liquidation or acquisition by another major airline [7]. In November 2008 the European Commission found that the recent loans provided by the Italian government to the airline constituted illegal state aid and therefore would have to be paid back to the government following airline's privatization [73].

Airline Alliances

Airline alliances, including mergers and cross-investments, have been part of airline management strategy since the 1980s. Inter-airline alliance agreements can vary from a simple marketing alliance, such as a joint frequent flier program and code-share agreements, to a fully strategic alliance which culminates in a merger of two airlines [57, p. 80]. Airlines view alliances as beneficial because they increase their market power and have a potential to reduce costs. For example, schedule and aircraft co-ordination can lead alliance partners to reduce their fleet requirements while extending each airline's geographical reach with little extra cost [57, p. 91].

Airlines sometime pursue international alliances, or cross-border joint venture opportunities, to circumvent the ownership and operating restrictions placed on foreign carriers in order to gain foreign network access. Among the countries studied in this work, airline alliances played an important role in air transportation development in Indonesia. In particular, airlines have been pursuing alliances to circumvent the restrictions in the international regulatory framework among the ASEAN (Association of Southeast Asian Nations) countries. For example, some foreign carriers established subsidiaries and formed cross-border alliances with Indonesian carriers to circumvent the foreign ownership restrictions and gain access to foreign domestic networks stimulating the country's air transportation development [89].

In addition to the cost savings for the airlines, airline alliances provide direct benefits to consumers through the reduction of fares in some markets, increased frequencies and route offerings. For example, several studies examining the differences in fares paid by the U.S. passengers both on domestic and international routes found that those traveling with alliance partners on a given journey paid fares up to 36% less than those using two no-partner airlines [57, p. 110].

Though alliances have been shown to provide positive consumer benefits through cost reduction and additional route offerings, they can also adversely affect competition. In particular, formation of alliances sometimes results in reduction or elimination of competition on specific routes or relevant markets. This occurs when two carriers previously competing on a route on which there is no third carrier decide that only one of the alliances should operate the route. For example, following the purchase in 1996 of 49.5% of Sabena by Swissair, Sabena was the only airline operating daily flights Geneva-Brussels as Swissair withdrew its services. In other words, routes where there was duopolistic competition before were turned into monopolies ultimately resulting in reduction of frequencies and an adverse effect on consumers [57, p. 96]. Because of this potentially anti-competitive behavior, airline alliances, especially strategic alliances such as mergers, are regulated by the government.

Alliances vary in their geographic reach: some apply only to specific routes, some are regional and others are global [57, p. 82]. The majority of global alliances rely on marketing, such as code-share agreements, rather than mergers. This is because airlines are usually prevented from acquiring a majority of airlines in other countries because of foreign ownership restrictions. However, several cross-border airline mergers and acquisitions have taken place in recent years. Two of the major mergers took place in Europe: the acquisition of KLM by Air France, and the acquisition of Swiss by Lufthansa [143, p. 128]. In order to finalize the acquisitions, the deal had to be approved by the shareholders, the countries' governments, the European Commission and the U.S. anti-trust authorities [143].

5.2 Air Transportation Demand Change Factors

The relationship between air transportation supply and demand determines the allocation of airline resources to a particular route. The air transportation demand change factors fall into two categories. First, are those which directly affect the demand: exogenous demand shocks, economic downturns, political and economic sanctions, competition from other transportation modes and civil unrest. Second, are those which affect the demand indirectly by changing the country's economic attributes through economic and institutional reforms, supporting infrastructure investment, exchange rate fluctuations, political and macroeconomic stability, and growing consumer demand. In addition to these indirect factors, other general factors helped stimulate air passenger development worldwide. They included changes in management practices, and liberalization and globalization of trade in manufacturing and services. These change factors are discussed next.

5.2.1 Factors Directly Affecting the Demand

The analysis identified several change factors which directly influence the air travel and freight need between a given economy and the rest of the world.

Exogenous Demand Shocks

Exogenous demand shocks include acts of terrorism, perceived health risks, natural disasters, aviation accidents, and oil shocks. For example, exogenous demand shocks resulted in suppression of traffic growth rates: in China and Vietnam following the SARS outbreak in 2003; in North America following the terrorist attacks of September 11, 2001; in Indonesia following the terrorist attacks of 2002; in Turkey following the earthquake in 1999; in Southeast Asia following the tsunami of December 26th, 2004; worldwide following oil crises of 1973 and 1979. As was discussed in Section 5.1.1, aviation accidents due to safety oversight and the resulting international restrictions suppressed inbound international leisure demand in the following countries studied in this work: Indonesia, Laos and Vietnam.

Since the demand is driven by the conditions both in a particular economy and the rest of the world, exogenous shocks on both sides of the demand spectrum affect the relationship. For example, following the announcement of SARS epidemic in Asia, travelers from other regions avoided travel to the affected countries. In comparison, even though the terrorist attacks of 9/11 took place in the U.S., the number of inbound leisure passengers to Jamaica decreased because the attacks affected the consumers in the U.S. which accounted for the majority of the visitors to the island.

Recent changes in the air cargo industry in Chile reflect the impact of rising fuel costs. In particular, an increase of fuel prices in recent years resulted in price increases for Chilean exports and hence negatively affected the demand for those goods in the U.S. and other economies. In order to stimulate the demand for their exports some Chilean producers had to cut transportation costs by shipping seafood frozen by sea instead of using the traditional air cargo services adversely affecting the development of the air cargo industry [45].

Economic Downturns

The demand is also directly influenced by economic downturns which can occur both in the economy of interest and the rest of the world and hence affect both the economy's outbound demand and the international inbound demand. For example, the Asian Economic Crisis of 1997 resulted in the decline of GDP across several countries in the region and suppressed both outbound and inbound air transportation demand in Indonesia. Economic recessions in Bulgaria and Zimbabwe affected the outbound demand while the countries' unstable economic and political climate decreased both the inbound leisure and business passenger demand. These economic recessions also negatively affected the air transportation supply because they severely limited access to the capital funds and resulted in the cash flow crisis for the national airlines. The cash flow crisis of Belgium's Sabena and Switzerland's Swissair and several U.S. airlines was also exacerbated by the economic downturn and the drop in demand following the September 11 attacks.

In some economies, air transportation demand is mostly dependent on international consumers both for leisure travel and demand for agricultural and other goods. In these economies, the inbound passenger and outbound cargo demand are particularly susceptible to the effects of economic recessions in the rest of the world. The island nations, which rely on foreign tourist expenditure for a substantial share of their GDP, are the most susceptible. Among the countries studied in this work, inbound air passenger demand was suppressed in Chile, Turkey, and Jamaica due to the economic downturns outside of the local economy. Inbound tourism demand in Turkey was negatively affected by the Russian economic crisis in 1999, while inbound tourism demand in Jamaica was negatively affected by the 2001 recession in the United States. Similarly, inbound tourism and air travel to Chile declined during the Argentine economic crisis between 1999 and 2002 with the greatest decline in 2002. In fact, as a result of the economic downturn in Argentina, the share of Argentinian tourists to Chile fell from 50% in 2000 to 33% in 2003, or from 859 to 536 thousand people [108]. The economic recession in the U.S. also affected the demand for Chilean agricultural goods and resulted in the suppression of outbound air cargo traffic from Chile.

Political and Economic Sanctions

Inbound and outbound travel demand is also influenced by the external political and economic sanctions which restrict air transportation access to the economy. For example, as was described in Section 5.1.1, as a result of the sanctions imposed by the United Nations, all international flights to and from Libya were suspended between 1992 and 1999. Similarly, the inbound passenger demand to South Africa was negatively affected by the geopolitical sanctions during the apartheid. In addition to external sanctions, the local government may influence demand by imposing travel restrictions. In particular, changes in visa requirements may constrain or promote both inbound and outbound tourism development. For example, relaxation of visa requirements helped stimulate inbound leisure tourism growth in Libya and China.

Competition from Other Transportation Modes

Air transportation is the only feasible long-distance transportation mode for high-value perishable commodities and time-sensitive people and is often the only means of access for geographically isolated areas. However, demand for short- and medium-haul air services is subject to competition from surface transportation modes such as road and rail. In particular, improvements in non-aviation transport infrastructure may

lead to unsustainable competition on certain routes. For example, a high-speed rail line was opened in 2007 in Taiwan offering 90-minute train service between the northern and southern ends of the island traditionally served by high-frequency domestic air services. Since the catchment area of the new rail line now covered the majority of the country's population, it became a serious impediment to further development of Taiwan's domestic air services [158].

Changes in the quality of air services may also affect the perceived attractiveness of other transportation modes. For example, in Europe, high-speed rail services, such as TGV, have long provided an alternative to short/medium-haul air travel. However, the attractiveness of rail travel notably increased in recent years because door-to-door travel times for air travel increased due to tight security regulations and the resulting security checks after 2001 terrorist attacks [101].

Civil Unrest

Among the countries studied in this work, security and safety concerns due to civil unrest and/or war suppressed inbound air travel demand in Kuwait, Algeria and Zimbabwe. Civil unrest and deteriorating political climate also had a direct negative impact on air transportation supply in those countries: the fleet capacity of Kuwait Airways was directly impacted when its aircraft were destroyed during the war while Air Zimbabwe had experienced shortages of hard currency, new equipment and jet fuel.

5.2.2 Factors Indirectly Affecting the Demand

In addition to the factors which directly impact air transportation demand, the case study analysis of air transportation system development identified several change factors which indirectly influence the air travel and freight need between a given economy and the rest of the world by affecting the economy's economic attributes.

Economic Liberalization

Economic factor conditions can be changed in a variety of ways including economic liberalization, institutional reforms, investment into supporting infrastructure, and educational reforms which increase the economy's skilled labor stock.

Among the countries studied in this work, economic liberalization reforms resulted in greater participation of the private sector in India, South Africa, Turkey, Vietnam and Chile. Specifically, decrease in the number of government regulations and restrictions enabled the flows of foreign direct investment. For example, India's economic liberalization reforms during the 1990s set higher limits on foreign direct investment and stimulated investment and development of a few key sectors including telecommunications. The government of Chile liberalized trade and began promoting diversification of agricultural production in the 1970s. These reforms resulted in the growth and diversification of the industry and growth of air cargo exports of high-value agricultural products to affluent consumers worldwide. Economic liberalization reforms in Turkey, Vietnam and South Africa enabled the growth of foreign trade and encouraged the development of services-based industries including tourism.

Institutional and Political Reforms

The economies of China, South Africa, Vietnam and Libya were effectively isolated from the global economy until the institutional and political reforms were implemented over the last several decades. For example, Vietnam experienced a period of prolonged international isolation until the institutional reforms of 1986 which shifted the economy from centrally-planned to a market-oriented economic model. The country's international reintegration followed and was aided by the establishment of diplomatic and economic relations with ASEAN (Association of Southeast Asian Nations), countries in Western Europe and Northeast Asia. As a result of these reforms, manufacturing and services came to play a more prominent economic role. Similarly, air transportation demand increased in China after the government decided to pursue international economic integration in the early 1980s. In comparison, air transportation development was suppressed in Libya and South Africa due to the political and economic sanctions which were imposed on these countries by the international community. In the case of Libya, these sanctions also restricted modernization of the national carrier's fleet and hence directly affected the capacity of Libya's airlines.

The country's institutional framework plays an important role in enabling the flows of foreign capital. For example, changes in institutional framework and various incentives to attract foreign direct investment and promote economic development stimulated the growth of foreign direct investment flows to China, India, United Arab Emirates, Qatar and Vietnam. However, the case study analysis also showed that to enable the flows of foreign investment it is necessary that the country's institutional framework matches the government's overall investment goals. For example, despite the incentives provided for foreign investors, the enabled flows of investment did not grow substantially in Chile, Jamaica and Libya. In Chile the incentives were provided to encourage investment into knowledge-based industries; in Jamaica the incentives were provided for investment into industries that earn or save foreign exchange, generate employment, and use local raw materials; in Libya the incentives were provided to encourage development of non-oil sectors. However, poor record of copyright protection undermined Chile's efforts to develop innovative, knowledge-based industries despite the incentives [192]. Similarly, the effort of Jamaica's government to increase foreign investment was undermined by the country's high crime rate, inefficient government bureaucracy and poor macroeconomic conditions [63]. In comparison, institutional changes in India, which followed the economic liberalization reforms in the 1990s, included increased information transparency and copyright protection. These changes stimulated the development of knowledge- and services-based industries [10].

Supporting Infrastructure Investment

Changes in the institutional framework and supporting infrastructure investment stimulated the growth of foreign investment flows into China, India, United Arab Emirates and Qatar. China began encouraging foreign investment and market-oriented economic development in the early 1980s and quickly became an attractive investment location due to its good physical infrastructure, availability of low-cost labor and a large domestic market size. India's software export industry has been expanding since the 1990s due to further economic liberalization and development of local supporting infrastructure, including telecommunications, which increased the level of foreign direct investment into the Information Technology sector. These developments helped bring the workers back to India and expand the range of offered services to outsourcing of business processes, call centers, and research and development. Prior to these reforms, it was customary

for Indian software professionals to travel to the client's premises to do work because India did not have the appropriate level of dedicated local supporting infrastructure. Liberal institutional framework, construction of free trade and investment zones and availability of high quality supporting infrastructure supported the foreign investment and inflows of foreign high-skill professionals into various knowledge-based industries including health-care and software development in the United Arab Emirates and Qatar. The analysis showed that supporting tourism infrastructure investment stimulated the growth of tourism flows in the United Arab Emirates, Vietnam, Laos and Libya.

Exchange Rate Fluctuations

The demand for goods and services produced by the economy is influenced by the exchange rates and trade agreements with the rest of the world. Fluctuations in exchange rate change the relative price of imports and exports. For example, if the local currency appreciates, or increases in value, then the local demand for imports increases because they become less expensive while the demand for exports decreases because their relative price increases. Local currency appreciation makes the country more expensive compared to other economies. As a result, it may have a negative impact on inbound tourism demand and capital investment. For example, according to the World Bank study, the fluctuations in the exchange rate of Jamaican currency may have had a negative impact on inbound tourism demand since the 1990s [209].

Alternatively, the exports become more competitive if the currency depreciates, or decreases in value. The economic literature suggests that exchange rate regimes have an impact on trade flows, including the flows of air cargo destined for international consumers, and economic growth. However, the studies provide mixed results as to the sign and the magnitude of that impact [133, 187]. Despite the fact that the impact has not been quantified, most economists would agree that macroeconomic policy is one of the important attributes of the nation's competitiveness and interaction with the rest of the world [165].

Political and Macroeconomic Stability

Political and macroeconomic instability may suppress both the economic and air transportation system developments as was demonstrated by the case studies of Bulgaria and Zimbabwe. In both of these countries, the policies implemented by the ruling political parties resulted in deteriorating economic and social conditions decreasing the number of inbound air passengers. The flows of business passengers and investors in particular were also suppressed in Jamaica, South Africa and Algeria due to the countries' inadequate political and economic stability levels.

Growing Consumer Demand

Strong economic growth can stimulate private consumer demand which includes the air travel demand. Among the countries studied in this work, strong economic growth in China, India, Turkey and Indonesia helped stimulate domestic and outbound passenger demand. The growth of domestic demand in India, Turkey and Indonesia was also affected by the changes in the air transportation industry. For example, while Turkey's strong economic growth in the 1990s fueled the demand and resulted in increased air passenger growth rates, the growth rates increased substantially only after the domestic deregulation reforms of 2003. Specifically, this demand growth was supported by the development of the low-cost domestic services which

followed Turkey's aviation deregulation. The low-cost demand stimulation effect following deregulation also helped stimulate the air passenger travel, particularly the leisure markets, in India and Indonesia. In China, while the majority of air passengers still travel for business purposes, the demand for leisure services which provide access to tourism destinations increased with an increase of China's middle class.

Change in Management Practices

Other general economic trends which contribute toward changes in air mobility and air cargo usage include a general worldwide trend toward globalization of trade in manufacturing and services, changes in management practices, such as just-in-time inventory and made-to-order models, progressive economic and trade liberalization reforms between countries, and political changes, such as opening of the Eastern Bloc countries to tourism over the last two decades.

Changes in economic attributes in competing economies may also influence the demand for air transportation services. For example, in recent years there has been a decrease in demand for air freight services in Taiwan as manufacturing moved to mainland China because developments in the manufacturing and air transportation sectors in China changed Taiwan's competitiveness with respect to the rest of the world [158]. Another example is the foreign direct investment flows into Turkey and Jamaica whose growth has been undermined in recent years by the competition from central and eastern European countries and from some Asian countries, respectively [66].

5.3 The Role of Government

Depending on the combination of economic attributes which define the economy's interaction with the rest of the world, different mechanisms dominate the relationship between air transportation and economic development. For example, an economy with factor conditions which include the availability of cheap low-skill labor and good infrastructure is an attractive location for low-cost manufacturing for foreign investors. On the other hand, an economy with a favorable climate and adequate accommodation facilities is an attractive location for inbound leisure tourism. A country's government plays a role in defining the economy's interaction with the rest of the world by influencing both the demand of air transportation services and air transportation system supply.

The government affects air transportation system supply through changes in the regulatory framework, infrastructure capability, support of the national carriers and vehicle capability. The government directly affects the air transportation demand by investing into other transportation modes and by controlling the economy's political and economic interaction with the rest of the world. The government may also indirectly affect the air transportation demand by changing the economy's factor conditions through economic liberalization, institutional and political reforms, supporting infrastructure investment and the economy's macroeconomic policy which includes exchange rate fluctuations. Figures 5-3 and 5-4 summarize the change factors which can be directly affected by the government.

Air Transportation Supply Change Factors
Regulatory Framework
Domestic Deregulation
International Liberalization
Privatization and Ownership
Safety and Environmental Restrictions
Geopolitical and Security Restrictions
Infrastructure Capability
Airport Capacity Expansion and Construction
Secondary Airports Availability and Incentivization
Air Traffic Management (ATM) Capability
Airline Strategy
Low-cost Carriers Demand Stimulation
Airline Expansion Strategy
Government Support of National Carriers
Airline Business Factors
Vehicle Capability
Perceived Airline/Fleet Safety
Fleet Capacity

Figure 5-3: Air transportation supply change factors: the government affects the factors highlighted in gray.

Air Transportation Demand Change Factors
Direct Factors
Exogenous Demand Shocks
Economic Downturn
Political and Economic Sanctions
Competition from Other Transportation Modes
Civil Unrest
Indirect Factors
Economic Liberalization
Institutional and Political Reforms
Supporting Infrastructure Investment
Political and Macroeconomic Stability
Exchange Rate Fluctuations
Growing Consumer Demand
Change in Management Practices

Figure 5-4: Air transportation demand change factors: the government affects the factors highlighted in gray.

Government Effect on Air Transportation Supply

Air transportation supply is set by the airlines whose decision to operate a particular route and pricing and scheduling of flights are influenced by their assessment of passenger and freight demand for the origin-destination market, their assessment of the route's profitability as part of the overall network, the capability of airport and navigation infrastructure, and the available airline resources. Local governments influence the competitive environment and airlines' willingness to operate through a variety of regulatory mechanisms: deregulation of domestic services, liberalization of international services, and creation and support of government-sponsored national carriers. In addition, governments can affect infrastructure capability and airline operating costs through airport construction and expansion, compliance with international safety and environmental standards, upgrading the navigation infrastructure, operational incentives, such as tax incentives to promote operations in under-utilized secondary airports, and development of other transportation modes. Ultimately, the relationship between supply and demand determines the allocation of airline resources to a particular route. This relationship is subject to exogenous demand shocks such as wars and acts of terrorism, political and economic sanctions, changes in the visa requirements, perceived health risks, natural disasters, significant shifts in world financial markets or exchange rates, and oil shocks.

Among the countries studied in this work, airline expansion strategies and changing business models played a major role in stimulating air transportation development in China, India, South Africa, Turkey, United Arab Emirates, Qatar, Ireland, Slovakia, USA, Kuwait, Belgium and Switzerland. In particular, the analysis showed that government-induced changes in the regulatory framework through international liberalization and domestic deregulation enabled airline growth in China, India, South Africa, Turkey, UAE, Ireland, Slovakia, USA, Belgium and Switzerland. In fact, prior to these regulatory changes, air transportation growth was essentially suppressed in China, India, South Africa and Turkey because the supply of air services that was offered by the state-owned airlines was insufficient. For example, until the recent liberal-

ization reforms, protectionist policy in India prevented foreign and private domestic carriers from offering additional services while India's government lacked capital funds to increase the capacity of the state-owned carriers. Similarly, multilateral aviation liberalization reforms in the European Union enabled airlines to expand their international networks, stimulate additional demand and become intra-European carriers.

Government support played a pivotal role in the development of some of the fastest growing airlines in the world including Vietnam Airlines, Qatar Airways, Turkish Airlines and Dubai's Emirates Airline. In particular, the international expansion strategy of each of these airlines was supported by the government through (1) bilateral air service agreements which granted these national airlines rights to expand their international coverage, (2) capital investment into airlines which allowed them to modernize their fleets, and (3) aviation infrastructure investment through privatization or directly by the government to support the airlines' hub operations. In particular, it was largely due to the government support that Emirates Airline could continue its growth in the 1980s while the country's GDP was declining. This support was provided by the government because sustainability and further growth of the national carrier was perceived as a necessary condition for achieving economic diversification and further economic development. Direct government intervention also played a major role in survivability of unprofitable national carriers in South Africa and Jamaica. In comparison, the governments of Belgium, Switzerland, Bulgaria and Maldives chose to let go of their national carriers when they could not sustain profitable operations.

Government support of the national carrier does not always stimulate air transportation system development because the government may lack capital resources to maintain adequate capacity and safety levels of their national carriers. Among the countries studied in this work, lack of capital resources hindered aviation development in India, Laos, Zimbabwe, Bulgaria and Maldives. For example, India's air transportation industry was traditionally constrained on the supply side because of insufficient capacity provided by the state carriers.

The analysis also showed that excessive regulation and lack of timely government action may constrain aviation development. For example, even though in recent years India changed significantly its regulatory framework to enable the growth of the private carriers, many aspects of the industry are still controlled by the government. In particular, restrictive regulations preclude timely investment into airport infrastructure and may result in a shortage of pilots and engineers which will hinder further development of the industry. Similarly, China's current restrictive regulatory framework suppresses the development of domestic low-cost carriers.

The government may also affect the perceived safety and vehicle capability of the airlines. For example, the growth of Air Jamaica was suppressed by the operating restrictions from the United States between 1996 and 1998 due to safety concerns even though the carrier has never been involved in an aviation accident. These restrictions were placed on the carrier because the U.S. Federal Aviation Administration determined that Jamaica's civil aviation authorities did not abide to proper civil aviation standards. The restrictions were removed after the government of Jamaica upgraded Jamaica's Civil Aviation Authority oversight procedures and maintenance management controls.

The government may also directly affect the vehicle capability of the airlines by placing restrictions on the type of aircraft an airline can acquire. Since there are only a few aircraft manufactures, aircraft purchases can be motivated by political considerations. For example, Air Zimbabwe, the national carrier of Zimbabwe, initiated a fleet modernization program in the late 1990s by leasing and purchasing Chinese and Russian, as

opposed to Western-built, aircraft. In comparison, Balkan Bulgarian Airlines upgraded its fleet to modern Western-built aircraft to attract demand from the European markets after the country lost Soviet support and trading partners in the early 1990s.

Government Effect on Air Transportation Demand

In addition to enabling changes in the air transportation supply, the government can affect air transportation demand because it determines the extent of economic and political integration of a country into the global economy and hence the extent of air transportation usage by its citizens and inbound international visitors. For example, air transportation usage in China and Vietnam increased markedly after the government decided to pursue international economic integration. In comparison, air transportation development was suppressed in Libya and South Africa due to the political and economic sanctions which were imposed on these countries by the international community. In the case of Libya, these sanctions also prevented the national carrier from modernizing its fleet.

Among the countries studied in this work, economic liberalization reforms resulted in a greater participation of the private sector in India, South Africa, Turkey, Vietnam and Chile. Specifically, decrease in the number of government regulations and restrictions enabled the flows of foreign direct investment. For example, India's economic liberalization reforms during the 1990s set higher limits on foreign direct investment and stimulated investment and development of a few key sectors including telecommunications. The government of Chile liberalized trade and began promoting diversification of agricultural production in the 1970s. These reforms resulted in the growth and diversification of the industry and growth of air cargo exports of high-value agricultural products to affluent consumers worldwide. Economic liberalization reforms in Turkey, Vietnam and South Africa enabled the growth of foreign trade and encouraged the development of services-based industries including tourism.

In addition to economic liberalization, changes in the institutional framework and various incentives have been provided by some governments to attract foreign direct investment and to promote economic development. For example, changes in regulations and direct incentives stimulated the growth of foreign direct investment flows to China, India, United Arab Emirates, Qatar and Vietnam.

The government also affects the demand by changing the economy's factor conditions by changing the country's institutional framework and quality of supporting physical infrastructure. Among the countries studied in this work, changes in institutional framework and supporting infrastructure investment have stimulated the growth of foreign investment flows into China, India, the United Arab Emirates and Qatar. The analysis showed that supporting tourism infrastructure investment stimulated the growth of tourism flows in the United Arab Emirates, Vietnam, Laos and Libya.

The government also has control over the economy's macroeconomic policy. Political and macroeconomic instability may suppress both the economic and air transportation system developments as was demonstrated in the case studies of Bulgaria and Zimbabwe. In both of these countries, the policies implemented by the ruling political parties resulted in deteriorating economic and social conditions. In addition, case study analysis showed that the flows of business passengers and investors in particular were suppressed in Jamaica, South Africa and Algeria due to the countries' inadequate political and economic stability levels.

Chapter 6

The Enabling Impact of Air Transportation

During the case study analysis in Appendix A, the enabling impact of air transportation was described at the individual country level by identifying the types of Enabled Flows which take place between a given Economy and the Rest of the World. In particular, the feedback model introduced in Chapter 1 was used to frame the discussion of the enabling impact of air transportation. The model is presented again in Figure 6-1.

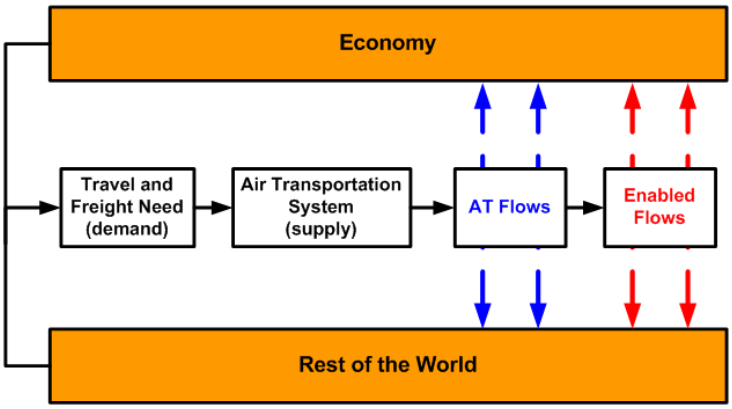
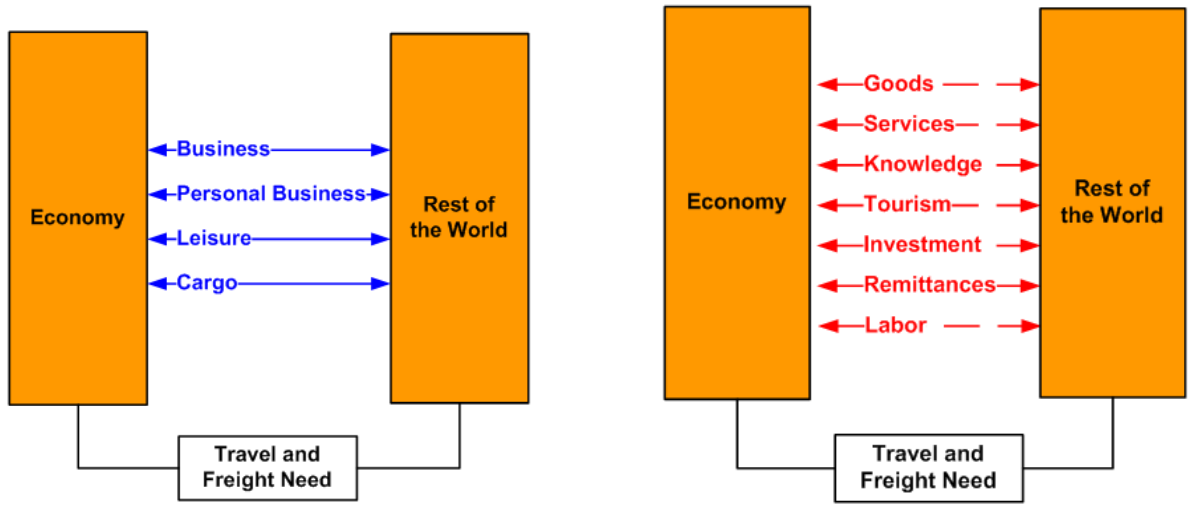


Figure 6-1: Feedback Model Representation: Air Transportation flows change the Economy's Economic Attributes which affect the air travel and freight need between an Economy and the Rest of the World.

This chapter uses the findings from the literature review in Chapter 2 and case study analysis in Appendix A to achieve the following objectives. First, to describe the Enabled Flows. Second, to describe the mechanisms through which Air Transportation Flows result in Enabled Flows. Third, to describe how Air Transportation Flows affect Economic Attributes and change the resulting air transportation demand.

6.1 Description of the Enabled Flows

The enabling impact of air transportation is realized through physical Air Transportation Flows of passengers and cargo which take place between a given Economy and the Rest of the World. These flows are summarized in Figure 6-2(a). The passenger flows belong to three major categories: business, leisure, and personal business. The primary purpose of travel of leisure passengers is recreation and holidays. The primary purpose of travel of business passengers is business, or attending convention, conference or seminar. The primary purpose of travel of personal business passengers is visiting friends and relatives, health, migrant, and education-related trips. These passenger categories are standard categories used by the World Tourism Organization and the United States Bureau of Transportation Statistics.



(a) Air Transportation Flows.

(b) Enabled Flows.

Figure 6-2: Air Transportation Flows provide connectivity for an Economy to the Rest of the World. Air Transportation Flows result in Enabled Flows which directly change the Economic Attributes and the resulting Travel and Freight Need between the Economy and the Rest of the World.

Air Transportation Flows give rise to the Enabled Flows which directly affect an Economy and hence influence the travel and freight need between a given Economy and the Rest of the World. The following Enabled Flows were identified during the case study analysis: goods, services, knowledge, tourism, investment, remittances [1] and labor. These flows are summarized in Figure 6-2(b). All flows are bi-directional; for example, inbound leisure passengers spend money in the Economy whereas outbound leisure passengers spend money abroad. In this work, the inbound passengers are those whose main place of residence is not in the Economy of interest and inbound cargo consists of goods produced outside of the Economy.

Both the Air Transportation Flows and the Enabled Flows use standard formulations and constructs available respectively in the literature on air transportation and economic development. The use of standard formulations aids in the development of understanding of air transportation impact by bringing together the two disciplines. Some of the Enabled Flows are directly observable in the economic data collected by orga-

[1] Remittances refer to transfers in cash or in kind from migrants to resident households in their countries of origin. Usually these are ongoing transfers between members of the same family, with persons abroad being absent for a year or longer [211].

nizations such as the World Bank: the number of tourists, the amount of foreign direct investment, exports and imports of goods and services, inward and outward remittance amounts, and labor flows. The Enabled Flows of knowledge are more difficult to measure directly, but surrogate metrics exist in the literature [2].

6.2 Mapping Air Transportation Flows to Enabled Flows

In standard economic theory two types of products may be traded between economies: either physical goods or intangible services. Examples of goods-producing industries include agriculture, mining, and manufacturing. Examples of service industries include financial services, insurance services, engineering services, legal services, medical services, education, entertainment, transport and tourism. The flows of goods and services are two of the Enabled Flows identified in the analysis.

The flows of knowledge and tourism have been separated from the other services flows typically considered by the economists. Knowledge is considered separately because some of the knowledge flows between economies are not traded, such as the knowledge shared by students who obtained their education abroad. In addition, knowledge flows, as opposed to generic services flows, directly impact the skill-level of the economy's labor force. Tourism is considered separately because of the industry's dominance over other service industries in several developing economies. In addition to flows of goods and services, there are flows of money which are captured through the Enabled Flows of investment and remittances. The Enabled Flow of labor captures the physical flow of both high-skill and low-skill workers between economies.

The relationship between individual Air Transportation and Enabled Flows is summarized in Figure 6-3. In particular, Cargo flights carry goods between economies. Business passengers provide a source of labor, knowledge, investment and services. Personal business passengers result in enabled flows of remittances, labor, knowledge, investment and services. Leisure passengers result in tourism flows.

	Goods	Services	Knowledge	Tourism	Investment	Remittances	Labor
Business		X	X		X		X
Personal Business		X	X		X	X	X
Leisure				X			
Cargo	X						

Figure 6-3: The relationship between Air Transportation Flows and Enabled Flows.

The following provides a summary of the enabling mechanisms which were observed during the case study analysis. The key enabled flows identified in each individual economy are summarized in Figure 6-4. The detailed description of the flows for each country is provided in Appendix A. Later sections present the detailed description of the relationship between Air Transportation Flows and their enabling impact on economic activity.

[2]Different organization use different metrics to evaluate knowledge, information and innovation. For example, the World Bank developed the Knowledge Assessment Methodology KAM described at *www.worldbank.org/kam*. The Organisation for Economic Co-operation and Development (OECD) also published several papers on this topic including a comprehensive paper titled *The Knowledge-Based Economy* from 1996.

	Goods	Services	Knowledge	Tourism	Investment	Remittances	Labor
China	x		x	x	x	x	
India		x	x	x	x	x	
South Africa				x			
Turkey				x		x	
UAE	x	x	x	x	x		x
Chile	x			x			
USA	x	x	x	x	x		x
Jamaica				x		x	
Libya							x

Figure 6-4: The following Enabled Flows played a major role in these economies.

6.2.1 Enabled Flows of Goods

Cargo flights enable the flows of goods between economies. Air cargo alleviates surface infrastructure deficiencies by providing fast, flexible, safe and reliable transportation. Table 6.1 compares the characteristics of different transportation modes as outlined in a textbook on supply chain management. As a result of air cargo's qualities, it is used to transport commodities which have high value, high business impairment value, low demand predictability, or are perishable.

	Rail	Road	Pipeline	Air	Water
Door-to-door	Sometimes	Yes	Sometimes	No	Sometimes
Price	Low	High	Very Low	Very high	Very low
Speed	Slow	Fast	Slow	Very fast	Very slow
Reliability	Medium	Medium	Very high	Very high	Low
Packaging needs	High	Medium	Nil	Low	High
Risk of loss and damage	High	Medium	Very low	Low	Medium
Flexibility	Low	High	Very low	Very low	Low
Environmental impact	Low[a]	High[b]	Low[c]	Medium[d]	Low[e]

[a]Minimal air and noise pollution, low energy consumption per ton-kilometer traveled.
[b]Air and noise pollution, traffic congestion, high energy consumption per ton-kilometer traveled.
[c]Pipeline rupture could result in catastrophic environmental damage.
[d]Air and noise pollution, very high energy consumption per ton-kilometer traveled.
[e]Minimal air and noise pollution, low energy consumption per ton-kilometer traveled.

Table 6.1: Characteristics of different transportation modes [93, p. 88].

Air cargo enables access to markets for those goods for which speed adds value; enables access to markets by providing a different distribution mechanism such as next-day delivery; enables access to physical capital by enabling delivery of high-value machinery and equipment which are shipped by air freight; enables more efficient production practices such as just-in-time manufacturing. Among the countries studied in this work, air cargo and the enabled flows of goods played a dominant role in the following economies: China, United Arab Emirates, Chile and United States of America.

6.2.2 Enabled Flows of Services

Air transportation enables access to high-skill labor such as consultant and other services professionals; enables access to markets so that local skilled services employees are not constrained to the local market; enables companies to share human resources and knowledge across divisions; enables access to health and medical services outside of the domestic economy. Among the countries studied in this work, enabled flows of services played a dominant role in the following economies: India, United Arab Emirates and United States of America.

6.2.3 Enabled Flows of Knowledge

Air transportation enables access to knowledge through educational and other learning opportunities which are not available in the local economy; enables people obtain education from abroad and then increase the knowledge level of the home economy; enables access to knowledge and skills from expert and consultant visits increasing local economy's skill-level and human capital through transfer of skills, collaboration, and training. Among the countries studied in this work, enabled flows of knowledge played a dominant role in the following economies: China, India, United Arab Emirates and United States of America.

6.2.4 Enabled Flows of Tourism

Air transportation enables access to tourism markets; enables seasonal retirement migration. Among the countries studied in this work, enabled flows of tourism played a dominant role in the following economies: China, India, South Africa, Turkey, United Arab Emirates, Chile, United States of America and Jamaica.

6.2.5 Enabled Flows of Investment

Air transportation provides access to financial capital by allowing investors an opportunity to oversee and monitor their investment. Among the countries studied in this work, enabled flows of investment played a dominant role in the following economies: China, India, United Arab Emirates and United States of America.

6.2.6 Enabled Flows of Remittances

Air transportation enables expatriate workers to maintain contact with their families and send home remittances. Among the countries studied in this work, enabled flows of remittances played a dominant role in the following economies: China, India, Turkey and Jamaica.

6.2.7 Enabled Flows of Labor

Air transportation enables access to both low-skill and high-skill labor. Among the countries studied in this work, enabled flows of labor played a dominant role in the following economies: United Arab Emirates, United States of America and Libya.

6.3 Describing an Economy Using Economic Attributes

The previous sections provided the description of Air Transportation Flows, Enabled Flows, and the enabling mechanisms. The objective of this section is to describe how Air Transportation Flows affect an Economy. To achieve this objective, it is best to use a generic description of an Economy. Describing an Economy

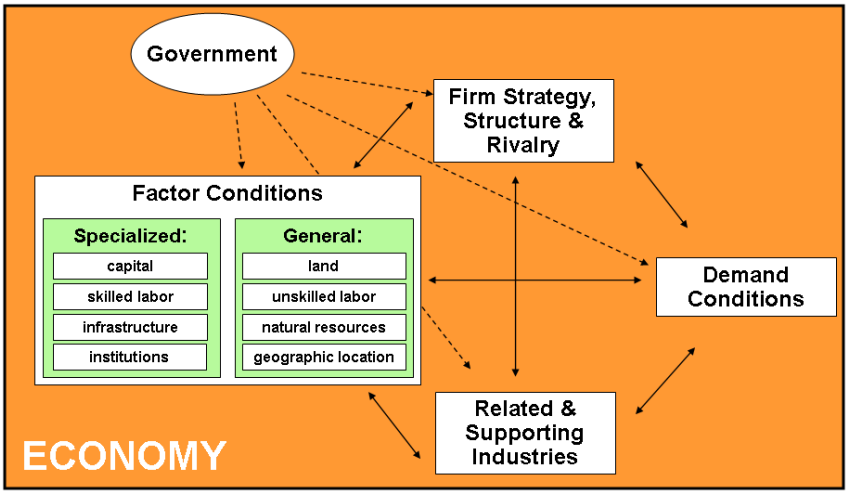


Figure 6-5: The Economy's air travel and freight need are determined by the four attributes with government and chance playing an important role. (Adapted from Porter [164].)

using Economic Attributes is one of the standard methods used both in economic development literature and Porter's theory of competitive advantage of nations [164, 156]. In particular, any Economy can be described by the following Economic Attributes summarized in Figure 6-5:

1. *Factor conditions.* Factor conditions are referred to as the factors of production in standard economic theory. Factor conditions can be subdivided into general and specialized. General factors are inherited and consist of land, unskilled labor, and natural resources. Specialized factors are created and are key to establishing the nation's competitiveness. They consist of capital, skilled labor, and infrastructure. In addition to the standard factor conditions used in Porter's general model, the model presented here also includes (1) geographical location as one of the general factor conditions since the nation's location and connectedness to the world's main markets affect its competitiveness; and (2) institutions as a specialized factor condition.

2. *Business conditions: firm strategy, structure, and rivalry.* These are determined by the conditions in the nation which govern how companies are created, organized, and managed.

3. *Demand conditions.* The original Porter's definition of demand conditions refers only to home demand for goods and services. The demand is characterized by its composition (the nature of buyer needs), its size and pattern of growth. In this work, the definition is expanded to include international demand for goods and services produced by the local economy.

4. *Related and supporting industries.* Presence of upstream and/or downstream as well as related industries in the same area results in clustering or agglomeration effects. Two types of agglomeration effects

are usually manifested: localization, or scale, externalities due to concentration of industries with similar activities, and urbanization, or scope, externalities which occur when heterogeneous industries are placed in proximity [126].

These four attributes form an inter-connected feedback system where government and exogenous factors play an important role. The exogenous factors include changes in management practices, such as globalization of trade in manufacturing and services, discontinuities in input costs such as the oil shocks, technological innovation, political changes, and economic regulation by foreign governments. The combination of these attributes defines the air travel and freight needs between the Economy and the Rest of the World. Air Transportation Flows in turn affect these Attributes through a set of enabling mechanisms effectively changing the Economy's potential air travel and freight need with the Rest of the World.

Since economic attributes vary between economies, the travel and freight need and the resulting air transportation and enabled flows vary as well. This variability can be observed in Figure 6-4 where the key enabled flows are summarized for the economies studied in this work. For example, China, whose factor conditions include the availability of cheap low-skill labor and good supporting infrastructure, is an attractive location for low-cost manufacturing and hence attracts the enabled flows of foreign investment. In comparison, Jamaica and Turkey are examples of countries with a favorable climate and adequate accommodation facilities. Because of these attributes these countries are an attractive destination for inbound leisure passengers and the resulting enabled tourism flows.

The next section describes how each type of Air Transportation Flow affects the corresponding Economic Attributes and illustrates the relationship using the supporting evidence identified during both exploratory and case study analyses.

6.4 Enabling Impact of Business Passengers

Inbound Business Passengers enable the flows of labor, services, knowledge and investment affecting the economy's *Capital*, *Skilled Labor* and *Firm Strategy*. Outbound Business Passengers enable the flows of investment, services and knowledge affecting the economy's *Capital*, *Skilled Labor*, *Firm Strategy* and *Demand Conditions*.

6.4.1 Impact of Inbound Business Passengers on Firm Strategy and Skilled Labor

Air travel impacts *Firm Strategy* and the economy's *Skilled Labor* by enabling companies to share human resources and knowledge across divisions. For example, access to air transportation allows companies to share managerial staff between headquarters and a regional location. Air travel enables face-to-face contact in multi-national corporations which affects the level of collaboration. Increased collaboration enables social network effects which improve firm performance and productivity.

Air transportation enables access to *High-Skill Labor*, such as consultant and other services professionals, increasing local economys skill-level and human capital through transfer of skills, collaboration, and training. Business passenger travel is an important operational component for some service industries in the United States. For example, producers of high-tech products, business services, insurance and computer-oriented

firms spend at least 25% more on air services than an average industry in the United States [58]. Business travel is also an essential *Firm Strategy* component for finance, educational and legal services industries because these industries depend on air travel for delivering their expertise to clients at their respective locations [58, p. 12]. Business passenger travel affects *Firm Strategy* by enabling companies to attract high-skill high-quality employees because their perceived quality of life is enhanced by the ready access to other regions. These *Skilled* employees enable technology transfer and knowledge spillovers in the local economy. Among the case studies analyzed in this work, the inbound high-skill business passenger flows played a particularly important role in the United Arab Emirates. In particular, these flows enabled the United Arab Emirates' growing economy, which lacks domestic labor resources but has sufficient financial resources, to gain access to foreign high-skill professionals.

6.4.2 Impact of Inbound Business Passengers on Capital

Business passenger travel impacts the economy's *Capital* stock by enabling investors to personally oversee and monitor their investment. In 2006, foreign direct investment (FDI) inflows worldwide reached US$1.3 trillion [195]. In 2006, the United States was the largest single FDI recipient and the largest inflows among developing economies went to China, Hong Kong and Singapore [195]. Even though cross-border mergers and acquisitions account for a high share of FDI flows, greenfield investment has been increasing in some of the world's regions including developing and transition economies of South-East Europe and the Commonwealth of Independent States. While Transnational Corporations (TNCs) from developed economies are the leading sources of FDI, accounting for 84% of global outflows, in recent years there has been an increase in the amount of outflows from TNCs from developing economies. Because of the increase in the amount of FDI flows worldwide, the employment generated by foreign affiliates of TNCs has nearly tripled since the 1990s. In particular, as of 2006, China was a host to the largest number of foreign affiliates in the world which employed 24 million people [195].

Capital flows from international investors are particularly important in developing economies because the countries may otherwise lack domestic capital sources. For example, because of China's underdeveloped domestic capital markets, foreign capital flows have played a substantial role in China's economic growth since the 1980s [127]. In fact, in 2007 trade by foreign-invested enterprises accounted for 58% of China's total trade [61, 41, p. 48]. The governments of Turkey, Jamaica and Chile also provided incentives to encourage foreign direct investment. However, these incentive programs had mixed results. In Turkey, foreign investment increased after 2003 due to some legislative changes, improved macroeconomic and political stability and the availability of the incentives for foreign investors [66]. However, investment inflows were undermined by the competition from central and eastern European countries [66]. In Jamaica, the government provides incentives to encourage foreign investment in areas that earn or save foreign exchange, generate employment, and use local raw materials [192]. The majority of Jamaica's foreign direct investment goes into the tourism sector while investment into other sectors is hindered by crime, inefficient government bureaucracy, poor macroeconomic conditions and lack of proper social and infrastructural investment levels [63]. In Chile, the majority of foreign investment goes into gas, water, electricity and mining [41]. Even though the government implemented tax reforms to promote foreign investment in research and development, poor record of copyright protection undermines Chile's efforts to develop innovative, knowledge-based sectors [192].

6.4.3 Impact of Outbound Business Passengers on Skilled Labor and Demand Conditions

Air travel enables the flows of knowledge by enabling local employees to get training at another location improving the economy's *Skilled Labor* stock. Personal meetings are one of the most effective ways of doing business, seeking out new markets, exchanging ideas and communicating with customers and colleagues [53]. Since its introduction in the 1970s, it has been suggested that virtual intra-company meetings via videoconferencing would reduce the demand for business passenger travel. However, studies have had only inconclusive evidence regarding the actual impact, indicating that the substitution effect has been rather limited [53].

According to the International Congress & Convention Association report, spending due to conference travel and international meetings is an important contributor to some of the regional economies in Europe and North America. For example, it is estimated that business passenger travel in the United States for meetings, conventions, exhibitions, and incentive travel accounts for nearly 17% of the air transportation industry's operating income and generates more than 36% of the hotel industry's revenue [44]. In fact, because of the perceived positive contribution of conference-related travel to the regional economy, several Asian and Middle Eastern cities have been investing into the supporting infrastructure to attract business travelers who tend to spend more compared to the leisure travelers [44].

Air travel enables access to markets by enabling local skilled employees to work as outsourced labor and not be constrained by the local markets. The ability to outsource affects *Firm Strategy* and international *Demand Conditions* for the locally produced goods and services. For example, outsourcing of software and related information technology (IT) services to developing countries for export plays in important role in the world's economy. In fact, according to Aspray et al., about 20% of the U.S. companies are currently outsourcing work to other countries [10].

In some countries, major services industries have been developed specifically for export to gain access to international *Demand*. In particular, Ireland, Israel, India, China, and some Eastern European countries invested into the development of the software industry primarily for export rather than domestic purposes. For example, as of 2005 export of software services was India's largest export [10]. Access to air transportation services has been an important component of the sector's development starting in the 1970s when local programmers began traveling to the United States to work at the client's premises. In the 1990s the software export industry in India had experienced a period of rapid growth which was in part enabled by further political liberalization and local supporting infrastructure investment. In particular, these developments attracted foreign direct investment and helped expand the range of offered services to outsourcing of business processes, call centers, and research and development [10, p. 21]. These developments also helped bring the workers back to India increasing the country's domestic *Skilled Labor* stock. In addition, improvements in local supporting infrastructure and ready access to air transportation enabled multinational corporations setup offices in India and employ local workers instead of transferring them to the client's premises.

Air travel enables local businesses to obtain foreign *Capital* investment through direct contact and advertising because face-to-face contact creates trade opportunities. Air travel also affects the flows of investment and goods by enabling salesmen to travel to recruit customers in new markets increasing the *Demand*.

6.5 Enabling Impact of Personal Business Passengers

Personal Business Passengers enable the flows of investment, knowledge, labor, services, and remittances affecting the economy's *Capital*, *Skilled Labor* and *Demand Conditions*. The major purpose of travel for Personal Business Passengers is visiting friends and relatives, health, migrant, and education-related trips.

6.5.1 Impact of Personal Business Passengers on Demand Conditions

Outbound migrant workers rely on access to air travel to maintain the family ties in the local economy resulting in flows of remittances for the home economy which affect the economy's local *Demand Conditions*.

Air travel, according to the World Bank Development report, enables flows of nearly 175 million migrant workers from the developing countries [210]. For these countries, remittances, which the migrant workers send to their families every year, is the second largest source of private capital after Foreign Direct Investment. According to the World Bank, recorded remittance flows to developing countries in 2007 were estimated at US$251 billion [211]. Although India and China were the top recipient countries, in small countries remittances tend to account for a larger share of GDP. For example, while India and China's remittances accounted respectively for 2.8% and 0.9% of GDP, Tajikistan (at 36%), Moldova (at 36%), Tonga (at 32%), the Kyrgyz Republic (at 27%), and Honduras (at 26%) were the largest share recipients in 2006 [211].

Among the countries analyzed in this work, inward remittances substantially outnumbered outward remittances in China, India, Jamaica, and Turkey. In Jamaica, inward remittances accounted for the largest share of the country's GDP — 18.5% in 2006 because nearly 40% of the country's population resided abroad [211]. In comparison, in Chile remittances accounted for less than 0.01% of GDP. In South Africa, United States and Libya the ratios of outward remittances to inward remittances were respectively 3:2, 15:1 and 60:1 [211]. In these three countries, immigrant and temporary migrant workers account for a substantial share of the country's labor force.

6.5.2 Impact of Personal Business Passengers on Unskilled and Skilled Labor

Inbound migrant workers are a source of *Unskilled Labor* for the host economy. The majority of the migrant workers from developing countries work as unskilled laborers in their host economies. In particular, unskilled migrant workers play an important role in oil-based economies. For example, both Libya and the United Arab Emirates rely on access to migrant low-skill labor. In fact, migrant workers, primarily from India and Pakistan, account for 85% of the population in the United Arab Emirates [59].

While some high-income economies rely on access to low-skill foreign laborers, low-skill laborers from the developing economies depend on access to high-income economies for jobs and income. For example, starting in the early 1960s, around 6% of the Turkish population was living abroad at any one time [104]. The majority of Turkish expatriates live in Germany and other European countries, earn income and have enough money to send home remittances and visit Turkey for family reasons and holidays.

In addition to the low-skill labor flows, air travel enables flows of *Skilled* emigrants which play an important role in some economies, including the United States. For example, the U.S. is one of the top three destinations for both low-skill and high-skill emigrants from India, Jamaica and China. In fact, according to Saxenian, over one-third of Silicon Valley's skilled workers were foreign-born [169]. In general, as of 2005

immigrants accounted for 13% of the country's population and the top five source countries were Mexico, Philippines, Germany, India, and China [211].

6.5.3 Impact of Personal Business Passengers on Skilled Labor and Capital

Air transportation enables access to knowledge through educational and other learning opportunities which are not available in the local economy. In particular, it enables people to obtain education from abroad while maintaining contact with their families and then increase the knowledge level of the home economy when they return. Maintaining contacts and families at home incentivizes expatriates to invest into the local economy to get the local factor costs benefits while bringing in knowledge, experience, and networks from abroad. Returning expatriates provide a source of *Capital* and *Skilled Labor* for their home economy.

The number of skilled migrant workers increased dramatically since the 1970s. While the total number of skilled migrants in the 1970s was estimated to be at only 300,000 people, in the 1990s more than 2.5 million highly educated immigrants from developing countries resided in the U.S. alone[3] [56]. While access to these foreign-born workers contributed to economic development in the United States, studies also showed that in recent years some of these educated workers began to return to their home countries [169, 168, 148]. These returning expatriates influenced the *Skilled Labor* and *Capital* factor conditions in their home economies.

For example, access to air travel enabled these foreign-born professionals to transfer the Silicon Valley model of high-risk investing to Taiwan and Israel in the early 1980s and more recently to India and China. One of the strategies used by these returning expatriates is taking advantage of low-cost skilled labor in their home countries while maintaining close ties to the technology and markets abroad [169, 168]. In other words, these entrepreneurs can provide investment and knowledge while operating profitably in the markets where they have the cultural and linguistic know-how [169, 168]. In fact, microeconomic analysis using survey data showed that cross-border social networks can serve as an important substitute to local institutions [148]. For example, the analysis of software firms in India showed that software companies located outside software hubs rely on diaspora networks for business leads and financing [148]. The analysis also showed that cross-border networks are most beneficial to the entrepreneurs who have previously lived abroad and rely on professional ties, rather than those who are connected through family or ethnic ties [148].

While there is evidence of returning expatriates in India and China [218, 169], there has been no evidence so far of the returning high-skill professionals who left South Africa and Jamaica during the last several decades. In Jamaica, more than 80% of the country's population with tertiary education currently resides abroad [211]. While the rate of emigration for high-skill workers is not as high in South Africa, many professionals, including almost 20% of physicians, left the country starting in the early 1990s [211]. The outward migration of professionals in Jamaica and South Africa had a negative impact on the economy's *High-Skill Labor* stock. In fact, some analysts believe that one of the critical structural problems of the labor market in South Africa is the excess of low-skilled and unskilled workers and the shortage of highly skilled workers [65, p. 23]. To improve the local high-skill labor pool, the governments of both Jamaica and South Africa have recently begun to address the skills shortage problem. For example, the South African government launched programs to encourage South Africans abroad to return home and to encourage high-skill migration from other countries [65]. While the outcome of these programs is not yet clear, air

[3]This estimate attempts to exclude the foreign students by excluding people under age 25.

transportation linkage may come to play an increasingly important role in enabling the country's access to high-skill labor and investors.

6.5.4 Impact of Personal Business Passengers on Skilled Labor

Air travel for education purposes allows the local population to gain access to education institutions abroad and increase the knowledge level of the home economy when the students return from their studies. For example, the number of international students and scholars studying, teaching or conducting research in the U.S. has been increasing over the last fifty years. In 2006, there were 582,984 students enrolled in U.S. institutions accounting for 3.9% of all tertiary students in the United States [106]. The leading places of origin of international students were India, China, South Korea, Japan, Taiwan, and Canada. During the 2006/07 academic year, the top five most popular fields of study for international students in the U.S. were Business and Management (18% of total), Engineering (15%), Physical and Life Sciences (9%), Social Sciences (8%), Mathematics and Computer Sciences (8%) [106]. In comparison, during the 2005/06 academic year 223,534 U.S. students studied abroad. The leading host regions of U.S. students were Europe (60% of total), Latin America (14%), Asia (8%), and Oceania (7%) while the most popular fields of study were Social Sciences (22%), Business & Management (18%), and Humanities (14%) [106].

Even though an increasing number of developing economies are sending students to educational institutions abroad, only a fraction of these students return to their home countries. For example, China sent its first students overseas in 1978 following the government's decision to rebuild the country's scientific community after the decade of Cultural Revolution [218]. Since then, the number of Chinese students abroad grew dramatically. While the return rate of these students varied through the years, there has been an increase in the return rate since the 1990s due to some policy changes. In fact, in late 1990s about one-third of the students eventually returned to China [218]. China began to encourage scientists to return from overseas by allowing greater freedom of movement both internationally and within China, providing research grants, world-class facilities, and competitive salaries [218]. Market liberalization reforms, expansion of the private sector and provision of state funds to encourage overseas entrepreneurship by providing dedicated and efficient facilities for high-tech firms provided additional advantages for the returning expatriates [218]. As a result of these government initiatives, there has been an increase in imported foreign capital and technology from the returning expatriates in the last decade [168, 218].

6.5.5 Impact of Personal Business Passengers on Demand Conditions

Health-related air travel has become more common in recent years. Air travel enables customers both in developing and developed economies to gain access to health services abroad both for diagnostic and in-patient treatment. In addition, air travel enables seasonal and permanent retirement migration for the perceived health and quality of life benefits. Both the health-related travel and the inbound retirement travel result in the development of the supporting infrastructure and employment at the destination which increase the local income levels and change the economy's *Demand Conditions*.

Health tourism, where patients travel overseas to obtain medical services, is an international industry which in 2005 was worth US$513 billion [39]. Historically, health professionals moved to new locations outside of their country of origin so they could increase their incomes. For example, doctors from India

and South Africa often moved to the United Kingdom. However, the trend has been reversed in recent years. The industry has grown rapidly since the 1990s due to high cost of health care in developed countries, long waiting lists for certain procedures, improvements in technology, skills and accreditation in destination countries, Internet marketing, the increase in barriers to foreign accreditation for doctors going abroad, and access to affordable international travel [130]. While Asia is the main destination region for medical tourism, particularly the countries of Thailand, India and Singapore, many other countries have sought to enter the market. Many of these destinations combine medical care and conventional tourism to increase the attraction of nearby beaches resulting in considerable benefits to the local tourism industry and the economy's *Demand Conditions* [43].

Seasonal retirement migration has a major impact on the resident populations of both sending and receiving communities. In the United States, the largest impact of seasonal migration occurs in the Sunbelt states, particularly Florida, Arizona and Texas. It is estimated that Arizona is a winter home to 273,000 long-term seasonal residents, while Florida had more than 800,000 elderly temporary in-migrants in 2005 from Canada and the United States (i.e., about 5% of the state's population) [174, 98]. Similarly, in Europe there is a north-south migration trend for retirees from Northern Europe who reside on the Mediterranean during the winter months [96]. Access to affordable air services is often necessary for seasonal migration, especially for transnational flows of retirees.

6.6 Enabling Impact of Leisure Passengers

Leisure Passengers affect the Economy's *Demand Conditions* by enabling the tourism flows between economies. Air transportation enables access to tourism markets for outbound passengers. It provides a faster mode of transportation increasing the number of possible leisure destinations given a tourist's utility function and limited vacation time. The ability to do leisure travel affects people's quality of life. The inbound tourism flows, through employment in supporting tourism infrastructure, affect the economy's *Demand Conditions*.

6.6.1 Impact of Leisure Passengers on Demand Conditions

Tourism industry is vital to the economies of many countries because it generates foreign exchange earnings, employment and linkages to other sectors such as transportation and entertainment industries. In fact, leisure passenger travel accounted for more than half of all trips taken by international visitors in 2006 [214]. The World Tourism Organization reported that 46% of the world's 850 million international visitors traveled by air in 2006 with the share of air transportation as a travel mode growing faster than transport over land or water [214].

Several countries rely on tourism spending for a substantial portion of their GDP. For example, as of 2005 the tourism receipts accounted for more than 10% of the country's GDP in the following economies: Fiji, Croatia, Albania, Antigua and Barbuda, Jamaica, Malta, Jordan, Seychelles, and Mauritius. Affordable access to air travel is integral to the overall measure of attractiveness of a leisure destination. In particular, the tourism industry of the island economies such as Fiji, Antigua and Barbuda, Jamaica, Malta, Seychelles, and Mauritius is dependent on the availability of air services. Either scheduled services or charter services operated by integrated tour operators are typically used by the leisure passengers.

6.7 Enabling Impact of Cargo

Cargo flights carry goods between economies and affect the Economy's *Demand Conditions*, *Capital* and *Firm Strategy*. Air cargo alleviates surface infrastructure deficiencies by providing fast and reliable transportation for high-value and perishable products.

6.7.1 Impact of Cargo on Capital

Inbound air cargo enables businesses to improve their physical *Capital* stock by providing a reliable transportation mode for high-value equipment, machinery and spare parts.

6.7.2 Impact of Cargo on Demand Conditions and Firm Strategy

Air transportation enables access to markets and affects the corresponding *Demand Conditions* for those goods for which speed adds value. By enabling access to markets, air cargo affects *Firm Strategy* by allowing businesses to obtain the benefits of the local economy, such as low-cost production, while satisfying and stimulating the demand of affluent consumers abroad. For example, air cargo is used for fast delivery of high value-to-weight manufactured goods with short product life cycles. In particular, microeconomic analysis of electronics firms in Southeast Asia by Leinbach and Bowen concluded that industry's reliance on air cargo services depended on product type, distance from forward and backward production linkages, product cycle times (obsolescence) and firm strategy (e.g., just-in-time production) [132]. Therefore, air cargo is used extensively by the semiconductor industry whose products have high value-to-weight ratios, very short product life cycles and are more susceptible to damage associated with sea freight. Conversely, consumer electronics are usually shipped using sea transport since they are bulkier, have less value and are characterized by longer product obsolescence cycle [132].

In addition to perishable electronics, air cargo is used for both routine and occasional shipments of high-value agricultural products to international consumers. Use of air cargo supports successful production of agricultural products in regions from which shipment via other methods is not viable. It is estimated, that up to 15% of worldwide air cargo is made up of perishable and exotic products [202]. Flowers and fruit from Colombia and Kenya destined respectively for the U.S. and European markets are examples of routine air cargo. Colombia is the largest flower exporter in the world after Holland, generating an income for around 800,000 people [72]. In Kenya, exports by air of agricultural products, in particular leguminous vegetables and cut flowers, are one of the countrys largest industries and the second biggest (after tea) foreign exchange earner [3]. In fact, air-freighted horticultural produce accounts for around 10% of the value of Kenya's trade [194] and Kenya's flower industry provides vital income for up to two million poor people [72].

As was shown in the case study of Chile, air cargo plays an important role in Chilean agricultural sector. In fact, a comprehensive study of Chilean firms found that 28% of sales were directly dependent on good air transport links [108]. The analysis of freight data for Florida showed that perishable foodstuffs, including fresh or frozen fish, seeds for sowing, fruit, vegetables and flowers comprised the majority of Chilean air exports to affluent consumers in the United States [94]. Cost is a major factor in providing a feasible transportation mode for perishable products. For example, high fuel prices in 2008 prompted some Chilean producers to ship seafood frozen by sea instead of using the traditional air cargo services [45]. The demand

for higher-value agricultural products is also particularly sensitive to economic recessions at the destination as was discussed in Chapter 5 [84].

Access to air cargo services affects the *Demand Conditions* by enabling access to additional markets by providing a different distribution mechanism such as next-day delivery.

6.7.3 Impact of Cargo on Firm Strategy

Access to air cargo enables more efficient production practices and affects *Firm Strategy*. For example, since air transportation is fast and reliable, it can be used for emergency delivery of products for reduced inventory and just-in-time production practices. The availability of efficient emergency and routine transportation of high-value components allows for disintegration of production of components and semi-processed parts as part of an integrated supply chain. Access to air cargo allows firms to gain competitive advantage by using the low-cost local labor and fast transportation access to main markets for perishable manufactured goods, such as clothes and electronics manufacturers in China for the U.S. consumers. Air cargo allows businesses to be more responsive to customer needs through efficient return and exchange procedures. Access to air cargo introduces robustness to demand variability and allows firms to quickly take advantage of new market opportunities since changes in the air freight links require minimal infrastructure investment.

Air transport is often viewed as a premium, emergency-type service that is used when all else fails. In particular, it is often used for emergency delivery of components in just-in-time manufacturing when the cost of stocking-out is too high. For example, Sanyo has been using reduced inventory practices since the late 1980s. However, when the Kobe earthquake struck Japan in 1995, Sanyo found its distribution chains severely disrupted. To avoid shutting down the production line, Sanyo used emergency shipments by air to keep the supply chain active [93].

6.8 Summary of Air Transportation Impacts

Figure 6-6 summarizes the relationship between individual Air Transportation Flows and their enabling impact on the respective Economic Attributes. While the impact at the individual economy level varies between regions, this table summarizes all of the possible linkages identified during the analysis. In particular,

	Capital	Skilled Labor	Unskilled Labor	Firm Strategy	Demand Conditions
Business	X	X		X	X
Personal Business	X	X	X		X
Leisure					X
Cargo	X			X	X

Figure 6-6: The relationship between Air Transportation Flows and Economic Attributes.

- Inbound Business Passengers enable the flows of labor, services, knowledge and investment affecting the economy's *Capital*, *Skilled Labor* and *Firm Strategy*. Outbound Business Passengers enable the flows of

investment, services and knowledge affecting the economy's *Capital*, *Skilled Labor*, *Firm Strategy* and *Demand Conditions*.

- Personal Business Passengers enable the flows of investment, knowledge, labor, services, and remittances affecting the economy's *Capital*, *Skilled Labor*, *Unskilled Labor* and *Demand Conditions*. The major purpose of travel for Personal Business Passengers is visiting friends and relatives, health, migrant, and education-related trips.
- Leisure Passengers affect the Economy's *Demand Conditions* by enabling the tourism flows between economies.
- Cargo flights carry goods between economies and affect the Economy's *Capital*, *Firm Strategy* and *Demand Conditions*. Air cargo alleviates surface infrastructure deficiencies by providing fast and reliable transportation for high-value and perishable products.

Depending on the combination of unique economic and air transportation attributes, different mechanisms dominate the relationship between air transportation and economic activity. As a result of these unique attributes, the nature of air transportation flows differs for each economy pair. In particular, the share of visits for a specific purpose varies significantly between individual economies. For example, leisure passengers account for 80% of the visitors to Jamaica while the primary purpose of visit for more than 70% of Russia's visitors is visiting friends and relatives [79, 213]. While particular air transportation flows dominate the enabling impact of air transportation in some economies, such as the impact of inbound leisure passengers on Jamaica's demand conditions, it is more difficult to evaluate the enabling impact in geographically large and economically diversified countries. For example, because of the ubiquity and maturity of the air transportation system and variability in the economic activity and attributes across geographic regions in the U.S., the enabling impact of air transportation flows varies substantially between the regions.

Chapter 7

Model of Tourism Impact in Jamaica

This chapter describes a quantitative system dynamic model of the evolution of the enabling impact of tourism in Jamaica. The purpose of this quantitative dynamic model is two-fold: to model quantitatively the evolution of the enabling impact of air transportation in an economy and to illustrate the feasibility of the modeling approach. In particular, even though the model was developed and calibrated to capture the impact of the inbound leisure passengers from the United States to Jamaica, the model can be used to describe the enabling impact of tourism in other economies with similar dynamics.

In particular, the following was performed. First, a model was constructed to capture the interactions between the volume of tourists, the attractiveness of air travel and the attractiveness of Jamaica as a leisure destination. The dynamic relationships in this model were derived from the analysis of the trends of the Jamaica's tourism industry. Second, the model was tested against the available data. Third, the model was used to evaluate the long-term impact of air tourism in Jamaica and the impact of several policy variables.

7.1 Introduction

Air travel is the primary means of reaching Jamaica by overnight visitors. The following enabled flows were identified during the case study analysis of Jamaica reviewed in Appendix A: the enabled flows of tourism and remittances. Tourism flows are the dominant enabled flows in Jamaica as is evidenced by the fact that almost 80% of the people visiting the island declare leisure as the primary purpose of their visit [213]. These enabled flows of tourists directly impact Jamaica's economy through spending and by providing employment in the service sector. Jamaica's tourism industry grew substantially over the past several decades and in 2007 dominated the country's service sector with tourism revenues contributing 20% to the country's GDP [41]. As was described in the case study of Jamaica in Appendix A, in addition to the enabled flows of tourism, personal business passengers and the resulting enabled flows of remittances also account for a substantial share of the country's GDP. In comparison, the economic impact of the enabled flows of business passengers is comparatively small. Since the enabled tourism flows dominate the enabling impact of air transportation in Jamaica, the scope of the model developed in this chapter is limited to evaluating the long-term impact of air tourism in Jamaica.

The leisure travelers gain access to the island through two of its international airports: Norman Manley

Figure 7-1: Jamaica is a lower middle income island economy in the Caribbean of fewer than three million people. In 2005, almost 1.5 million international overnight visitors traveled to the island, the majority of them for leisure purposes [213]. The map has been obtained from [41].

International Airport in the country's capital Kingston and Sangster International Airport in Montego Bay — Jamaica's busiest airport and primary tourist destination. Jamaica's air transportation development is closely tied to the growth of its national airline Air Jamaica which was launched in 1969 and has played an important role in providing air transportation access to the island ever since. As of 2007, according to the Air Jamaica website, the carrier operated a total of twenty-six destinations worldwide including the United Kingdom, Canada, and the United States and accounted for 55% of all passengers to Jamaica. The island's air transportation needs are also served by foreign carriers, primarily from the United States. The air travel and freight need, or air transportation demand, between Jamaica and the rest of the world is primarily generated by foreign travelers. In particular, the country's tourism industry is highly dependent on the U.S. market with the U.S. nationals accounting for 73% of all tourist arrivals in 2002 [37]. Because tourists from the U.S. dominate the tourism flows to the island, it is assumed in further analysis that the aggregate relationship between vacationers from a high-income economy and Jamaica's attractiveness as a leisure destination can be captured by analyzing only the U.S. market.

Air travel demand is affected by several factors including the availability of air transportation services and attractiveness of Jamaica as a leisure destination. Over the years, the Jamaican tourism industry has been continuously evolving attracting a different kind of visitor reflecting the change in the island's attractiveness as a leisure destination [161].

One of the major changes in the Jamaican tourism industry was the introduction of all-inclusive hotels. These hotels first appeared in 1976 and were primarily responsible for the growth of the tourism industry in Jamaica ever since. In 2004 all-inclusive resorts accounted for 53% of all rooms available [99]. The all-inclusive concept was first introduced to Jamaica in 1976 as a full service tourism product designed to eliminate extra charges which may typically be incurred during a vacation. In the Caribbean today, the all-inclusive resorts cover practically everything a resort has to offer including accommodation and all food, land and water activities, transportation, equipment with instruction, drinks and tips [121]. There are different types of all-inclusive accommodations in Jamaica which appeal to different types of tourists including singles,

couples, families, and high-end vacationers. While the cost of staying at all-inclusive hotels is comparable to other types of accommodation, a 1996 UN report found that the expenditure of tourists staying in all-inclusive resorts tends to leak outside of the local economy as opposed to other types of accommodation [99]. In other words, individual tourists staying in all-inclusive resorts tend to have a smaller economic impact on local demand conditions when compared to tourists staying in other types of accommodation.

Many of the new all-inclusive resorts were built on Jamaica's norther beaches, including Negril, Montego Bay and Ocho Rios, to be easily accessible by tourists through the connections provided at the international airport in Montego Bay. Some of these areas, including Montego Bay and Ocho Rios, also serve as ports for large cruise liners [67]. As a consequence of growth in activity around these marine ports, the area's coral reefs and water quality degraded over the years. In particular, the marine environment degraded due to poor sewage and solid waste disposal practices, sedimentation from coastal construction, habitat loss and physical damage from boat anchors, as well as diving and snorkeling activities [27]. In an effort to minimize degradation and promote sustainable use the government began to devise environmental policies in the 1990s. However, according to an environmental study by Bunce et al., many of these policies were never actually implemented or enforced [27].

In recent years Jamaica's tourism industry had to compete with an increasing number of other worldwide leisure destinations. Over the last thirty years there was an increase in the number of possible worldwide leisure destinations because some governments opened their economies to international visitors. At the same time, leisure air travel became more affordable because the average price of air tickets decreased over the years while the per-capita income of the holidaymakers increased. In fact, the data in Figure A-15 in Appendix A show that the average price paid per passenger-mile by the U.S. holidaymakers decreased in real terms from 8 cents per mile in the 1970s to less than 4 cents per mile in year 2000 while the disposable income of U.S. consumers increased. While the nominal price of air services decreased, the worldwide air transportation network grew providing access to an increasing number of leisure destinations in other parts of the world. An increase in the number of other leisure destinations had a negative impact on Jamaica's attractiveness as a tourism destination. Specifically, despite the general growth in the number of inbound leisure passengers, the Jamaica's share of the tourism market and the year-on-year growth rates have been decreasing since the mid-1990s. In particular, in terms of world tourism expenditure, between 1983 and 2000, Jamaica's share declined from 0.39 to 0.28 percent [209].

In addition to competition from other leisure destinations, the tourism industry in Jamaica also competes with the cruise industry. The competition from the cruise industry has the greatest effect on Jamaica's all-inclusive accommodations because both provide all-inclusive packages for the holidaymakers [121]. The Caribbean cruise industry has been growing in recent years and in 2004 accounted for 44% of the total number of international tourist arrivals to Jamaica [213, 121]. In comparison, the cruise industry accounted for only 35% of all arrivals in 1995 [213].

7.2 Model Scope

Since the enabled tourism flows from the United States dominate the enabling impact of air transportation in Jamaica, the scope of the model developed in this chapter is limited to evaluating the long-term interaction between the impact of leisure passengers from the U.S. and attractiveness of Jamaica as a leisure destination.

In particular, several long-term trends which affect tourism attractiveness and were described in the previous section were modeled: development of the all-inclusive hotel industry, competition from the cruise industry and competition from other leisure destinations. Other trends affecting the industry included crime and exchange rate fluctuations. However, since the effect of these variables is relatively short-term and the available data are rather limited, these interactions were not included in the model. The model is described in detail in the next section.

7.3 Model Structure

The purpose of the model is to describe the evolution of tourism impact in Jamaica by capturing the relevant dynamics in simulation. The model's outline is shown in Figure 7-2. The model assumes that a person's predisposition to travel for leisure purposes is determined by sociodemographic characteristics and can be captured using the *Propensity to Air Travel* variable [42]. Specifically, the exogenous *US Population* and *US GDP* variables determine the level of disposable income and hence their *Propensity to Air Travel*. In addition to air travel, holidaymakers may choose other transportation modes, such as the cruise industry or automotive travel. This effect is captured by the exogenous variables *Competition from Other Modes*. Finally, the number of *Air Tourists to Jamaica* is determined by the total *Potential Air Traveling Population* from the United States and the endogenous *Jamaica Tourism Attractiveness*. Since Jamaica competes with other leisure destinations based on air ticket price, the number of *Air Tourists to Jamaica* can also be influenced by the *Effect of Change in Price of Airline Tickets*.

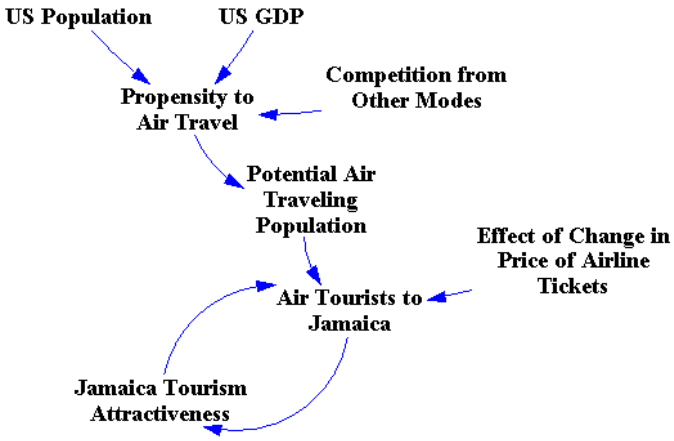


Figure 7-2: Model Outline.

7.3.1 Tourism Attractiveness

According to the Encyclopedia of Tourism, several variables can influence tourists' choice of a particular destination. These consist of (1) attractions, such as scenery, climate, historic sites, culture, sport, entertainment facilities, (2) accessibility, which is defined as the relative ease or difficulty of reaching the destination, (3) tourism infrastructure and amenities, such as availability and quality of local transportation, accommodation

and shopping facilities, (4) image, which is influenced by marketing and includes qualities such as safety and exoticism, and (5) price [42].

The main feedbacks between *Air Tourists to Jamaica* and *Jamaica Tourism Attractiveness* are shown in Figure 7-3. The model has two reinforcing loops: *Popularity* and *Tourism Expansion*. The *Popularity* loop reflects the following dynamic: an increase in the number of tourists to the island increases the island's name recognition which increases its popularity as a vacation destination. The *Tourism Expansion* loop reflects the following dynamic: an increase in the number of tourists results in additional demand for accommodation facilities and hence results in investment into hotel infrastructure which ultimately affects room availability.

The model has three balancing loops: *No Space*, *Natural Deterioration*, and *Economic Growth*. The *No Space* loop accounts for the crowding effect: as more people travel to the island, the amount of *Beach per Person* decreases. The *Beach Quality* loop reflects the environmental degradation of the natural resources: *Beach Quality* decreases as the number of people using the beach increases. The *Economic Growth* loop captures the effect of tourism expenditure on the destination's attractiveness. Specifically, an increase in tourism expenditure results in a positive impact on the country's GDP and hence increases the *Cost per Day* of staying at the destination thereby decreasing the destination's attractiveness.

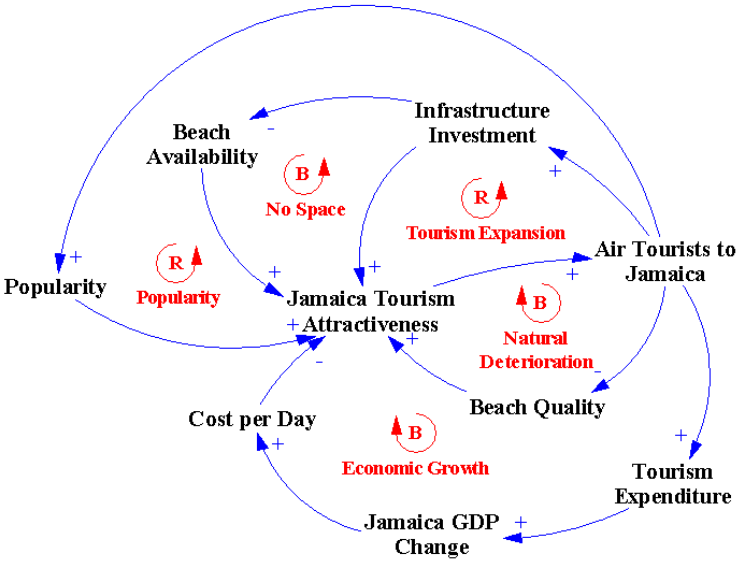


Figure 7-3: Feedbacks affecting *Jamaica Tourism Attractiveness*.

Tourism Infrastructure

Tourism infrastructure data are available starting in 1988 from the Annual Reports published by the Jamaica Tourism Board [122]. In addition, statistics on the average length of stay and room occupancy are available from the World Tourism Organization starting in 1995. These data are presented in Appendix K.

The model considers two types of tourism infrastructure investment: all-inclusive and other hotels. These accommodations differ in their use of *Beach Requirements* and the magnitude of local economic impact. According to a recent study of Jamaica's tourism industry, all-inclusive hotels tend to have larger beach

requirements and smaller local economic impact due to larger leakage effects when compared to other types of accommodation [99, 196]. It is assumed in this work that hotel infrastructure adjusts accordingly to match the perceived number of tourists to the number of rooms available on the island. It is also assumed that there is a one year adjustment delay since the statistics for previous year are available only at the beginning of the next year.

Natural Attributes

It is difficult to give a precise measurement of how much of the total beach area in Jamaica is dedicated to hotel infrastructure. However, since most of the hotels, both inclusive and other types, are concentrated around certain areas, one is able to approximate the density of the hotels in those areas and the resulting occupied beach area. In this work, the hotel types and current room availability were investigated for the hotels around the Montego Bay area. The number was then scaled to the island as a whole based on the Montego Bay's share of the hotel rooms.

The literature search produced no reliable sources of data for quantitatively describing Jamaica's beach quality and degradation. In fact, a publication about reef management in Montego Bay [27] provided no quantitative data about the actual reef conditions. Neither did the references in that publication. In general, environmental data are notoriously difficult to find for developing economies and can be collected often only through field-study research. Therefore, in this model it was assumed that beach quality deteriorates at a certain rate based on the number of people visiting the beach and can potentially be improved through implementation of sustainable reef management practices.

Impact of Crime

Crime rate may have an impact on tourism attractiveness. For example, Alleyne and Boxill used statistical tools to describe the relationship between tourist arrivals and changes in the crime rate in Jamaica over the period 1962–1999 [8]. Their analysis showed that crime rate had a negative impact on tourism arrivals. Their analysis also showed that the total impact of crime rates on tourism attractiveness was relatively small since tourists, especially those visiting all-inclusive resorts, were isolated from the general population [25]. Since an increase in the crime rate was shown to have little impact on the number of tourists staying in all-inclusive hotels, which accounted for the majority of accommodations on the island, the impact of crime on tourism attractiveness was excluded for the purposes of this simulation.

Economic Impact

The enabled inbound tourism flows affect the economy's demand conditions and GDP through employment and spending in the supporting tourism infrastructure. Tourism expenditure data are available starting in 1992 and are summarized in Appendix K. In order to accurately estimate the *Cost per Day* parameter, one should use historic data on accommodation costs. If these data are not available, this parameter can sometimes be approximated by the local GDP per capita, assuming that the accommodation cost increases with the cost of living. However, the analysis of recent data trends in Figure K-8 in Appendix K shows that this assumption does not hold for Jamaica. Therefore, since no reliable sources of historic data were found, the parameter was kept constant in the simulation.

Depending on the model's purpose, one may want to develop a more extensive economic impact module including the feedback effects to the local employment and household expenditure. Since the purpose of the model developed here was to evaluate the aggregate long-term impact of tourism, the model's scope did not include such level of detail.

In particular, in more detailed model implementations one may want to capture the effect of exchange rate fluctuations on the *Cost per Day* parameter and the resulting inbound tourism demand. For example, the World Bank study found that the declines in the tourism expenditure growth rates in Jamaica coincided with the periods of appreciation of the Jamaica's local currency [209, p. 154]. Generally speaking, appreciation of the local currency, or increase in its value, tends to decrease destination attractiveness because it effectively increase the cost of staying at the destination for foreign visitors. Such analysis can be particularly beneficial for the policymakers, since the currency rate is typically controlled by the government.

7.3.2 Model Constructs

The model's main constructs were based on standard formulations typically employed in the system dynamics literature. The feedbacks affecting the *Jamaica Tourism Attractiveness* and summarized in Figure 7-3 were captured by multiplying the corresponding *Effects* variables shown in Figure 7-4. This is a standard model construct used to describe the effect of various variables on a reference variable Y described in Chapter 13 of the *Business Dynamics* textbook, i.e. $Y = Y^{\star} *$ Effect of X_1 on $Y *$ Effect of X_2 on $Y * \cdots *$ Effect of X_n on Y [180, p. 525]. The *Yearly Tourists to Jamaica* is then a function of *Potential Air Traveling Population* multiplied by the *Trips per Year for Average Tourist* and the *Fraction of Potential Air Tourists Choosing Jamaica*.

Other standard constructs used in the model included the coflow structure described in Chapter 12 of the Business Dynamics textbook [180]. The coflows were used to trace the beach requirements for each type of hotel infrastructure. The model also used the Adjustment to a Goal formulation to adjust the level the hotel infrastructure investment [180, p. 523].

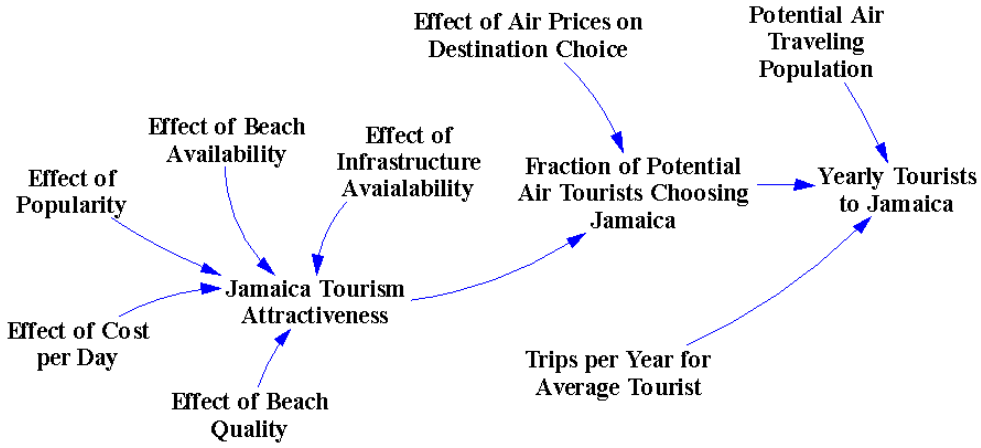


Figure 7-4: Implementation of the model's constructs.

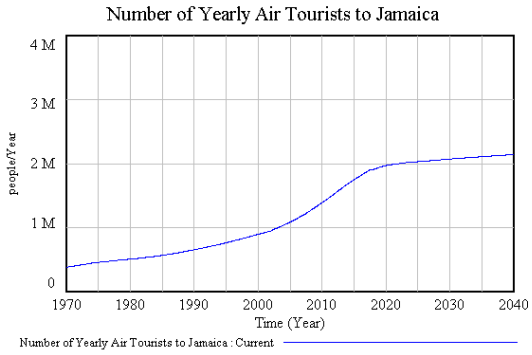
The time horizon for the model was 1970–2040: historic data were used for the 1970–2005 time period

and 2006–2040 was the forecast period. Since data availability was intermittent over this time period, some of the data had to be estimated or extrapolated to proceed with the testing. The data are described in detail in Appendix K. The initial simulation year was set at 1970 because (1) some of the data, including air passenger, ticket costs, and the U.S. economic data, are available starting in the 1970s, and because (2) infrastructure investment into all-inclusive hotels was initiated in the late 1970s as well. The annual tourism and accommodation statistics are available starting in 1992 from the World Tourism Organization, historic numbers were obtained from secondary data sources described in Section 7.1.

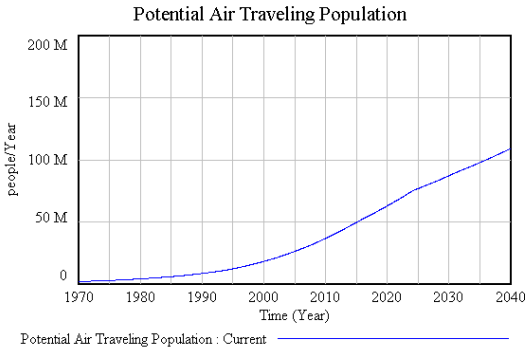
The model was then used to evaluate the impact of several policy variables. Some of the policy variables captured the effects of regulation of types of hotel infrastructure investment as well as zoning and construction requirements: *Fraction of Infrastructure to All-Inclusive Hotels*, *Beach Requirements of All-Inclusive Hotels*, and *Beach Requirements of Other Hotels*. A government's decision to improve the Jamaican beach quality was captured through the *Year of Starting Improvements to Improve Beach Quality* parameter. The model also had two exogenous policy variables, *Competition from Other Modes* and *Relative Airline Ticket Price*, which impacted the number of *Air Tourists to Jamaica*.

7.4 Results

The reference mode is shown in Figure 7-5. In the reference mode, the only hotel infrastructure investment is made into all-inclusive resorts and there is no policy to improve beach quality or change beach requirements of the hotels. Under these assumptions, the rate of growth in the number of yearly air tourists to Jamaica declines after 2010 despite the growth in the number of potential air tourists from the United States. These trends can be observed in Figures 7-5(a) and 7-5(b).



(a) Air Tourists to Jamaica.

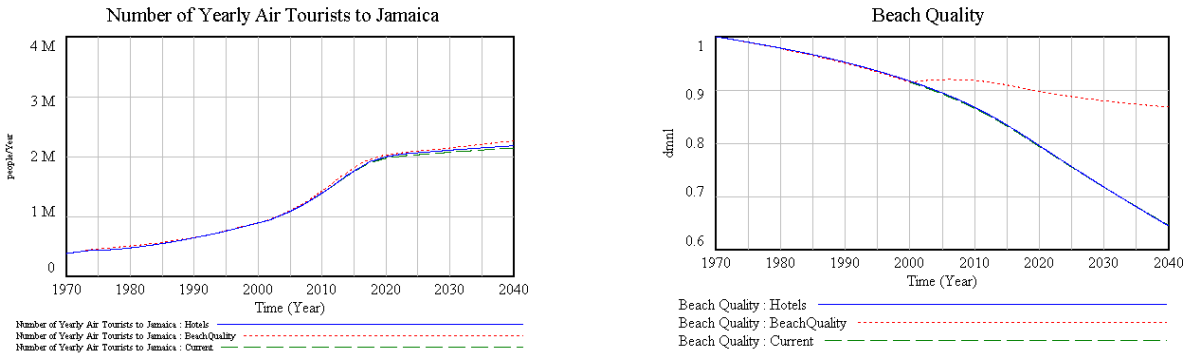


(b) Potential U.S. Air Tourists.

Figure 7-5: Reference mode: the number of air tourists to Jamaica exhibit *S-shaped growth* typical of many constrained systems.

The effect of changes in beach quality starting in year 2000 is investigated next. These results are shown in Figure 7-6 and are labeled *BeachQuality*. As Figure 7-6(a) shows, the number of tourists does not increase significantly despite the marked improvement in beach quality past year 2000 as shown in Figure 7-6(b).

The effects of changes in beach requirements for new hotel investments and the resulting changes in the accommodation establishments are shown in Figure 7-7. It is assumed that as a result of these changes only

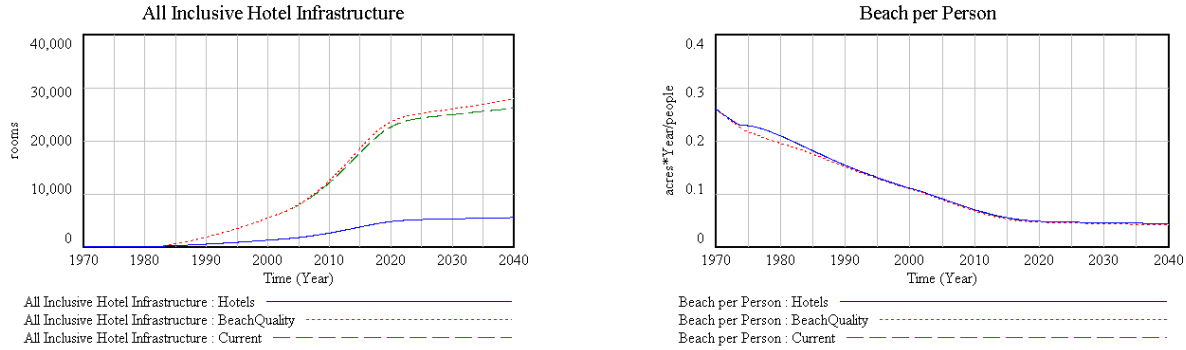


(a) Air Tourists to Jamaica.

(b) Change in Beach Quality.

Figure 7-6: Beach Quality improvements started in 2000.

20% of the new hotel investment is made into all-inclusive hotel infrastructure. This trend is reflected in Figure 7-7(a). However, despite the reduction in the number of all-inclusive hotels with their larger beach requirements, there is practically no difference in the amount of beach available per person as shown in Figure 7-7(b). Since the impact on the available beach space is relatively small, this policy does not markedly change the number of tourists visiting the island as reflected in Figure 7-6(a) under the label *Hotels*. It is important to note, however, that even though the number of actual tourists does not change significantly, the local economic implications of this policy can be substantial due to the differences in economic impact by the tourists visiting the two different types of accommodations.



(a) All-Inclusive Hotel Infrastructure is only 20% of all new hotel investment.

(b) The Resulting Beach per Person.

Figure 7-7: Hotel Infrastructure and Beach per Person.

Since the two policies presented above do not have a substantial impact on the number of tourists visiting the island, the *Beach per Person* parameter is the one that seems to have the largest effect on the tourism attractiveness. Since the potential demand for tourism continues to grow (see Figure 7-5(b)), the actual physical beach capacity negatively affects Jamaica's tourism attractiveness and hence constrains further growth of the tourism industry. In particular, the finite physical beach capacity is the primary reason behind the *S-shaped growth* dynamic observed in the figures above. In the *S-shaped growth*, the growth

is exponential at first, but then gradually slows because the system becomes constrained by the available resources. Many of the real systems exhibit *S-shaped growth* behavior. Examples of the *S-shaped growth* behavior include adoption of new technologies and population growth models in ecology where resources are constrained by the fixed carrying capacity [180].

While many of the systems exhibiting *S-shaped growth* behavior are limited by absolute constraints, in the case of Jamaica it is possible for the government to develop new beach areas to maintain the current *Beach per Person* levels and hence improve local attractiveness. Unfortunately, this policy is not sustainable in the long run because eventually beach development will be constrained by the physical capacity of the island. Moreover, this policy may lead to devastating environmental consequences. Therefore, this policy might ultimately be not beneficial to the Jamaican economy in the long run. Figure 7-8 shows the result of the simulation where physical capacity of the island, and hence the available beach areas, are increased by a factor of ten. The simulation is labeled *LargerIsland* in Figure 7-8.

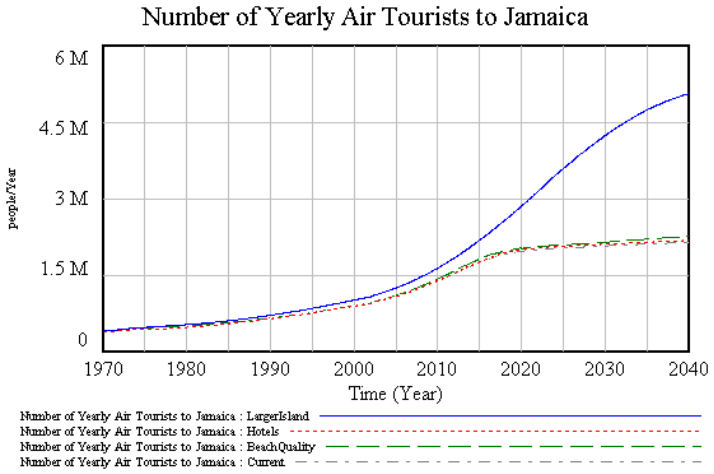


Figure 7-8: Impact of various policies on the number of air tourists to Jamaica.

The effects of two exogenous policy variables captured by the *Effect of Change in Price of Airline Tickets* and *Competition from Other Modes* in Figure 7-4 are tested next. The current implementation of these two exogenous policy variables is based on conservatively crude estimates. In the model, the impact of competition from other modes is captured by shifting a demand curve for potential air travelers. The *OtherModes* run in Figure 7-9 shows that if other transportation modes become more attractive compared to air travel, the number of yearly air tourists to Jamaica would decrease. Changes in air prices also have an impact on the number of comparable destinations available for the potential leisure passengers. The model assumes that the number of destinations increases with the decrease in the airline yield, or air ticket price per mile. This relationship is described in more detail in Appendix K. The airlines offering services between the U.S. and Jamaica may influence the relative price of tickets to Jamaica. In particular, the model's run *AirDiscount* in Figure 7-9 implements a policy of discounting the air fares by 30% compared to the price to other leisure destinations around the world during the Air Jamaica's privatization period between 1994 and 2000.

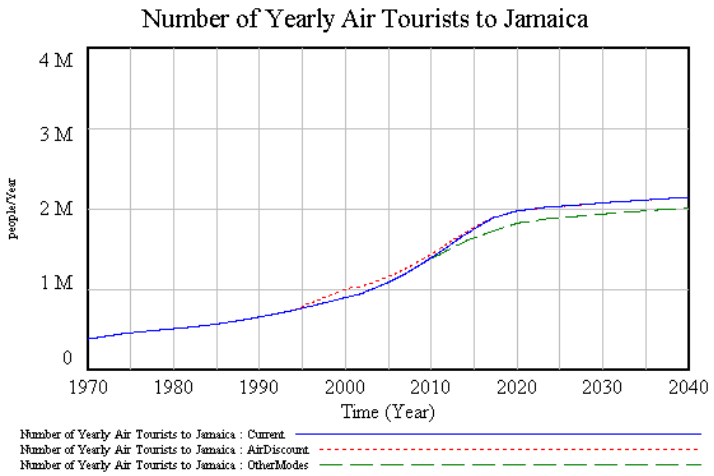


Figure 7-9: Tourism trends as a result of two policies: (1) *AirDiscount* discounts Jamaica's air fares by 30% between 1994 and 2000, (2) *OtherModes* introduces competition from other modes starting in 2010.

7.5 Model Uncertainty

A model can have two types of uncertainty: uncertainty in model formulation and uncertainty in the parameters. The uncertainty in model formulation was reduced by analyzing multiple tourism impact studies to identify the variables which affect tourism development. The uncertainty in the parameters was more difficult to address due to the limited data availability. In particular, the simulation parameters were based on real data where data were available and expert knowledge otherwise. Unfortunately, data availability is very poor for Jamaica, particularly environmental and infrastructure investment data, while the other data were available intermittently.

7.6 Model Recommendations

The model results suggest that the enabling impact of leisure passengers in Jamaica may have unsustainable long-term implications. Specifically, the model showed that natural capacity of the island serves as the binding constraint on the number of tourists it can support in the future. Several policies were tested to investigate their impact on future tourism development trends. They included investment into different types of accommodation facilities and improvement of beach quality. However, the impact of these policies on the total number of visitors to Jamaica was relatively small when compared to the implications of having a physical binding constraint.

Summarizing, the model results suggest that to sustain the attractiveness of Jamaica to tourists and continued economic contribution of the tourism industry it is important to implement policies which would help achieve a favorable level of tourism receipts without increasing the total number of tourist arrivals. In other words, a sustainable growth level of the tourism industry in Jamaica can be achieved if the island caters toward the high-end, as opposed to the mass market, tourism segment.

Instead, the data show that individual tourism receipts in Jamaica have been declining in recent years. In

particular, recent trends for individual tourism expenditure shown in Figure K-7 in Appendix K indicate that over the last 14 years individual expenditure declined by about 10% in constant dollars. This trend indicates that Jamaica may currently be going through one of the last phases of the destination life cycle described in [161], or the phase when the destination is visited by less affluent and less adventurous consumers. If the individual tourism receipts keep decreasing while there is an increase in the total number of visitors, the growth of the industry will hit physical capacity constraints even sooner.

7.7 Potential Model Improvements

Since a lot of the data are not available in printed or on-line sources, one way to improve the model's accuracy is through field study research and/or close cooperation with the Jamaica Tourist Board. In particular, field study research can be used to investigate tourism development trends in a given region, such as Montego Bay, as opposed to the island as a whole. The tourism trends might be very different in isolated locations since the economic conditions and natural attributes vary substantially between the regions. For example, the Tourist Board may be interested in comparing, for example, Kingston's and Montego Bay's tourism infrastructure and beach quality.

The developed model captured the relevant dynamics which described the evolution of air tourism impact in Jamaica. The model, despite its simplicity, can serve as a stepping stone to describe the interaction of the tourism and other sectors in the local economy. For example, the dynamics captured in this model can be used to improve the Millennium Institute T21 model for tourism sector in Jamaica. The model developed by the Millennium Institute captures crime and labor quality dynamics, but does not capture some of the feedbacks described in the current model, such as environmental and popularity effects. Since T21 model includes other economic sectors as well as employment, the combination of the two models would result in the improved assessment of the economic impact of the tourism sector on Jamaican economy.

Another extension to the model would be to include the feedback mechanisms between competition from other modes, such as the cruise industry, and the number of air travelers to the island. To understand these dynamics, it would be necessary to investigate in more detail if the cruise industry developed a new tourism market or if it instead captured some of the potential air tourists. In addition to the impact on tourism demand, some sources indicate that the impact of cruise ships is detrimental to the environmental health of the reefs due to inadequate sewage disposable and treatment near the beaches of Montego Bay [123]. In other words, in addition to the direct impact on tourism demand, the cruise industry may impact tourism demand through deterioration of *Beach Quality* which would negatively affect the island's attractiveness for overnight visitors and hence may have a positive impact on the number of cruise passengers.

Chapter 8

Summary and Conclusions

Air transportation usage has grown worldwide over the last several decades and has come to play an important role in the global economy. While the relationship between air transportation usage and economic activity is nonhomogeneous and complex, both the reviewed literature and the data analysis in this work confirm that they are interdependent. Air transportation provides employment and enables certain economic activities which are dependent on the availability of air transportation services. The economy, in turn, drives the demand for air transportation services resulting in the feedback relationship between the two.

The existing studies of the relationship between air transportation and economic activity have the following limitations: (1) the analysis is usually performed on a case by case basis and therefore does not provide a comprehensive description of interaction dynamics between air transportation and economic activity, (2) the studies describe the enabling impact of air transportation only in developed economies, (3) the cross-sectional statistical approach may not be appropriate due to the data limitations identified in this work, and (4) the studies do not describe in sufficient detail the air transportation system and factors which influence its development.

This research attempts to alleviate some of these drawbacks by providing broad-scope analysis of the interaction between air transportation and economic activity and by analyzing the factors which influence their development. Specifically, this work contributes to the understanding of the relationship between air transportation and economic activity in the following ways:

- Identifies and describes the types of growth patterns between air transportation passengers and GDP using broad-scope analysis of trends at the individual country level.
- Provides a description of air transportation development and the enabling impact of air transportation for twenty-two representative countries from varying income and regional categories.
- Identifies demand- and supply-side change factors which may stimulate or suppress air transportation system development.
- Describes the role of government intervention in the development of the air transportation system.
- Develops a framework for describing the enabling impact of air transportation.
- Develops a quantitative model of the enabling impact of tourism in Jamaica to explore positive and adverse consequences of air transportation.

The results of this work can help guide further development efforts, investment and policy decisions pertaining to air transportation usage especially in developing economies.

The Enabling Impact of Air Transportation

One of the contributions of this work is the framework which was developed to describe the enabling impact of air transportation. The advantage of this framework lies in the fact that it combines some of the well-established concepts from both the air transportation and economic development literatures. Hence, it can be used by the economic developers to understand and quantitatively model the enabling impact of air transportation. In this work the framework was used in Chapter 7 to develop a quantitative system dynamics model of the enabling impact of air transportation in Jamaica.

The outline of the framework is presented in Figure 8-1. The enabling impact of air transportation is defined as the total economic impact on employment and income generated by the economic activities which are dependent on the availability of air transportation services. The enabling impact of air transportation on a given Economy is achieved through Air Transportation Flows of passengers and cargo which occur between an Economy of interest and the Rest of the World. These Air Transportation Flows give rise to the Enabled Flows which are defined as flows that directly impact the Economy.

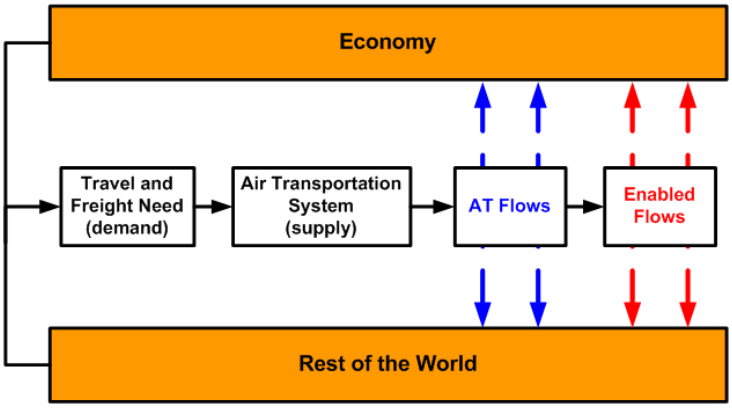


Figure 8-1: This feedback model describes the relationship between air transportation and economic activity.

During the case study analysis the following Enabled Flows were identified: *goods, services, knowledge, tourism, investment, remittances and labor*. These Enabled Flows impact a set of Attributes which are used to characterize a given Economy. The Economic Attributes consist of (1) factor conditions (2) business conditions, or the conditions in the nation governing how companies are created, organized and managed, (3) demand conditions, and (4) presence of related and supporting industries. The factor conditions can be of two types: general and specialized. The general factors are inherited and consist of land, unskilled labor, natural resources and geographical location. The specialized factors are created and are key to establishing the nation's competitiveness. They consist of capital, skilled labor, institutions and infrastructure.

The relationship between the flows and the economy's factor conditions, demand conditions and business conditions is described in detail in Chapter 6. In particular, the chapter describes in detail the mechanisms through which Air Transportation and the resulting Enabled Flows can change the following Economic

Attributes: factor, business and demand conditions. The following factor conditions were found to be affected by air transportation: capital, skilled and unskilled labor. As the Enabled Flows change the Economic Attributes, the Travel and Freight Need, or air transportation demand, between an Economy and the Rest of the World changes as well. The changes in potential demand affect the Air Transportation System Supply which is set by the airlines. The internal supply and demand relationship between the airlines and the potential passenger and freight need of the economies results in the physical Air Transportation Flows of passengers and cargo which take place between an Economy of interest and the Rest of the World closing the feedback loop.

Depending on the combination of unique economic and air transportation attributes, different mechanisms dominate the relationship between air transportation and economic activity. As a result of these unique attributes, the enabling impact of air transportation varies between economies. For example, tourism flows are the key flows enabled by air transportation in Jamaica while the enabled flows of labor dominate in Libya. This work showed that many of the enabled flows typically occur in diversified economies while many small economies usually have only a few of the enabled flows.

Air Transportation System Change Factors

Aggregate worldwide data analysis in Chapter 4 showed that air transportation development, and hence its impact on economic activity, can either be stimulated or suppressed. Twenty-two representative countries were chosen for further case study analysis to cover the breadth of interaction dynamics and investigate which factors were responsible for changes in the air passenger growth rates for different economies.

The subsequent analysis in Chapter 5 showed that both air transportation supply and demand factors can affect air transportation development. The key supply change factors consist of changes in the regulatory framework, infrastructure capability, vehicle capability and airline strategy. The air transportation demand change factors fall into two categories. First, are those which directly affect the demand: exogenous demand shocks, economic downturns, political and economic sanctions, competition from other transportation modes and civil unrest. Second, are those which affect the demand indirectly by changing the country's economic attributes through economic and institutional reforms, supporting infrastructure investment, exchange rate fluctuations, political and macroeconomic stability, and growing consumer demand. In addition to these indirect factors, other general factors helped stimulate air passenger development worldwide in recent decades. They included changes in management practices, liberalization and globalization of trade in manufacturing and services.

The Role of Government Intervention

While some of the change factors are uncontrollable, the analysis in this work showed that the government may play a significant role in the development of the air transportation system because it can influence both air transportation and economic attributes. The government affects air transportation system supply through changes in the regulatory framework, infrastructure capability, support of the national carriers and vehicle capability. The government directly affects the air transportation demand by investing into other transportation modes and by controlling the economy's political and economic interaction with the rest of the world. The government may also indirectly affect the air transportation demand by changing the

economy's factor conditions through economic liberalization, institutional and political reforms, supporting infrastructure investment and macroeconomic policy which includes exchange rate fluctuations.

Air transportation supply is set by the airlines whose decision to operate a particular route and pricing and scheduling of flights are influenced by their assessment of passenger and freight demand for the origin-destination market, their assessment of the route's profitability as part of the overall network, the capability of airport and navigation infrastructure, and the available airline resources. Local governments influence the competitive environment and airlines' willingness to operate through a variety of regulatory mechanisms: deregulation of domestic services, liberalization of international services, creation and support of government-sponsored national carriers. In addition, governments can affect infrastructure capability and airline operating costs through airport construction and expansion, compliance with international safety and environmental standards, upgrading the navigation infrastructure, operational incentives, such as tax incentives to promote operations in under-utilized secondary airports, and development of other transportation modes. Ultimately, the relationship between supply and demand determines the allocation of airline resources to a particular route. This relationship is subject to exogenous demand shocks such as wars and acts of terrorism, political and economic sanctions, changes in the visa requirements, perceived health risks, natural disasters, significant shifts in world financial markets or exchange rates, and oil shocks.

Since each economy is defined by a unique set of attributes, different governments pursue different types of incentives for economic development. Some of these incentives affect the air travel and freight need between an economy and the rest of the world and hence affect the type of the enabling flows which take place between the regions. For example, the governments of many tropical developing countries, such as Jamaica, consider the enabling impact of tourism to be an integral part of their developmental framework. In the case of Jamaica the government affected the demand for inbound leisure travelers by encouraging the development of supporting tourism infrastructure. The government also affected the air transportation supply by underwriting the national carrier Air Jamaica to ensure continued air transportation access to the island. Other countries, such as Chile and Dubai, consider air transportation development to be part of their economic diversification strategies. Their governments incentivized the growth of the enabled flows by changing the country's regulatory framework, promoting foreign direct investment and investing into supporting infrastructure development. For example, the Chilean government pursued changes in economic regulation to promote free-market export-oriented policies to gain access to new markets. These changes, which resulted in improvements in yield and higher productivity, coupled with the demand for high-valued agricultural products in the United States, helped to increase export-oriented agricultural production in the country. The development of the air transportation sector was in turn aided by international liberalization and privatization reforms. Similarly, the government of Dubai pursued changes in the institutional framework, invested into the supporting physical infrastructure, development of the aviation infrastructure and supported the expansion strategy of the national carrier in order to promote the growth of business and leisure passenger flows which enabled the flows of investment, high-skill labor, services, knowledge and tourism.

Air Transportation and Economic Activity are Interdependent

The analysis of aggregate and individual country-level data in Chapter 4 investigated the relationship between air transportation passengers and GDP. In particular, the data analysis of 139 countries over a time

period between 1975 and 2005 showed that the mutual growth behavior is the most common behavior between the two variables. In the majority of the countries with positive growth rates significant changes were observed both in the air transportation supply, such as changes in the regulatory framework and infrastructure capability, and the air transportation demand, such as economic liberalization reforms and supporting infrastructure investment. As was described in the previous section, many of these change factors can be directly controlled by the government. In particular, direct government intervention and support of the national carriers resulted in positive air passenger growth rates in the United Arab Emirates and Jamaica while the countries had negative GDP growth rates.

The mutual decline behavior of both air passengers and GDP was captured by the case studies of Bulgaria, Zimbabwe and Kuwait. The interaction between air passengers and GDP in these countries was characterized by several factors which negatively affected air transportation demand: economic downturns, civil unrest, macroeconomic and political instability. These economic factors also affected the air transportation supply. In particular, it was observed that in each of these countries air transportation development was suppressed by the insufficient fleet capacity which prevented the airlines from maintaining and modernizing their aircraft. In Bulgaria and Zimbabwe the fleet capacity was reduced due to the lack of capital while in Kuwait the fleet capacity was reduced after the Iraqis destroyed the airline's fleet following the invasion.

Several change factors were found to be responsible for behaviors characterized by positive GDP growth and decline in air transportation usage. Airline business factors and the resulting airline bankruptcy were primarily responsible for suppressed air passenger growth rates in Belgium, Switzerland, Bulgaria and Maldives. At the same time, the actual traffic flows to and from those countries did not decrease as much as the airline data seem to imply because the countries' air transportation needs continued to be served by airlines not registered in those countries. Airline business factors also played a role in the negative air passenger growth rates in the United States. These air transportation supply factors were exacerbated by the air transportation demand factors which included the terrorist attacks of September 11 and the economic downturn at the turn of the century. Meanwhile, the country's diversified economy continued to grow. Air transportation usage in Libya and Algeria was constrained for many years by geopolitical sanctions and security concerns which restricted the operations of both domestic and foreign carriers and reduced the demand for air passenger services. Meanwhile, the countries' GDP continued to grow because of the growing revenues from the hydrocarbons sector which accounted for more than quarter of the GDP in these two countries. The negative air passenger growth rates in Indonesia were primarily a result of the exogenous demand shocks which affected the number of international passengers traveling to and within the country. In particular, the demand was affected by the terrorism threats and changes in the perceived airline safety which decreased significantly in the 1990s. Meanwhile, the country's economy and GDP continued to grow except for a short-term economic downturn following the Asian financial crisis of 1997.

Implications for Further Development

This work showed that future air transportation growth in some regions may be suppressed from both the air transportation supply and demand sides. The following constraints affect the supply side: aviation infrastructure, political and environmental restrictions and limited supply of fuel. The following constraints affect the demand side: competition from other transportation modes, limited vacation time and physical limitations at the destination.

Airports traditionally have been built near major metropolitan areas and, as the urban areas grew, they often enclosed airport infrastructure within their boundaries. As a result of a long history of traffic growth, limited land availability and environmental constraints many of the most important airports could not be expanded and currently operate at nearly full capacity. For example, as was described in Chapter 5, the New York multi-airport system experienced sub-linear traffic growth and had the highest level of flight delays in the United States because of capacity saturation issues. Similarly, physical and institutional constrains prevented further capacity expansion at London's Heathrow airport. Because of these capacity constraints airlines have been prevented from taking full advantage of the recent EU-US Open Skies agreement which could have otherwise increased the number of services at these two airports and stimulated the air transportation growth between the two regions.

Airports operating at nearly full capacity have persistent flight delays which increase the effective cost of air travel to consumers and decrease the attractiveness of air travel as a transportation mode. In particular, unreliable air services may suppress air transportation demand and have an adverse economic impact on the regional economy because they affect the location decisions of businesses dependent on having reliable access to air transportation. In fact, in places where the air transportation system experiences persistent delays and is not reliable, alternative business and leisure locations may become more attractive resulting in significant changes in economic activity, regional employment and industry composition.

Physical infrastructure constraints are not the only factors limiting further growth. Other factors which may constrain further development include political and environmental restrictions as well as the limited supply of fuel. In addition to the factors limiting the air transportation supply, the market, or air travel demand, may become saturated as well. In particular, demand for air travel may saturate due to the competition from other transportation modes, such as the high-speed rail, which can satisfy the travel and freight needs on short and medium-haul routes. Leisure passenger demand may saturate as well because higher incomes do not necessarily generate more leisure trips since the ability to take additional trips will eventually be constrained by the limited vacation time. In addition, as was explored in more detail in the model of Jamaica's tourism impact in Chapter 7, physical limitations at the destination, such as the limited supply of beaches, may also reduce the destination's attractiveness and inhibit future growth of leisure passenger demand.

Appendix A

Case Studies

Twenty-two representative countries were identified during the worldwide analysis of air transportation and economic growth trends in Chapter 4. These countries cover the four major interaction behaviors between air transportation and economic growth. The countries also cover the three major trends present in air transportation development: stimulated growth, suppressed growth and average growth.

This chapter reviews air transportation development and change factors affecting its growth for each country. The case studies also describe in detail the relationship between air transportation and enabled economic activity at the individual country level. As was described in the feedback model in Figure 1-6 in Chapter 1, analysis of the enabled flows is one way of evaluating the enabling impact of air transportation. These enabled flows directly impact the country's economic activity by changing the economic attributes and hence affect the air passenger travel and freight need between that economy and the rest of the world. In this chapter, the enabling impact of air transportation at the individual country level is described by identifying the major types of enabled flows which take place between a given economy and the rest of the world.

The cases of stimulated air transportation development are described first. The first two countries are China and India. Both of these countries experienced rapid increases in the number of air passengers, particularly on domestic routes, following partial domestic deregulation and international liberalization reforms. In recent years, the domestic traffic also grew substantially in South Africa and Turkey. In Turkey, the traffic growth was also fueled by the growth of the national carrier which recently began to pursue an international expansion strategy. An expansion of the international networks of national carriers was also one of the major factors behind the high air passenger growth rates for the United Arab Emirates, Qatar, and Vietnam. The high growth rates in Laos were due to the fact that the country's aviation market was so small that a purchase of a single aircraft resulted in a substantial change in the number of carried passengers. The high-growth behavior in Ireland and Slovakia was enabled by the growth of the countries' low-cost carriers which were able to pursue an expansion strategy under the EU liberalized international aviation framework. Chile's air transportation development was also enabled in large part by changes in the aviation regulatory framework which changed in the early 1980s.

The countries with average air transportation growth rates are presented next. The representative countries are the United States, Jamaica and Kuwait.

The countries with suppressed air transportation development are described last. Air transportation development in Libya and Algeria was affected by political and economic sanctions which led to air services suspensions, raised security concerns and ultimately resulted in a drop in demand for international air services. Security concerns and perceived airline safety were some of the major reasons behind the decline in the number of air passengers in Zimbabwe. Negative air passenger growth rates in Indonesia were primarily a result of declining airline safety which affected air passenger demand. Air transportation development in Belgium and Switzerland was historically closely linked to the growth of their national carriers. Therefore, the traffic levels declined substantially when the carriers declared bankruptcy and ceased operations. The bankruptcies of the national carriers were also primarily responsible for the air passenger traffic dynamics in Bulgaria and Maldives.

Even though the countries studied here exhibited stimulated, average, and suppressed air transportation behavior in the long run, several of them had more than one type of temporal behavior over the thirty-year time period. For example, even though the total number of air passengers carried on Libya's airlines decreased between 1985 and 2005, Libya had a positive air passenger growth rate between 2002 and 2005. Therefore, both suppressing and stimulating change factors are identified in that case study. The analysis also helped identify factors which may have had or may have in the future a negative impact on air transportation growth by constraining air transportation development in several countries despite the overall positive growth of air passenger traffic. For example, the case study of China primarily describes the factors which helped stimulate the country's air transportation system development since the early 1980s. However, the analysis also identifies some of the suppressing factors which affected China's air transportation development during that time period. In addition, the analysis identifies several factors which resulted in short-term suppression of air transportation demand.

A.1 Stimulated Growth: China

As Figure A-1 shows, China's air transportation sector and economy have seen rapid expansion since the 1980s. Between 1985 and 2005, the average growth rates for the number of passengers carried by China's airlines and GDP were 15.8% and 9.6% [212]. During these years, the air transportation industry underwent several changes both in the regulatory framework and infrastructure capability. These changes allowed for the development of both international and domestic aviation markets. In particular, China's rapid economic growth and increase of the discretionary income of the emerging middle class fueled the development of domestic air travel demand.

Access to air transportation has played an important role in the country's economic development. In particular, air transportation aided in the development of the manufacturing sector because it provided access to foreign capital and knowledge and enabled flows of goods to major global markets. In recent years there has also been an increase in the quantity of expatriate travel as the government began providing incentives for high-skill diaspora to return to China. Ready access to air transportation has enabled these high-skill professionals to maintain cross-border networks abroad while taking advantage of the local opportunities in China. In addition to knowledge and capital flows from the diaspora, remittances have played an important role in the country's economy. While the majority of air passengers from China still travel for business purposes, as the country's economy continues to grow, air transportation has come to play an important role

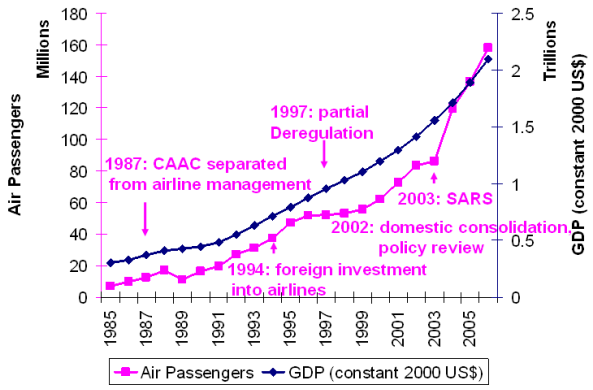


Figure A-1: China: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by China's airlines and GDP were 15.8% and 9.6%.

in providing access to tourism destinations for China's growing middle class. Access to air transportation has also been essential for the international tourists traveling to and within this geographically large country.

A.1.1 China: Air Transportation System Development

The regulatory changes in China's air transportation system reflect the general economic reforms in the country which started in the late 1970s. The major milestones in China's air transportation development are shown in Figure A-1. The first regulatory change occurred in 1980 when the Civil Aviation Administration of China was separated from the Air Force and came under the direct supervision of the state council [217]. Since then, deregulation, privatization and airline consolidation were encouraged by the government to increase operational efficiency and profitability of the airline industry. However, many of the industry's operational aspects still remain under governmental control.

China began deregulating its air transportation sector in 1987 when it separated the Civil Aviation Administration of China from direct management of airlines and airports and proceeded with further deregulation and privatization reforms in 1997. The civil aviation authority is promising full deregulation in 2010, but, as of 2007, the government maintained control over air fares and required a permission for entry to and exit from a route [217]. In particular, in order to slow the rapid traffic growth and strain on the infrastructure and the supply of skilled labor, the government stopped issuing new airline licenses until 2010. Despite these restrictions, there are indications that some of China's domestic markets have, de facto, been deregulated since the government accepted a hands-off approach to price regulation and requires prior approval for entry and exit only on routes with high traffic volume and routes linking only the busiest airports [217].

Extensive government regulation has been a major obstacle to the growth of domestic budget, or low-cost, airlines. The industry is still dominated by state-owned airlines, but several low-cost private airlines have emerged since 2004. Many of them, however, failed to operate profitably and had to adopt a more traditional business model to stay solvent [162]. The low-cost carrier development in China is suppressed mostly by extensive government regulation which includes governmental control over the prices of jet fuel, which are 20-30% above international rates, landing charges, aircraft purchases, and places restrictions on routes and fares [134, 188]. As a result of these controls, up to 80% of the costs associated with running an

airline in China are fixed [162]. In particular, state control of the landing fees prevents secondary airports from providing financial incentives to low-cost airlines as was done in Europe to attract budget carriers to underutilized secondary airports [134]. In addition, low Internet penetration rate, lack of credit cards, and a shortage of pilots and secondhand planes all stall low-cost carrier development [134]. As a result, as of 2006, low-cost carriers played only a minor role in China's aviation market accounting for less than 4% of the domestic traffic [162]. On the other hand, international low-cost carriers from other Asian countries have generally been more successful [188]. In particular, liberalization of bilateral air service agreements at the beginning of the century helped stimulate their development.

China is pursuing a cautious approach to liberalization of international services which are currently regulated through bilateral air service agreements. The government maintains strict limits on international passenger and cargo flights and is pursuing a gradual approach to opening its aviation market. By 2004, China had bilateral aviation agreements with 96 countries. In 2005 alone, 75 new destinations were made available [91]. In addition to restricting the number of airlines on international routes, China maintains strict control of the airspace with only about 30% of the country's airspace available for civil aviation as of 2006. According to the International Air Transport Association, this policy results in restrictive flight planning for domestic and international air routes over China which ultimately results in delays and increased cost to the airlines due to the waste of time and fuel.

When compared to the air passenger market, air freight market is more liberalized. In fact, all-cargo flights are scheduled to receive open-skies benefits around the end of the decade. For example, the U.S. and China are scheduled to sign an Open Skies agreement by 2011 [186]. Recent regulatory changes to air cargo industry included (1) privatization reforms in 2002 which allowed foreign investors up to a 49% stake in a Chinese company, as long as no one investor holds more than a 25% stake, and (2) more liberal air services agreements in 2004 which allowed entry of more international carriers and stronger competition with the Chinese carriers [186]. Despite the privatization reforms, it is still difficult for foreign airlines to gain access to the Chinese freight markets. For example, the development of China's first international joint venture, Jade Cargo, has been stalled by many bureaucratic hurdles [86]. In particular, even though the airline was ready to commence operations in 2004, its was forced to ground several of its new 747s for more than a year because extensive regulation prevented it from recruiting and licensing a necessary number of pilots [86]. In general, shortage of pilots and adequate aviation infrastructure have come to play an important role in China's aviation industry due to its rapid growth in recent years.

The growth in air traffic has put a strain on the existing aviation infrastructure and the country has been investing into new airports, runways, terminals, and surveillance infrastructure. China's airport infrastructure consists of 151 civil airports. The government is planning to raise that number to 240 by year 2010 — most of them regional [188]. Some of the recent airport investments were instigated by the 2008 Beijing Olympic Games and the 2010 Shanghai World Exposition. For example, the country's largest airport in Beijing opened a new terminal in February 2008 which doubled its capacity to 76 million passengers. Chinese infrastructure investment, including airport construction, is preemptive in nature since it is perceived as a necessary condition for economic development. In particular, China promotes regional aviation development with subsidies for small and medium airports and for airlines running short flight routes helping to balance its airline sector away from big trunk routes and eastern hubs [157]. According to the Civil Aviation Administration of China, government airport spending consisted of $14.9 billion for 1990-2005 and

is planned for $17.4 billion for years 2006 through 2011. To promote airport development, reforms have been initiated in 2002 to allow private sector involvement as well as international financing [91]. However, since some institutional reforms, particularly information transparency, are not yet in place, large international participation is lacking [215].

A.1.2 China: Economic Impact of Air Transportation

Until the economic reforms at the end of 1970s, China's economy was isolated from the rest of the world. After 1978, the Chinese government moved toward market-oriented economic development and opened the economy to foreign investment. The country quickly became an attractive investment location due to its good physical infrastructure, policies favoring foreign investment, availability of the low-cost labor and a large domestic market size. According to the 2007 Global Competitiveness Report, China was ranked at 34 among the world's 131 countries and had several problematic factors inhibiting business development [165]. These included access to financing, inefficient government bureaucracy, corruption, and policy instability. Air transportation has helped alleviate some of these deficiencies because it enabled access to foreign capital and knowledge flows. Air transportation also helped establish new consumer markets by providing a feasible transportation mode for high-value goods and tourists.

As was described in Chapter 1, the analysis of enabled flows is one way of evaluating the enabling impact of air transportation. These enabled flows directly change the country's economic attributes and hence affect passenger travel and freight need, or air transportation demand, between economies. In China, the following key enabled flows were identified: goods, investment, knowledge, tourism, and remittances. These flows were enabled by the air passenger and cargo flows which provided access to markets, people and resources. These enabled flows are described next.

Goods Flows

China's trade and cargo movements both by sea and by air have increased since the government started encouraging foreign investment into the country's manufacturing activities. In 2005, goods and services exports contributed 40% to the country's GDP [212]. Among the manufactured goods, Chinese high-tech exports have surpassed all other consumer goods in value shipped [186]. In 2005, they represented 58% of China's exports to North America and Europe as compared to a 38% share in 1995 [186]. Since China's economic growth continues to depend on exports of goods and services to international consumers, Boeing forecasts that in the next twenty years China will be the primary driver of global air freight flows based on projected domestic and international traffic [100]. Air cargo is often used to ship high-tech goods because they are time-sensitive and have high value. The majority of the goods exports from China are destined for the United States [61]. China's typical air export shipments to the U.S. consist of electronics, industrial machinery, power generation equipment, apparel and games [186]. In addition to providing access to new consumer markets, access to air cargo has enabled Chinese businesses to follow a new firm strategy. In particular, in recent years Chinese manufacturing began to transition toward final assembly and component integration manufacturing. This transition has been in part enabled by air cargo flows as evidenced by the fact that the fastest growing air exports from the U.S. to China currently consist of intermediate materials and capital equipment [186].

China's air cargo market experienced 19.6% average annual growth between 1990 and 2005 [100]. This growth in air cargo activity was supported by the liberalization reforms and relaxation of some ownership restrictions which took place since the turn of the century. These regulatory reforms also helped develop China's new air cargo hubs. Prior to liberalization, which included the 2004 bilateral air service agreement with the U.S., Chinese exports from the mainland were consolidated in Hong Kong for transport overseas [186]. Following changes in the regulatory framework, three other major centers have emerged in Beijing, Guangzhou and Shanghai [207].

Investment Flows

While China has a large low-cost labor force and good infrastructure, the country's economic development has been traditionally constrained by the availability of local capital [127, 165]. Because of the lack of local capital, foreign direct investment flows have played an important economic role in China since the government underwent economic reforms in the 1980s. In 2007, annual inflows of foreign direct investment rose to $75 billion with trade by foreign-invested enterprises accounting for 58% of China's total trade [61, 41, p. 48]. Foreign investment is enabled in part by the ready access to air transportation because high-speed transportation connection enables investors to monitor their investment to ensure positive returns, and allows them to improve productivity by hiring foreign experts.

Since undeveloped domestic capital markets force entrepreneurs to rely on the overseas capital, capital flows from the diaspora have also come to play a significant role in China's economic development [127, 218]. Personal business and business travel from these expatriates has been growing in recent years as the government implemented several reforms to encourage reverse migration. In addition to providing a source of capital, a growing number of Chinese expatriates returning home contribute knowledge and skills to the economy [127].

Knowledge Flows

Access to international knowledge pools has been traditionally perceived by the government as an important components of China's growth strategy. Air transportation access has been an important component of this strategy since Chinese students began traveling overseas. China sent its first students overseas in 1978 following government's decision to rebuild the country's scientific community after the decade of Cultural Revolution [218]. Since then, the number of Chinese students abroad grew dramatically. As of 2007, China was the second largest sender of students to the U.S. after India with over 67 thousand students studying during the 2006/07 academic year [106]. In fact, as of 1999, 25% of Chinese students nationwide entering graduate programs went abroad [218]. While air transportation can play an essential role in maintaining close personal ties with family and friends across borders, other institutional and economic restrictions may deter people from traveling. For example, because of the political and economic situation in China, only about one-third of the students returned to China until policy changes were implemented in the late 1990s [218].

Knowledge flows from the returning expatriates and students who studied abroad have increased since the 1990s. The flows increased because the Chinese government began to encourage scientists to return from overseas by allowing greater freedom of movement both internationally and within China, providing research grants, world-class facilities, and competitive salaries [218]. Market liberalization reforms, expansion of the private sector and provision of state funds to encourage overseas entrepreneurship by providing dedicated

and efficient facilities for high-tech firms provided additional advantages for the returning expatriates [218]. As a result of these initiatives, in the last decade there has been an increase in imported foreign capital and technology from the returning expatriates [168, 218]. The government is also promoting international collaboration with the remaining Chinese expatriates to benefit domestic economic growth [218]. In addition, knowledge and skills transfer occurs in the growing number of research centers run by Microsoft, Intel, Oracle and other multinational corporations [218].

Tourism Flows

China's inbound tourism has been steadily increasing since the 1990s except for the decrease in the arrivals during 2003 following the SARS epidemic [213]. About half of the international arrivals to the country are for leisure purposes and only about 12% of the tourists reach the country by air. However, over the last ten years, air travel has been growing faster than land or sea transportation modes [213]. There has also been an increase in the amount of domestic and outbound travel by Chinese nationals as leisure travel has been growing in popularity among the middle class citizens along with the growing number of destinations which became accessible by air. The World Tourism Organization forecasts that by 2020, China will have 100 million outbound travelers whereas in 2001 China's outbound travel market was only 12 million people [190].

Remittances

In 2007 China, with $25.7 billion in inward flows, was the second largest recipient of migrant remittances [1] in the world [211]. The number, though growing over the years from $6.2 billion in 2000, accounts for less than 1% of the country's GDP [212, 41]. Since the top three destinations for Chinese emigrants in 2007 were the United States, Singapore and Japan, access to air travel enables these migrant workers and expatriates to maintain close personal contact with their family and friends [211].

A.1.3 China: Conclusions

China's growing consumer markets and interaction with the rest of the world resulted in rapid development of both air passenger and cargo services over the last twenty years. The growth was in part stimulated by the reforms initiated in the mid-1980s which deregulated the domestic airline industry and resulted in expansion of the domestic network following the creation of new airlines. To accommodate the rapid growth in demand, the government has been investing into the aviation infrastructure with particular emphasis on development of regional airport and aviation infrastructure to promote economic development away from Eastern hubs. In addition to development of regional airport infrastructure, infrastructure expansion projects were conducted in major centers including Beijing, Guangzhou and Shanghai.

International aviation development is still suppressed by bilateral agreements which restrict the number of routes and international airlines flying to and from the country. However, limited liberalization and privatization reforms were initiated near the turn of the century stimulating competition between the airlines. In particular, there have been extensive reforms in the air cargo industry with all-cargo flights scheduled to

[1] Remittances refer to transfers in cash or in kind from migrants to resident households in their countries of origin. Usually these are ongoing transfers between members of the same family, with persons abroad being absent for a year or longer [211].

be fully liberalized by the end of this decade. Limited liberalization of passenger markets in recent years has also allowed the low-cost international carriers to extend their operations to China.

Despite the general growth of China's air transportation, several suppressing factors which have constrained air transportation development have been identified during the analysis. First, the domestic deregulation has not been complete because some of the operational aspects of the industry remain under governmental control suppressing development of domestic budget, or low-cost, carriers. Second, foreign ownership restrictions have been preventing foreigners from investing into China's airline industry. Third, due to the rapid growth of the industry the country may be faced with the shortage of qualified aviation personnel, especially pilots, in the nearest future.

In addition to factors which have stimulated the growth of air transportation supply, China has had strong growth in air travel demand both for passengers and cargo. In particular, China's growing middle class and tourism awareness have helped stimulate domestic and outbound air travel demand. In addition, inbound travel demand has been growing following the institutional and political reforms in the 1990s which have resulted in greater knowledge and investment flows both from foreign nationals and returning Chinese expatriates. In addition to the institutional reforms, physical supporting infrastructure played an important role in the growth of these flows and the development of export-based manufacturing and services industries.

In China, air travel demand has been directly suppressed by exogenous demand shocks. In particular, the growth rate declined significantly in 2003 following the Severe Acute Respiratory Syndrome (SARS) pandemic which spread through China between November 2002 and July 2003.

The enabling impact of air transportation plays a significant role in China's economic development and reflects the country's unique factor conditions: growing market-oriented economy, well-developed supporting physical infrastructure, low-cost labor, and government support of foreign investment. Access to air cargo changes demand conditions by providing access to international markets for manufactured goods. The availability of air passenger services allows China to access foreign investors, it enables the flows of remittances, knowledge and investment from the diaspora, and helps enable inbound tourism as well as develop the domestic and outbound tourism industries.

China: Change Factors Summary

Stimulating:

- Domestic deregulation
- Liberalization of all-cargo flights
- Aviation infrastructure investment
- Airport capacity investment: both new and existing
- Regional (secondary) airport incentivization
- Institutional and political reforms
- Supporting infrastructure investment
- Growing consumer demand

Suppressing:

- Exogenous demand shocks: SARS epidemic in 2003

- Air Traffic Management: routing restrictions
- Air Traffic Management: shortage of qualified aviation personnel
- Ownership restrictions

A.2 Stimulated Growth: India

As Figure A-2 shows, air transportation development in India has been lagging economic development until the air passenger traffic experienced unprecedented growth starting in 2003. India is the largest country in South Asia and the world's second most populous country. While the change in the growth rate of air passenger traffic is relatively recent, the country's economy has experienced steady growth over the last two decades with an average rate of 6.0% between 1985 and 2005 [212].

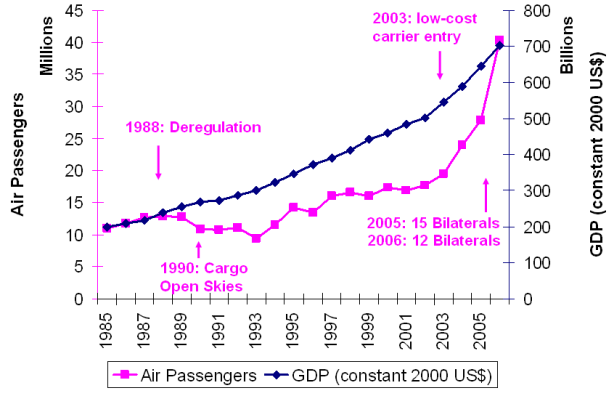


Figure A-2: India: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by India's airlines and GDP were 4.7% and 6.0%.

The recent increase in the air passenger growth rates has been primarily due to domestic deregulation and the ensuing development of low-cost carriers which led to a sharp drop in prices and enabled personal air travel for the country's growing middle class. In addition to domestic air passenger growth, India's international aviation flows have increased substantially in recent years following the signing of bilateral aviation agreements which enabled international airlines to gain access to India's aviation markets. India's economic liberalization also helped stimulate air passenger demand. Over the years, business passenger travel and foreign investors in particular have come to play an important role as India has continued to develop its services-based industries for international consumer markets. In addition to foreign investors, air transportation has enabled access to the extensive diaspora community affecting inward flows of capital, knowledge and remittances. However, despite the strong growth in recent years, India's future aviation development may be suppressed by poor aviation infrastructure and lack of skilled personnel.

A.2.1 India: Air Transportation System Development

Until the early 1990s Indian aviation needs were served by two inefficient state-owned carriers. The government started deregulating the industry in 1988 when it authorized operation of domestic charter flights

by private companies. By 1993 private operators had a 30% domestic market share [208]. However, it was only after 2003 that India's domestic aviation has experienced unprecedented growth rates following the entry of the first low-cost carrier Air Deccan which led to a sharp drop in prices and enabled personal air travel for the country's growing middle class [62]. According to the India's Ministry of Finance website, in 2007 private airlines accounted for around 60% of the domestic passenger traffic. Despite deregulation reforms, India's domestic aviation market deregulation has not been complete because some of the industry's operational aspects remain under government control. These include restrictions on fuel hedging, staffing levels, outsourcing and ownership [152]. In addition, the government does not allow investment in domestic airlines by foreign carriers and has a 40% cap on foreign equity investment in air transportation [152]. These restrictions may potentially suppress further development of the industry because they affect airline strategy and the resulting profits.

The majority of India's international services are regulated by bilateral air service agreements. India is gradually opening up to foreign airlines by signing more flexible bilateral agreements with other countries. For example, according to the Ministry of Civil Aviation, in 2005 India signed 15 bilateral air service agreements including the open-skies agreement with the United States. While the international passenger flows are still largely regulated, international air cargo flights have been operating under the Open Skies policy since 1990. Until the liberalization reforms were put in place, the demand growth was suppressed on many of the international routes because India's state carriers did not have sufficient capacity [181]. Following liberalization, foreign carriers were allowed to become the dominant operators on some of the city-pairs satisfying the previous demand levels and stimulating further growth in demand by improving route networks and lowering air fares.

Ultimately, the sustained growth of Indian aviation industry may be restricted by overcrowded airports, strained airspace infrastructure, antiquated ground handling equipment and a shortage of pilots and engineers [181]. India has a poor record of airport infrastructure investment in large part due to the bureaucratic hurdles. As a result, airport expansion projects are often initialized after the airport's capacity limits have been exceeded. Airports Authority of India currently owns and operates all of the country's 125 airports, of which 11 are designated as international airports[2]. In order to promote airport development, the government aims to attract private investment into aviation infrastructure. The public-private partnership was first used to build a new airport in Cochin in 1999. The strategy was also used to build new international airports in high-tech hubs of Hyderabad and Bengaluru. These two airports were opened respectively in March and May of 2008. The government is also planning to pursue public-private partnership to upgrade Delhi and Mumbai's airports and build a second international airport to serve the Mumbai catchment area.

A.2.2 India: Economic Impact of Air Transportation

India has a growing economy which underwent economic liberalization reforms in 1991. The country's economic attributes include democratic and inefficient government, poor infrastructure capability, institutional framework which supports information transparency and property rights, and a large pool of skilled English-speaking university graduates. The Global Competitiveness Index ranks India at 48 among the world's 131 countries [165]. The report lists inadequate supply of infrastructure, inefficient government bureaucracy,

[2]The primary source for the following description is India's Ministry of Finance website: *http://www.pppinindia.com/sector-airports.asp*

restrictive labor regulations, and corruption as the most problematic factors for doing business in India.

The poor condition of infrastructure is a major hindrance to growth of goods exports from India [62]. In particular, the lack of supporting infrastructure, including surface transportation, hinders the development of air cargo industry despite the international consumer demand for Indian products. For example, because of poor inland transport infrastructure and inefficient customs clearing procedures, India's agricultural exports to Europe cost the same as those from Chile even though Indian exports are 40% cheaper to produce [138].

Because of the lack of supporting infrastructure, air cargo has played a minor role in India's economic development. In comparison, air passenger travel has been used extensively to support the services industries which constitute India's major source of economic growth [41]. Air transportation is used to support the sector by providing access to labor, knowledge and capital. The availability of air services allows India to access markets, particularly in information technology, and foreign investors. Air transportation enables the flows of remittances, knowledge and investment from the expatriates and migrant workers and helps enable inbound tourism as well as develop the domestic tourism sector.

Services Flows

Services are the major source of India's economic growth, accounting for more than half of GDP with less than one third of the labor force [41]. The growth of the services sector has been fueled by the availability of well-educated low-cost English-speaking labor and demand for their services on international markets. India is a major exporter of software services and software workers: as of 2005, software services export was the country's largest export [10]. Access to air passenger travel has played an enabling role in the development of software industry in India starting in 1974 when local programmers began traveling to the United States to work at the client's premises. Since the 1990s the software export industry in India has expanded due to further political liberalization and local infrastructure development. Access to air transportation services has been an important component of the sector's development. In particular, air transportation enabled multinational corporations to setup offices in India and employ local workers instead of transferring them to the client's premises because air transportation enabled the employees to travel to other locations to share knowledge, expertise and training. In addition, the infrastructural and institutional developments in recent years have helped bring the workers back to India and expand the range of offered services to outsourcing of business processes, call centers, and research and development [10, p. 21].

Investment Flows

India traditionally provided little support to foreign investors while promoting indigenous entrepreneurship and innovation [127]. However, as a result of economic reforms in the 1990s, higher limits on foreign direct investment were permitted in a few key sectors including telecommunications [41]. In addition to changes in the regulatory framework, the government invested into dedicated supporting infrastructure to promote growth and development of niche technological clusters around the country. For example, Software Technology Parks of India were created to provide the necessary physical infrastructure, such as telecommunications, and institutional freedoms, such as 100% foreign equity investment and tax incentives, to promote export-oriented development of computer software and other professional services. According to the National Association of Software and Service Companies (NASSCOM), the software sector's contribution to the countrys GDP has been steadily increasing from a share of 1.2% in 1998 to 5.2% in 2007 [149]. In 2007, the sector employed

2 million people [149]. The changes in regulatory framework and supporting infrastructure investment increased the attractiveness of these export-oriented industries to foreign investors while air transportation enabled them to personally oversee their investment and pursue specific business development strategies such as outsourcing.

The software industry in India is dominated by several major domestic companies which include Tata Consultancy Services (TCS), Infosys, Wipro Technologies, and Satyam, each with revenues above US$1 billion. But in recent years subsidiaries of major IT multinationals, such as IBM and Accenture, have expanded their Indian operations. For example, IBM employed more than 60,000 people in India as of 2007 [9]. According to NASSCOM, nearly 75% of Fortune 500 and 50% of Global 2000 corporations source their technology related services from India with an increasing number of multi-national corporations outlining their investment plans for setting up R&D operations in India [149].

In addition to foreign investment flows from multi-nationals, air transportation has helped facilitate capital flows from the increasing number of returning diaspora entrepreneurs [148].

Knowledge Flows

Increased foreign investment flows, which are facilitated by air transportation, into India's services sector have resulted in international cooperation between branches and transfer of knowledge and skills from international high-skill professionals. Access to air transportation is also particularly important for the returning expatriates because evidence shows that they tend to rely more on cross-border networks for business leads and financing when compared to the local entrepreneurs [148]. In addition, the recent development of the domestic air transportation network allowed these entrepreneurs to adjust their business location decisions to rip the benefits of lower labor costs away from the largest technology centers.

Access to air passenger services enables Indian students to gain access to educational institution abroad. The number of students studying abroad has been increasing through the years. For example, in 2007, more than 84,000 Indian students enrolled into American colleges: more than 70% of them for graduate work [106]. While many of these students stay in the U.S. for employment, some of them return to India increasing the country's high-skill labor stock.

Remittances Flows

India has an extensive global diaspora which consists of both high-skill and low-skill workers. Air transportation enables family members to reside in different countries to seek better opportunities and use air travel to maintain close personal contact. For example, air transportation enables male migrant workers in the Middle East to regularly visit their families back in India. Remittances and investment from the diaspora as well as remittances from migrant workers, such as those in the Middle East, contribute to the GDP. In 2007 India was the largest recipient of migrant remittances in the world [211]. The $27 billion in remittances accounted for 2.8% of GDP [211, 41]. The United Arab Emirates, Saudi Arabia and the Untied States were the top three destinations for Indian emigrants [211].

Tourism Flows

Air transportation is often the only means of access to international destinations for tourists with limited vacation times. In India, more than 80% of the people visiting the country arrive there by airplane [213]. India's liberalized aviation framework and recent increase in air transportation capacity have helped to increase the number of tourist arrivals to the country to 4.5 million people in 2006 which contributed $8.6 billion to the GDP [214]. While the number of tourists is small for the country's size, the sector has been growing at above-average rates of greater than 10% in recent years [214]. In fact, the number of visitors has increased two-fold from 2.1 million tourists in 1995 [213]. More than 95% of these international tourists declare leisure as the primary purpose of their visit. Development of domestic air travel has also been essential to the international visitors since poor quality and unreliability of surface transportation in India have a negative impact on India's attractiveness as a leisure destination and may have previously suppressed the tourism demand.

In addition to leisure travelers, India has also become one of the major markets for medical tourism [43]. Some sources claim that 150,000 medical tourists, or 6% of all visitors, came to India for medical treatment in 2002, almost half of them from the Middle East [43, 213].

A.2.3 India: Conclusions

India is the second largest country in the world characterized by poor general infrastructure levels, the availability of low-cost labor, a large number of English-speaking engineers, government support of development of the information technology sector, and the institutional framework which guarantees freedom of information and protection of property rights. As a result of these factor conditions, the enabling impact of air passenger flows dominates over the cargo flows. The following enabled flows have been observed in India: enabled flows of foreign investment; enabled flows of remittances, knowledge and investment from the diaspora; enabled flows of international and domestic tourism; the enabled flows of services which arise because air transportation access changes the country's demand conditions by providing access to international markets for the exporting firms.

Domestic air services deregulation and introduction of low-cost carriers in 2003 were the major stimulating factors behind India's air transportation growth. In particular, poor level of other transportation infrastructure, growing consumer demand and reduced fares provided by the low-cost carriers enabled rapid growth of the domestic air transportation industry. Until 2003, insufficient domestic capacity was provided by the national carriers suppressing traffic development.

Additional stimulating factors included India's economic liberalization and privatization reforms in the early 1990s which affected both air transportation supply and demand. In particular, these reforms enabled both investment into the aviation infrastructure and development of export-oriented industries which rely on access to foreign capital and markets. In particular, supporting infrastructure investment into the high-tech clusters and institutional reforms ensuring copyright protection have enabled investors to increase foreign capital flows into export-oriented services industries.

Gradual liberalization of international passenger services has also stimulated the growth of international passenger traffic. In particular, it allowed foreign airlines to carry passengers on routes where the demand growth was suppressed prior to liberalization because India's national carriers had insufficient capacity

to satisfy the potential demand levels. India had a liberalized Open Skies framework for air cargo since 1990. However, the development of the air cargo industry has been hindered by the lack of reliable inland transportation infrastructure, handling facilities, and inefficient customs procedures which result in long turn-around times.

In general, deficiencies in aviation and airport infrastructure have negatively influenced India's air transportation development. However, recent ownership and privatization reforms have enabled the flow of private funds into the aviation sector and resulted in the construction of several new airports in major urban areas. Specifically, new investments included the construction of greenfield airports in Cochin in 1999, Hyderabad and Bangalore in 2008, and a second international airport to serve the Mumbai catchment area. Until these reforms were put in place, ownership restrictions prevented private investment into the industry while the government lacked sufficient funds to improve the quality and expand aviation infrastructure. The analysis also showed that future air passenger traffic growth may be suppressed by the shortage of skilled aviation personnel, including pilots and air traffic controllers.

India: Change Factors Summary

Stimulating:

- Domestic deregulation: low-cost carrier development
- International liberalization
- Privatization and ownership
- Low-cost carrier development
- Economic liberalization
- Institutional and political reforms
- Supporting infrastructure investment for the technology centers
- Growing consumer demand

Suppressing:

- Insufficient capacity of national carriers
- Ownership restrictions
- Airport infrastructure capacity and quality
- Air Traffic Management: shortage of qualified aviation personnel

A.3 Stimulated Growth: South Africa

South Africa has been isolated from the global economy during decades of the apartheid era which ended in the early 1990s. Since then, the economy underwent liberalization and privatization reforms to develop manufacturing and services sectors and has experienced steady growth as shown in Figure A-3. Since the country was isolated politically and economically during the apartheid, air transportation development in South Africa during that time has been subject to geopolitical restrictions as opposed to economic regulation. After the restrictions were removed, air transportation came to play a supporting role in the country's changing economy. In particular, reforms have been implemented to deregulate the domestic sector, privatize

the country's aviation infrastructure and the national carrier — South African Airways. As a result of these reforms, air transportation usage has been growing in recent years as reflected in Figure A-3.

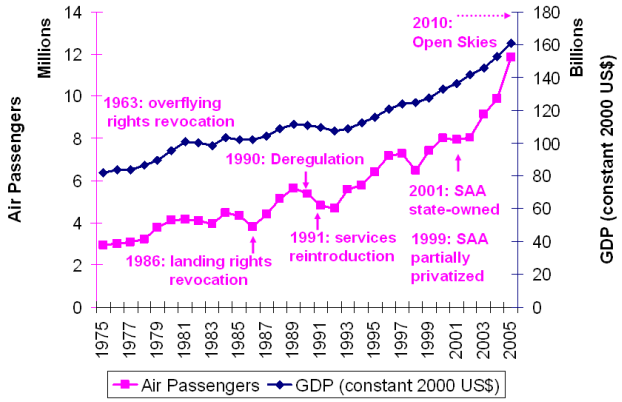


Figure A-3: South Africa: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by South Africa's airlines and GDP were 5.2% and 2.3%.

Air transportation in South Africa is used primarily by leisure passengers from Europe and other high-income countries. International business passenger traffic may increase in the forthcoming years because the government has begun providing incentives to enable high-skill labor flows in order to increase the country's human capital stock. In addition to passenger flows, air cargo has been used in recent years by several niche agricultural producers to ship products internationally to affluent consumers worldwide. Since the introduction of low-cost carriers in 2001, there has also been a growth in the amount of domestic and regional passenger and cargo traffic. These operations have enabled interregional business travel and trade whose development has been traditionally hindered by poor transportation links in the region.

Overall, South African Airways plays an important role in the Sub-Saharan region: South African air transportation market is almost five times as large as the next biggest aviation market in the region and South Africa's airlines account for half of all passengers carried by airlines registered in the region [212].

A.3.1 South Africa: Air Transportation System Development

Some observers claim that the region's aviation infrastructure is generally underdeveloped and its airlines are not competitive in the global market [111]. As a result of these deficiencies, over 70% of the African traffic is transported by foreign airlines [111]. South Africa's airlines play a dominant role in Sub-Saharan Africa. In 2005 South Africa's airlines accounted for more than half of all passengers in the region, while accounting for only about 0.6% of the world's passenger traffic [212]. The country's air transportation infrastructure is one of the best in Africa and South Africa's airlines connect all major domestic destinations and provide an extensive number of international links, particularly to Europe and the U.S., and increasingly to Asia and the rest of Africa [65].

Until the early 1990s, geopolitical restrictions associated with the apartheid played a substantial role in international operations of airlines in South Africa [160]. These restrictions included revocation of landing and overflying rights of South African Airways, the state-owned national carrier, by other African governments in the 1960s. Non-African governments also placed restrictions on international operations to and

from South Africa in the 1980s which, for example, resulted in suspension of flights between South Africa and the United States and Australia. However, even though geopolitical restrictions were removed in the early 1990s, South Africa's development of the international air transportation networks has been hindered by restrictive air traffic rights in Sub-Saharan Africa. In particular, political fragmentation and restrictive bilateral agreements prevent coordination between carriers in the region [30].

In order to stimulate air transportation development, South Africa's government has undertaken a series of open market reforms in aviation since the early 1990s. As Figure A-3 shows, the industry was deregulated in 1990 and the government is planning to fully liberalize international operations by 2010 [92, 18]. In addition, airline and aviation infrastructure privatizations have been pursued to increase the industry's competitiveness [92].

While the majority of the services are still provided by the state-owned carrier South African Airways, South Africa's aviation needs are also served by an increasing number of smaller private competitors including the low-cost carriers. Low-cost carriers services have helped stimulate air transportation development after the first one, kulula.com, started operations in 2001. The resulting increase in the growth rate can be observed in Figure A-3. As opposed to India, where low-cost carriers also helped stimulate domestic demand, in South Africa low-cost carriers operate both domestic and regional services to the neighboring countries. These operations help enable business travel and trade whose development would otherwise be hindered due to the lack of reliable surface and air transportation links in the region [88].

South Africa's international traffic is regulated by means of bilateral air service agreements with plans to pursue open skies policy by 2010 [18]. In particular, the government first outlined a liberalized approach to bilateral negotiations in 2006 with the express aim of ensuring that capacity is created ahead of demand to support the tourism sector. South Africa, as a member of the African Union, is also taking part in intercontinental liberalization reforms that were passed in 1988 following the Yamoussoukro Declaration. However, the process of implementing the removal of restrictions between countries has been slow and uneven [111].

Fixed aviation infrastructure was privatized in 1998 in order to promote tourism development and achieve adequate capacity for the football World Cup in 2010 [92]. In particular, the Airports Company of South Africa is building a new international airport at La Mercy and upgrading the existing airport infrastructure by expanding terminals and building new aircraft parking terminals and car parks at its ten airports. Following these expansions, the airport capacity (excluding the new airport) will be 55 to 60 million passengers per year [65].

In order to increase competition and relinquish state control of the industry, the government privatized the state carrier South African Airways. The airline was intially privatized in 1999 when Swissair purchased 20% of the airline's shares. However, during the latter part of 2001, Swissair experienced financial difficulties and declared bankruptcy. As a consequence of the Swissair's default, Transnet, the para-statal holding company of South African Airways, re-acquired the shares. According to South African Airways annual financial reports, while the airline's revenues have been growing between 1998 and 2008, the total net losses exceeded net profits during that decade. In other words, even though the carrier's operations have been growing, this growth may not be sustainable in the future due to the carrier's lack of profitability. As of 2008, the majority ownership in South African Airways has been held by the government and the airline has been undergoing a restructuring strategy to achieve profitability [182].

A.3.2 South Africa: Economic Impact of Air Transportation

After the economic liberalization reforms in the 1990s, South Africa became a relatively open economy with foreign trade accounting for more than 60% of GDP [65]. In 2007, services were the most important contributor to the GDP at 65.5%, followed by industry at 31.3% and agriculture at 3.2% [41]. The services sector is dominated by the financial services, followed by the growing tourism and retail sectors [65]. Access to air transportation has played a pivotal role in the growth of the tourism industry.

Industry's exports are dominated by manufacturing while mining and agricultural exports have fallen in recent years [65]. Most of the manufactured goods exported from South Africa have low value-to-weight ratio and hence are not transported by air. The growth of the manufacturing and services industries is a result of the economic restructuring strategy initiated in the mid-1990s. The goal of the strategy has been to integrate the country into the global economy after decades of isolation during the apartheid era. Prior to these reforms, the economic system was based on import substitution, protective trade regimes which included high tariffs and subsidies, anticompetitive behavior, and extensive government intervention in the economy [192].

Tourism Flows

Access to air transportation has played a pivotal role in the growth of South African tourism industry since it enabled access to European and other high-income leisure markets. According to the Statistics South Africa, the number of arrivals of foreign travelers grew by 30% between 2002 and 2006. However, almost 70% of these foreigners come from other African countries and arrive to South Africa via land transportation modes. The majority of these travelers from the neighboring countries are on day-shopping and business trips, while some of them declare visiting friends and relatives as the main purpose of their visit.

Air transportation is used primarily by overseas travelers, 90% of whom declare leisure travel as the primary purpose of their visit with the remainder visiting for business [65]. Europe accounted for 60% of the originating tourists in South Africa in 2005 while arrivals from North America experienced the highest rate of growth of 40% between 2002 and 2006 [213, 65]. South Africa is an attractive destination for leisure passengers because of the availability of cultural attractions, beaches, wildlife reserves, sporting facilities, and extensive use of English by the local population. The tourism sector currently accounts for 8% of GDP and is promoted by the government because it is labor-intensive and provides foreign exchange earnings [65].

Goods Flows

Manufacturing accounts for the majority of the industry's earnings and two-thirds of the country's exports [41]. South Africa manufactures a wide range of consumer goods, including foodstuffs, textiles and clothing, and footwear, together with metal, chemical and paper products. The manufacturing sector is driven by metals and engineering, particularly steel-related products, and the automotive industry. Mining is one of the country's important industries: South Africa is the world's largest producer of platinum, gold, chromium [41]. The country's major exports include metals, minerals, machinery and equipment while the major imports consist of of machinery, chemicals, petroleum products, scientific instruments, and foodstuffs [41]. Since the majority of the country's exports are bulky and time-insensitive, land and sea shipping are the primary shipping modes. As a result, air freight plays a small part in the flows of goods between

South Africa and the rest of the world. For example, some of the agricultural goods are shipped internationally. These goods include wine, high-value fruits and ostrich which compete with other international producers in several niche markets [65]. These markets and the resulting trade flows, however, are very small compared to South Africa's major crops of maize and sugarcane [65].

Labor Flows

Even though South Africa is classified as the upper-middle income economy by the World Bank, the country has one of the largest income inequalities in the world with almost two-thirds of its labor force earning less than US$250 per month [65]. Analysts argue that one of the critical structural problems of the labor market in South Africa is the excess of low-skilled and unskilled workers and the shortage of highly skilled workers [65, p. 23]. Access to air transportation has traditionally played an important role in the worldwide high-skill labor flows.

Low-skill migration from neighboring African countries to South Africa has increased sharply since the early 1990s due to the opening of borders and the relaxation of border controls. During this time, the number of high-skill immigrants has been low while outward high-skill migration to Australia, New Zealand, the UK and the U.S. remained high. The majority of inward low-skill workers arrive to the country by surface transportation, while air transportation has been used primarily by the high-skill workers. As of 2005, South African emigrant stock accounted for 1.5% of the country's population while the immigrant stock accounted for 2.3% of the population [211]. As a result of these labor flows, the economy is experiencing a skills shortage. In addition, because of the unbalanced labor flows, the outward remittances outnumber the inward ones. In 2006, inward remittance flows were US$735 million while the outward remittance flows numbered at US$1,067 million, or respectively 0.3$ and 0.4% of South Africa's GDP [211].

Air transportation linkage may play an increasingly important role in enabling the country's access to high-skill labor since the government is beginning to address the skill shortage problem and has launched programs to encourage South Africans abroad to return home and encourage high-skill migration from other countries [65].

A.3.3 South Africa: Conclusions

South Africa was isolated from the global economy during decades of the apartheid which ended in the early 1990s. Since then, institutional and political reforms have helped integrated the country into the global economy and stimulate the growth in air passenger demand. In addition to changes in political framework, liberalization and privatization reforms were implemented to develop services and manufacturing sectors. Prior to these reforms, the economic system was based on import substitution, protective trade regimes, which included high tariffs and subsidies, anticompetitive behavior, and extensive government intervention in the economy.

Tourism industry was one of the service industries which rapidly expanded after the liberalization reforms. Air transportation enabled the growth of the tourism industry because it enabled leisure passengers to travel to South Africa from Europe and other high-income economies. The enabling impact of international air passengers and cargo in other economic sectors has been relatively small. For example, since the majority of South Africa's exports are low-value, air cargo is used only by several niche exporters such as some agricultural

producers. While there are indications that business passenger travel may increase in forthcoming years after the government begins providing incentives to enable the inflows of international high-skill professionals, their impact is small at this time. However, business passenger flows have been growing on domestic and regional networks following introduction of low-cost carriers in 2001. These operations enabled interregional business travel and trade which have traditionally been hindered by poor transportation links in the region.

During the apartheid, South Africa's air transportation development, particularly that of the state carrier South African Airways, has been subject to geopolitical rather economic restrictions. After the restrictions were removed, the government of South Africa began to liberalize the aviation industry. The reforms included domestic deregulation in the early 1990s, privatization of the national carrier and fixed aviation infrastructure, and gradual liberalization of international operations. In particular, deregulation and privatization reforms enabled the growth of private operators and low-cost carriers. However, privatization of the national carrier, South African Airways, was not successful. The carrier was initially privatized in 1999 by re-nationalized in 2001 after the major shareholder Swissair declared bankruptcy. The government of South Africa effectively underwrites the carrier to ensure continued services. For example, the carrier has continued to grow its network in recent years despite the fact that it has been unprofitable since re-nationalization in 2001. Despite the lack of profitability, South African Airways is still the major carrier in the region accounting for almost half of the passengers traveling on airlines registered in Sub-Saharan Africa.

South Africa: Change Factors Summary

Stimulating:

- Government support of the national carrier
- Domestic deregulation: low-cost carrier development
- Low-cost carrier development
- Economic liberalization
- Institutional and political reforms

Suppressing:

- Political/economic sanctions
- Geopolitical restrictions: airline ban/services suspension

A.4 Stimulated Growth: Turkey

As Figure A-4 shows, Turkey's air passenger growth rates have increased first in 1991 and then in 2003. As a result of these two increases, Turkey had one of the highest air passenger growth rates over the last twenty years. The country's GDP has been growing as well despite a brief period of stagnation between 1998 and 2001.

Turkey is a middle-income economy which is currently in transition from a high degree of reliance on agriculture and heavy industries to a more diversified services-based economy [192]. Air transportation access is essential for the country's economic transition. In particular, air transportation enables the flows of leisure travelers from Western Europe and increasingly from other countries. Air transportation enables

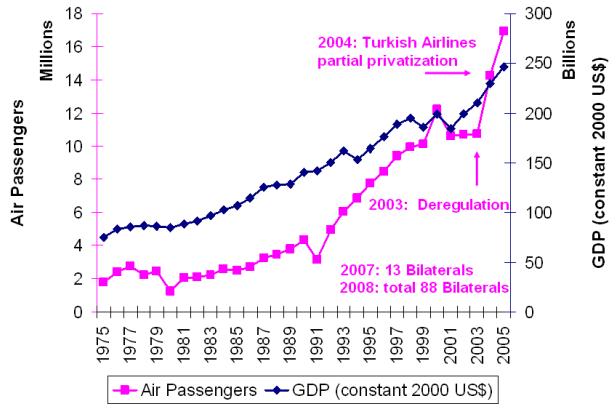


Figure A-4: Turkey: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Turkey's airlines and GDP were 10.0% and 4.3%.

Turkish citizens living abroad to visit friends and relatives and maintain a steady flow of remittances to the Turkish economy. There is also evidence that, despite the fact that air travel is still dominated by leisure and expatriate travelers, there has also been an increase in the flows of private business investors and cargo flights.

Strong economic growth in the 1990s and after the 2001 financial crisis stimulated private consumer demand including air travel demand. In particular, the growth in air passenger travel was stimulated by both economic and aviation liberalization reforms which were implemented starting in the 1980s. For example, economic liberalization reforms made the economy more competitive by removing state controls, encouraging foreign trade, and relying on free-market principles [70]. As a result of these reforms, the country became more attractive to foreign investors increasing air travel demand. The economic liberalization reforms were extended to the air transportation sector in the 1990s and resulted in the traffic growth reflected in Figure A-4. Domestic deregulation of the aviation industry in 2003 has been the major factor behind the growth in air passenger traffic in recent years. In particular, domestic deregulation resulted in the development of low-cost carriers which were able to lower the domestic air fares and stimulate air passenger demand. In addition to domestic deregulation, Turkey's air transportation industry underwent international liberalization. The new bilateral agreements and change in the airline strategy of the national carrier Turkish Airlines resulted in the growth of international traffic as the carrier pursued an expansion strategy to establish itself as a global network carrier.

A.4.1 Turkey: Air Transportation System Development

Turkey began liberalizing its aviation industry in the early 1990s which resulted in greater availability of flights as strong economic growth fueled the demand and resulted in increased air passenger growth rates as reflected in Figure A-4. The largest growth in air passenger traffic has occurred after Turkey's domestic aviation market was deregulated in 2003. Since then, the domestic market has tripled in size from only 5 million passengers to over 16 million in 2007 [177]. Following deregulation, several carriers started providing low-cost domestic service in addition to their traditional charter services. At the same time, the domestic market share of Turkish Airlines declined from 100% to 60% as the national airline switched its focus to

international operations and began establishing itself as a transit carrier between Europe and Asia [177]. As of 2008 Turkish had a 45% share of the country's scheduled international market [176].

Recent international aviation liberalization reforms, which in part supported the aggressive expansion strategy of the national carrier Turkish Airlines, helped stimulate the growth of international passengers. Turkey's international market is operated under the bilateral aviation agreements. According to Turkey's Directorate General of Civil Aviation, as of 2008 the country had bilateral aviation agreements with eighty-eight countries. In order to support the growth of Turkish Airlines as a transit carrier, Turkey's government has started an initiative to help the carrier extend its international network coverage. As part of the initiative, in 2007 Turkey signed bilateral aviation agreements with 13 countries [191]. Some of these agreements are fully liberalized, such as the 2000 Open Skies agreement between the U.S. and Turkey. Other agreements favor the national carrier, Turkish Airlines, and therefore inhibit expansion of services on many of the profitable international routes for other carriers. The national carrier also affects domestic development since it can influence slot allocation and tariff policies [177].

Even though private carriers account for a substantial share of domestic and international operations, the national carrier Turkish Airlines, remains a strong player in the airline industry. Turkish Airlines is a government-backed airline which was initially privatized with a 1.5% token share in the early 1990s. It was further privatized in 2004 and 2006 and, as of 2008 the government owned a 49% stake in the carrier [176]. Turkish Airlines is a developing network carrier whose market strategy is aimed at serving the short-haul to long-haul route networks between Europe and the Middle East as opposed to the long-haul networks of the Persian Gulf carriers. Its advantages include (1) a geographically favorable hub location and a 70-million-strong home market which faces no strong competitor on domestic routes; (2) low labor costs compared to the European carriers; (3) operating efficiency with low units costs when compared to Emirates since the cost of seat-mile for short-haul to long-haul connection is 6% less than for the long-haul to long-haul connection, (4) short-haul operation in Europe allowing it to serve more cities and provide greater frequencies than the Gulf carriers, (5) government backing which includes plans for further capacity expansion at the airline's hub in Atatürk International Airport [87, 176].

To support aviation development and integration of Turkey into the global economy, the Turkish government gives special priority to major infrastructure projects, especially in the transport sector. The government is in the process of building new airports, high-speed rail service and highways [176]. The government will realize many of these projects by utilizing the build-operate-transfer (BOT) model [192]. Airport privatization reforms have been initiated in the 1990s. Since then, several of the major airports have been rebuilt on a build-operate-transfer basis and are currently run by the private sector. For example, the country's largest airport, Istanbul International Atatürk Airport, is currently operated under the BOT agreement by TAV Airport Management. The airport is due to be replaced by a new airport in 2013 [176]. However, many airports are still owned and run by the state [66].

A.4.2 Turkey: Economic Impact of Air Transportation

Until the 1980s Turkey's economy was largely state-directed and relatively closed to the outside world. Since then, the government pursued an economic policy based on removing state controls, encouraging foreign trade, and relying on free-market principles to develop a more diversified services-based economy [70, 192]. As a result of these reforms, in 2006 services accounted for 63% of GDP and 47% of employment, followed by

industry with 28% and 25% shares, and agriculture with 9% of GDP and 27% of employment shares [41, 66]. Tourism is one of Turkey's major industries and has been growing since the 1980s. Geographically, Turkey is located at the cross-roads of Europe and Asia and has a favorable location as a transshipment point for global flows of passengers and cargo. Turkey is a middle-income economy with a large labor force: many of the country's industries, including tourism, manufacturing and agriculture, rely on European consumers from high-income countries for growth. While roads are the most important means of carrying passengers and freight, air transportation industry have come to play an important role in the country's economy because it provides domestic and international links for business passengers and the growing tourist charter traffic on the Aegean and Mediterranean coasts [70]. Overall, air travel accounts for nearly 70% of all international arrivals to the country [213].

Tourism Flows

Tourism is one of the most important sectors of the Turkish service economy. In 2005 tourism contributed 5% of GDP [66]. The industry grew rapidly in the last decade reaching 21.1 million visitors in 2005 compared with 7.7 million in 1995. Turkey attracts visitors mainly from Western Europe and nearby countries for seaside holidays, sightseeing, activity holidays, shopping, conferences, sports events, family visits and various other purposes. Overall, leisure travelers account for 77% of all tourist arrivals and vast majority of them arrive to the country by air [213]. The greatest number of leisure travelers are package holidaymakers heading for the southern and western coasts in the summer months. Many of these holidaymakers arrive to the country on charter flights as opposed to scheduled passenger services. While sun-seekers traditionally come mainly from Germany, the UK and other countries in northwestern Europe, recent years have seen rapid growth in arrivals from a wider range of European and non-European countries, especially Russia [66].

The tourism industry and the resulting leisure passenger demand are particularly sensitive to exogenous demand shocks. In 2006 the demand declined because of the bad publicity over the avian flu and tensions between the West and Muslims. In 1999 the tourism sector was hurt by an earthquake and the Russian financial crisis which reduced tourism demand [66]. Over the years, however, as Turkey became a more familiar destination and started attracting tourists from a wider area, the sensitivity of visitor numbers to domestic and international political developments appears to have declined [66]. However, there is still concern about the continued domination of the tourism sector by low-spending holidaymakers, typically on all-inclusive package tours. Other issues pertaining to sustainability of the industry include over-development of popular coastal zones, decline in the quality of service and the need to attract tourists to all regions year round [66].

Remittances Flows

Starting in the early 1960s around 6% of the Turkish population was living abroad at any one time [104]. The majority of Turkish expatriates live in Germany and other European countries and visit Turkey regularly for family reasons and holidays. Their remittances historically contributed up to 3% of GDP [104]. Even though the demand for Turkish workers abroad has subsided over the years, in the early 21st century there were roughly one million Turkish citizens working abroad [70]. These workers account for 13% of all arrivals to the country and the majority of them arrive to the country by air to visit their families and friends [213]. Remittances used to play an important role in providing foreign funds to pay for imported goods and services,

and foreign debt. In the recent years, however, the role of remittances as a provider of foreign exchanged has diminished as tourism, exports, and other income sources came to play a more substantial role in the economy [104].

Investment Flows

In 2006, around 10% of international visitors declared business as the primary purpose of their visit [213]. While the share of business passengers is still small, domestic and international business passenger demand has been growing the fastest in recent years [176]. Strong economic growth in the 1990s and after the 2001 financial crisis was an important contributor to the rapid growth of air travel. Turkey's economy is driven primarily by private consumer demand which accounts for about two-thirds of the nominal GDP [66]. Private sector is the largest contributor to fixed capital investment at 80% and foreign direct investment is supported by the government [66]. In fact, foreign investment increased after 2003 due to some legislative changes, improved macroeconomic and political stability and the availability of the incentives for foreign investors [66]. In general, Turkey scores well in terms of infrastructure growth, regulatory and competitive environments and the transport intensity index, especially when compared to other countries in the Middle East and Africa [28]. These factors help increase Turkey's overall level of business competitiveness for foreign investors and drive the demand for business passenger travel. However, foreign direct investment has been undermined in recent years by the competition from central and eastern European countries [66].

Goods Flows

Turkey's foreign trade grew rapidly since the 1980s. Before the 1980s, exports consisted largely of unprocessed agricultural goods [66]. Following the economic liberalization reforms, Turkey's leading exports became clothing and textiles, motor vehicles and parts, iron and steel, household appliances, fruits and vegetables [66]. Almost 70% of imports are intermediate goods which include machinery, chemicals, petroleum products, and transportation equipment [70, 66]. About half of all trade in Turkey is with Europe, where Germany is the main trading partner [70]. Because the majority of Turkey's exports have low value to weight, sea and road transport account for 93% of total freight traffic. Air freight, however, is the fastest growing transportation mode, followed by pipeline throughput and maritime cargo [28]. Air freight is routinely used to transport high-value goods to affluent Western European markets.

A.4.3 Turkey: Conclusions

Turkey is a middle income country with a recently liberalized economy and a growing services sector. Tourism is one of the major industries and has been growing since the 1980s. The majority of inbound leisure travelers are package holidaymakers who arrive to the country by plane from Western Europe and increasingly from other countries. Over the years, inbound leisure passenger demand increased due to the growing popularity of the Turkish holiday resorts and the growing levels of discretionary income in some of the originating countries, especially Russia and other Eastern European countries. The demand for leisure passenger travel has been suppressed by the economic downturns in the originating countries, perceived safety and health risks and political instability at the destination. Air transportation also plays an important role for Turkish citizens living abroad who visit friends and relatives and send remittances. While air travel is still dominated

by these two groups, recent economic liberalization reforms helped stimulate the growth of air cargo and flows of private business investors.

Domestic and outbound air passenger demand has been stimulated by the growing discretionary income of Turkish people because the country experienced strong economic growth in the 1990s and after the 2001 financial crisis. The government helped stimulate air transportation development through changes in regulatory policy and its support of the state carrier Turkish Airlines. First aviation liberalization reforms were initiated in the 1990s as the demand for air travel grew with the growth of the domestic discretionary income. Further reforms were implemented more recently. These included domestic deregulation reforms of 2003 which resulted in the growth of low-cost carriers and tripled the domestic traffic in four years. In addition, international traffic grew after Turkish Airlines began to pursue an expansion strategy which focused on establishing the airline as a transit carrier between Europe and Asia. This strategy was supported by the government through changes in the bilateral aviation agreements which have been gradually liberalized since the turn of the century. However, there is evidence that further international traffic growth may be suppressed because the agreements tend to favor the national carrier and thereby inhibit competition and expansion of other carriers. In addition to regulatory reforms, traffic growth and the expansion strategy of the Turkish Airlines were supported by the government through aviation infrastructure investment which increased following the privatization reforms in the 1990s.

Turkey: Change Factors Summary

Stimulating:

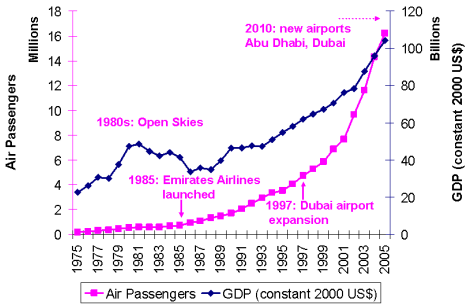
- Domestic deregulation: low-cost carrier development
- International liberalization
- Airport capacity investment
- Government support of the national carrier
- Airline expansion strategy
- Low-cost carrier development
- Economic liberalization
- Growing consumer demand

Suppressing:

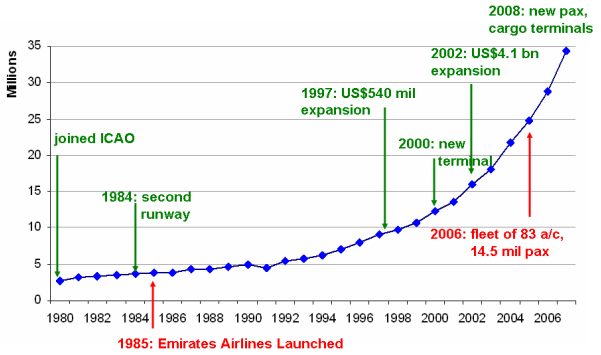
- Economic downturn at the tourists' country of origin
- Exogenous demand shocks: safety and health risks
- Political instability

A.5 Stimulated Growth: The United Arab Emirates

The United Arab Emirates is a representative case of stimulated air passenger development: the country had some of the highest air passenger growth rates during the last twenty years both during the periods of growing and declining GDP levels.



(a) Between 1985 and 2005, the average growth rates for the number of passengers carried by UAE's airlines and GDP were 16.9% and 4.7%.



(b) Passenger Embarked + Disembarked for Dubai International Airport in Dubai, United Arab Emirates. Airport and airline developments are noted in green and red respectively. The primary data source is the official airport website: *http://dubaiairport.com*.

Figure A-5: Growth in air passenger traffic and GDP for the United Arab Emirates.

The United Arab Emirates is a Middle Eastern economy whose air transportation sector has experienced sustained high growth rates over the last twenty years. As Figure A-5 shows, air passenger growth rates first increased in the mid-1980s followed by a larger increase after 2001. The growth in air passenger traffic was accompanied by the increase in the country's GDP starting in the early 1990s. However, the GDP was on average decreasing through the 1980s and reached its 1981 levels only in 1994 as can be seen in Figure A-5.

The high air passenger growth rates were in large part generated by the rapidly growing Dubai's Emirates Airline from its hub at the Dubai International Airport. Dubai is one of the seven emirates in the United Arab Emirates. The emirate's government, which is effectively the ruling Maktoum family, has been pursuing the economic diversification strategy since the 1980s. This long-term strategy included extensive infrastructure projects, economic liberalization reforms and support of foreign investment. The development of the aviation industry in Dubai has been stimulated by investment into the national airline, extensive aviation infrastructure investment, liberal aviation framework and general financial and institutional support of the government both at the aviation and economic levels. In recent years, other emirates and neighboring countries in the region have began pursuing diversification strategies as well. They will be described following the analysis of Dubai's air transportation system development.

Dubai's air transportation and economic development are closely tied because of the emirate's dependence on international labor, tourism and goods markets. In particular, air transportation enables access to labor, services and knowledge flows which support the country's growing service-based economy and provide a source of unskilled labor for construction, oil and gas industries. Air transportation also enables access to international tourism markets and helps the country grow its tourism industry. The enabled flows of goods have come to play an important role as well due to the growing transshipment infrastructure and country's general reliance on international supplies for a broad range of products.

A.5.1 The United Arab Emirates: Air Transportation System Development

The high air passenger growth rates observed in Figure A-5 were in large part generated by the rapidly growing Emirates Airline which is based in the Dubai International Airport. The first increase in the country's passenger growth rate in Figure A-5(a) followed the airline's launch in 1985 with two leased planes and a $10 million loan from the Dubai government [137]. The airline started its operations with two daily flights to Pakistan which supported the flows of low-skill migrants between Dubai and Pakistan. As the airline grew, it pursued a number of bilateral air service agreements with international partners. Many foreign governments readily signed the bilateral air service agreements with Dubai since, according to Maier [137], in the 1980s Emirates was still a new airline without a sizable fleet and therefore was not perceived as a threat to rivals. Dubai signed the bilateral agreement with Singapore in 1987 and by 1991 had agreements with Germany, Hong Kong, Thailand, and the United Kingdom [137]. Dubai itself has had an Open Skies policy from the start. These bilateral agreements allowed Emirates to grow its international network which by the early 1990s included Europe, Singapore and other East Asia nations.

In recent years, the airline has been expanding aggressively by growing its network and increasing the frequency on established routes. In particular, the Emirates has been competing with European and Asian carriers on long-haul routes connecting Europe to Asia and Australasia through its hub in Dubai. As of 2006 the airline had a fleet of 83 aircraft and transported 14.5 million passengers. In order to support its expanding route network and increase service frequencies, Emirates is planning to increase its fleet size to more than 450 aircraft by 2020 [103]. As of 2008 it had firm orders for 243 planes with a total estimated value of $60 billion and is scheduled to take delivery of 22 planes in 2008 [3]. These orders include fifty-eight A380 Superjumbo jets which Emirates plans to use on both short and long-haul services [103].

About half of Emirates passengers make a connection at Dubai airport [151], so a large share of passengers going through the airport are connecting passengers. Dubai has a favorable geographical location as an international hub since any two major cities on earth can be connected via Dubai with only one stop [129]. To promote the development of the Emirates Airline as a long-haul carrier, the Dubai airport has undergone several expansion programs including new runway and terminal constructions noted in Figure A-5(b). In 2007, Dubai International Airport handled 34 million passengers and, with the growth rate of 19%, was the fastest growing airport in the world. It is scheduled to open new passenger and cargo terminals in 2008 to increase its capacity to 75 million passengers a year. Funding for the expansion of the airport is provided by the government which is following a general strategy of developing capacity ahead of anticipated demand. Other policies supporting airline's development include absence of income tax and of noise control restrictions at Dubai airport which allows takeoffs and landings twenty-four hours a day [137]. Airport's twenty-four hour operation allows Emirates to achieve better aircraft utilization. Emirates keeps its fleet in the air on average for nearly 14 hours a day, compared to 11 hours of some of its rivals [137]. Absence of noise control restrictions and round-the-clock operation are also attractive attributes for cargo carriers and help support the airport's development as a transshipment hub.

[3] The primary source for the following description is the company's website: *http://emirates.com/*

A.5.2 The United Arab Emirates: Economic Impact of Air Transportation

Until the economic reforms were initiated in the 1980s, Dubai's economy was based on oil exports to the rest of the world. Oil revenues accounted for a large share of Dubai's GDP: in 1975 oil revenues made up 64% of the GDP [35]. Since then, Dubai has replaced oil as the source of wealth with a booming service-based economy which depends heavily on tourism, construction, telecommunications, media, real estate and financial services [59]. As a result of economic diversification, in 2006 the non-oil sector revenues accounted for 97% of the emirate's total GDP [35]. Access to air transportation both for passenger and cargo services has played an essential role in the country's economic diversification strategy.

Labor Flows

Since the discovery of oil more than thirty years ago, the emirate underwent a transformation from an impoverished desert region to a modern state with a high standard of living [41]. However, since the Dubai's population itself would not have been sufficient to support this level of growth, the economy relies extensively on access to both low-skill and high-skill labor from abroad. In fact, UAE nationals account for only 15% of the emirate's population [59]. Air transportation enables access to the workers from abroad, particularly male workers from India and Pakistan who dominate the demographics [59].

Services and Investment Flows

In addition to enabling labor flows, air transportation enables flows of services from international high-skill professionals and foreign investors. These professionals play an important role in the development of service-based industries such as financial, information technology, and health industries. In 2007, Dubai's two original free-zones housed more than 3,000 companies and Dubai Internet City, Dubai Healthcare City and Dubai Media City are some of the new specialized zones under development [59]. The development of service-based industries is supported by liberal government policies which support foreign investment, development of the supporting infrastructure, and low operational costs. In particular, the country's free trade zones — offering 100% foreign ownership and zero taxes — are helping to attract foreign investors [41].

Knowledge Flows

Air transportation enables knowledge flows by providing access to international high-skill services professionals, foreign educational institutions and international faculty for recently established domestic educational institutions. During the last decade, a number of foreign accredited universities have been set up in the city. They include the American University of Dubai and several colleges which directly cooperate with universities based in foreign countries such as Dubai School of Government which cooperates with the Harvard University's John F. Kennedy School of Government. In addition, a dedicated education zone was established as part of the Dubai Internet City/Dubai Media City Free zone. As of 2007 sixteen international partners, including universities from the UK, Canada, Belgium, Australia, India and Pakistan, were attracted to this educational zone [59]. Access to international teaching staff and collaboration with foreign universities are paramount if these educational enterprises are to succeed. Air transportation allows the staff to maintain dual teaching positions and close personal contacts at home while teaching in Dubai.

Tourism Flows

Dubai placed the development of the tourism industry at the heart of its economic diversification plans. While the cruise industry is present in Dubai, the majority of tourists reach the emirate by air. In recent years, there has been an increase in the number of leisure passengers visiting the city in part due to the development of retail duty-free zones, entertainment and other supporting tourism infrastructure. Dubai's goal is to attract 15 million visitors a year by 2010, up from 5.5 million in 2004 [59]. To reach this goal, the government is pursuing several ambitious projects in tourism infrastructure investment: these include construction of $3bn Palm Islands and the $9.5bn Dubailand entertainment complex [59].

Goods Flows

The emirate's economy depends on international suppliers for a broad range of products. These range from core goods, such as food and agricultural products, to strong demand of its many wealthy citizens for high-end imported items [59]. While only a fraction of goods are delivered by air, the industry's development has been stimulated by recent infrastructure projects. In particular, between 1996 and 2005, re-export business grew from a US$9.1bn to US$41bn [59]. The growth can be attributed in part to the improvement and expansion of goods handling facilities. As of 2007 the Dubai airport was the thirteenth busiest airport by cargo traffic according to the Airports Council International — right behind the Los Angeles International Airport. This ranking is a reflection of Dubai's commitment to establishing itself as a leading transshipment point with major infrastructural investments into the Dubai Airport Free Trade Zone which included investments into the Cargo Mega Terminal and the Flower Center for perishable transit cargo. In addition, according to the official airport website, the government is building a new Logistics City capable of handling 12 million tonnes of air cargo annually as part of the Dubai World Central airport development.

A.5.3 The United Arab Emirates: Conclusions

The United Arab Emirates, and the Dubai emirate in particular, had some of the highest air passenger growth rates over the last two decades. The emirate's unique economic attributes consist of hydrocarbon assets; institutional framework which supports business development through liberal and free market business policies; development and promotion of high-quality tourism and service-oriented infrastructure; availability of sufficient investment funds on the part of government; government commitment to economic diversification; shortage of sufficient local labor resources to pursue the government's economic diversification strategy. As a result of these attributes, air transportation plays an important role in contributing to the economy's growth since the success of new business developments depends on having access to skilled and unskilled workers as well as the leisure passengers.

The high air passenger growth rates reflect in part the fact that over the years Emirates Airline could establish itself as a successful long-haul carrier. The airline operates from its hub in Dubai International Airport where almost half of its 14.5 annual passengers make a connection. Several factors helped establish Dubai as a transcontinental hub: favorable geographic location; availability of sufficient investment funds on the part of government for aviation infrastructure and financial incentives for the national airline; availability of sufficient investment funds and supporting institutional framework which resulted in the growth of the local economy and air travel demand; low operating costs compared to European and some East Asian

carriers; favorable institutional framework, including liberalized air service agreements; and the first-mover advantage on the part of the Emirates Airline. In addition to establishing itself as a passenger hub, the Dubai airport became a major transshipment point of the Middle East.

Over the years, there were two large increases in the air passenger growth rates: in the mid-1980s and after 2001. Several factors stimulated the first increase in the growth rate: government funds were provided to establish a flag carrier and to develop aviation infrastructure. In addition, liberal aviation regulatory framework established by the government helped the carrier grow its international network. The changes in the regulatory framework and aviation infrastructure investment reflected the government's overall goal to move the economy away from oil-exporting activities toward development of the service-based industries. Air transportation development was also supported by the growing air travel and freight need of Dubai as the economy moved away from the oil-exporting activities. To promote this diversification of demand and global integration of Dubai's economy, the government in the 1980s began sponsoring the development of supporting business and tourism infrastructure and established a regulatory framework based on free-market principles which encouraged foreign investment. In the recent years, some of these infrastructure projects have been completed boosting the economy's international profile and encouraging the inflow of labor and capital.

The second growth phase was stimulated by the demand from the economy's growing services sector and the rapidly expanding long-haul carrier Emirates Airline. To support Emirates expansion strategy, the government continuously upgraded and expanded the local aviation infrastructure in anticipation of future demand. In addition to increasing the capacity of Dubai International Airport, the government invested into construction of a new major airport as part of the Dubai World Central development.

Since the early 1980s, 1982 was the only year when the UAE's airlines registered a negative growth rate in air passenger traffic. While the country's recent economic growth has been strong, the country's GDP was on average decreasing through the 1980s and reached its 1981 levels only in 1994 as can be seen in Figure A-5(a). This decrease in the country's GDP growth rates coincided with the decline in the world's oil prices after their peak in 1980. In other words, the United Arab Emirates had positive air passenger growth behavior while the economy's GDP had a negative rate of growth. The government's strategy, which focused on the development of the air transportation sector as part of overall economic diversification strategy, was the primary reason behind this uncorrelated behavior between the two variables. In particular, the airline's development was supported by government funds and regulatory and infrastructure reforms despite the declining government revenues during that time period.

The United Arab Emirates: Change Factors Summary

Stimulating:

- International liberalization
- Aviation infrastructure investment
- Airline strategy
- Government support of the national carrier
- Institutional and political reforms
- Supporting infrastructure investment

A.6 Stimulated Growth: Qatar

The success of Emirates and the belief that air connectivity between regions may stimulate economic growth and diversify economic activity, prompted several neighboring Middle Eastern economies to invest into air transportation. In particular, several neighboring economies in Figure A-6 are in the process of investing heavily into air transportation infrastructure to support their diversification strategies and grow the national airlines. Other Gulf countries, including Bahrain and Oman, have also had many recent developments in aviation, business, finance and real estate fueled by the booming oil prices [107, p. 55].

In addition to the Dubai International Airport described above, as of 2008, several other major airports are being expanded or constructed in the region. Figure A-7 provides a list of airports and the respective relevant statistics. There are two major airports in the neighboring emirates of Abu Dhabi and Sharjah, a new airport in a neighboring country of Qatar, and a new airport in Dubai. Geographically, these five airports are all within a 350 kilometer distance from each other.

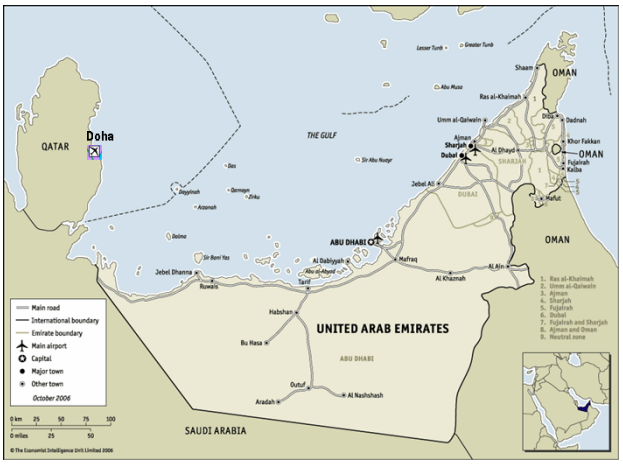


Figure A-6: Map of major airports around Dubai. The figure was adapted from the Economist [59].

Dubai has two airports: the Dubai International Airport (DXB) described above and a new Al Maktoum International Airport which is part of the Dubai World Central development. The new airport will be the world's largest airport with annual capacity of 120 million passengers and a logistics center which will be able to handle over 12 million tonnes of cargo. The new airport is located about 40 kilometers from the Dubai International Airport and is scheduled for initial opening in 2009 and to be fully operational by 2015.

In addition to the two major airports in Dubai, there is a smaller airport in a neighboring emirate of Sharjah and an airport in the Abu Dhabi emirate. The Sharjah airport is located 30 km from Dubai and serves primarily low-cost and cargo markets. Sharjah airport was able to create a niche market in sea-air freight traffic due to its unique position of having ports situated on both the Arabian Gulf and the Indian Ocean. The airport also claims a 90% share of the UAE's cargo charter market [193]. Similar to Dubai, the emirate's government perceives air transportation development as important for economic diversification. Therefore, it has attempted to stimulate cargo traffic growth by supporting aviation and other infrastructure development, which includes the 1995 opening of the Sharjah Airport International Free Zone, and liberal open skies policy. In addition to serving the cargo markets, since 2003, the airport has also served as a hub

	Passengers	Cargo tonnes	Dominant Airline	Projected Capacity
Abu Dhabi, UAE AUH	5.2 mil (04) 6.9 mil (07)	315,317 (07)	Etihad Airways	20 mil pax by 2010 2 mil tonnes of cargo
Dubai, UAE DXB	16.0 mil (02) 34.4 mil (07)	764,193 (02) 1.4 mil (06)	Emirates Airlines	75 mil pax by 2008 3.5 mil tonnes of cargo
Dubai World Central JXB (40 km from DXB)				120 mil pax by 2017 12 mil tonnes cargo
Sharjah, UAE SHJ	1.0 mil (02) 4.3 mil (07)	497,010 (02) 570,363 (07)	Air Arabia	8 mil pax by 2007
Doha, Qatar DOH	4.4 mil (02) 9.4 mil (05)	90,879 (02) 207 988 (05)	Qatar Airways	24 mil pax by 2009 750,000 tonnes of cargo

Figure A-7: Major airports around Dubai: airport statistics, expansion and new construction development as of 2008. The data have been gathered from the respective official airport and airline websites.

to a profitable low-cost airline Air Arabia which operates scheduled services to 32 destinations in the Middle East, North Africa, the Indian subcontinent and Central Asia. While its traffic figures are more modest compared to the neighboring Dubai airport, the Sharjah airport's expansion program included increasing its annual capacity to eight million passengers and on-going improvements in airport retail activity.

Abu Dhabi International Airport (AUH) is also investing into expansion of its airport facilities in part to support the growth of the national full service carrier Etihad Airways which was launched in 2003. The airport is located 120 km from Dubai and will have a 20 million passenger capacity by 2010. Abu Dhabi's air transportation development strategy is similar to Dubai's in the sense that the government has readily available capital funds for investment and supports airport and national airline development as part of the economic diversification strategy. In part due to the readily available capital, the flag carrier is able to pursue an aggressive expansion strategy and develop a network of new long-haul routes between Europe, South Asia, Asia and Australasia.

The state of Qatar is also investing into expansion of its aviation infrastructure, national airline, and supporting business infrastructure. The majority of that investment is government-sponsored and is derived from the oil and gas revenues. In recent years, the increasing oil and gas revenues made Qatar the highest per-capita income country in the world [41]. While these revenues still account for more than 60% of Qatar's GDP, the government began to diversify economic activity after a change in the government following a bloodless coup in 1995 [41]. Since then, economic policy has been focused on increasing private and foreign investment in non-energy sectors [41]. In particular, following the successful Dubai strategy, the government of Qatar is interested in development of travel and tourism industries [78]. Initiatives undertaken by Qatar stimulated the construction of new upmarket hotels, resorts, high-rise apartments, restaurants, museums and leisure facilities [78]. Air transportation system development has been an integral part of the government's economic diversification strategy.

Qatar's air transportation development strategy is similar to Dubai's. In particular, the government is stimulating aviation growth through investment into the nation's flag carrier and is supportive of the airline's expansion strategy to become a hub operator through infrastructure investment and regulatory reforms. As

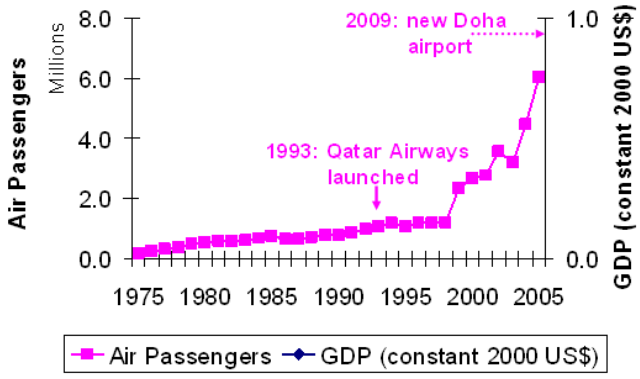


Figure A-8: Qatar: growth in air passenger traffic. Between 1985 and 2005, the average growth rate for the number of passengers carried by Qatar's airlines was 11.2%. The GDP data are not available in the World Bank database.

Figure A-8 shows, Qatar's air passenger traffic grew at an annual compound growth rate of 11% between 1985 and 2005 largely due to the rapid expansion of the national full-service carrier Qatar Airways [4] [212]. The airline was founded in 1993 and was originally owned by the royal family of Qatar. It was, however, re-launched in 1997 under a new management team. As of 2008, the government holds a 50% share in Qatar Airways and 50% is held by private investors. Over the past ten years the airline was among the fastest growing airlines in the world and had a 35% year-on-year growth rate. In 2008 the airline flew to over 80 destinations worldwide and was one of only five airlines in the world with five star ranking for service and excellence awarded by Skytrax, an independent aviation industry monitoring agency.

Qatar's air transportation development has been stimulated by the government's support of the carrier and aviation infrastructure investment. The government is committed to the success of Qatar Airways which is exemplified by the fact that in 2002 they decided to withdraw their 25% share in Bahrain-based carrier Gulf Air in order to develop their own national airline. The government also invested into the development of a new Doha International Airport which is set to open in 2009 with opening day capacity of 24 million passengers and 750,000 tonnes of cargo. The airport itself is being promoted as a Middle Eastern aviation, business and logistics hub because, in addition to aviation facilities, the construction includes a 100-acre business park and free trade zone, a courier and mail facility and a general aviation facility.

Qatar: Change Factors Summary

Stimulating:

- Airport infrastructure investment
- Government support of the national carrier
- Airline strategy
- Supporting infrastructure investment
- Institutional and political reforms

[4] The primary source for the following description is the company's website: *www.qatarairways.com*

A.7 Stimulated Growth: Vietnam

Vietnam's economy experienced a period of economic stagnation and international isolation until 1986. In December 1986, the Sixth National Congress of the Communist Party of Vietnam approved an economic reform package which shifted the economy from centrally-planned to more market-oriented economic model. The country's international reintegration followed in 1989 after removal of Vietnamese troops from Cambodia and authorization of foreign direct investment [192]. Further economic development was aided by the establishment of diplomatic and economic relations with ASEAN (Association of Southeast Asian Nations), countries in Western Europe and Northeast Asia [192]. As a result of the reforms, manufacturing and services have come to play a more prominent economic role. In 2007, industry accounted for 42.3% of GDP, followed by services at 38.2% and agriculture at 19.5% [41]. Tourism, in particular, has come to play an important role in the services sector [192].

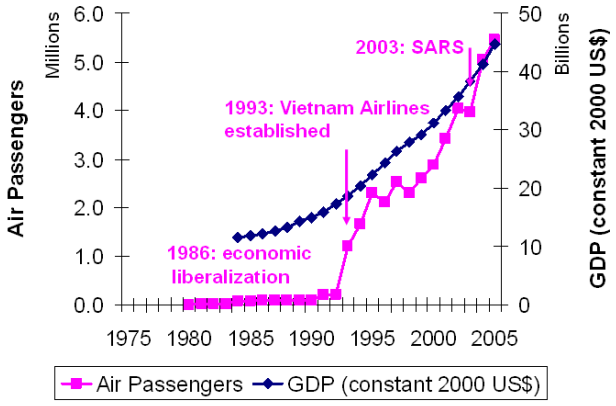


Figure A-9: Vietnam: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Vietnam's airlines and GDP were 13.6% and 7.5%.

International leisure travel grew eight-fold between 1993 and 2005 while the total number of international visitors grew only five times. In 1993, almost 700,000 international tourists visited the country with 40% of them declaring leisure, 30% declaring business and 22% declaring visiting friends and relatives as the primary purpose of their visit [213]. In 2005, Vietnam had 3.5 million international visitors with 60% arriving for leisure, and business and family visitors accounting for 14% each [213]. Air transportation accounted for 65% of these arrivals.

Vietnam's air transportation got its start in 1956 with the establishment of Vietnam Civil Aviation [5]. During the 1970s and the 1980s, the country began inaugurating international routes and in 1980 Vietnam Civil Aviation became an official member of the International Civil Aviation Organization. Vietnam Airlines is a government-owned airline which was established in April 1993 and since then has transformed itself from a relatively small airline operating primarily Soviet-made aircraft to a modern international airline flying to 20 domestic and 44 international destinations. The majority of the airline's profits come from its international operations.

While the airline has enjoyed remarkable growth since 1993, several factors negatively affected its de-

[5]The primary source for the following description is the company's website: *www.vietnamairlines.com.vn*

velopment. The airline had several fatal aviation accidents which all involved Soviet-made aircraft. The most recent fatal aviation accident occurred on September 3rd, 1997 when a Tupolev Tu-132 operated on a domestic flight by Vietnam Airlines crashed on approach killing 65 of the 66 passengers on board [12]. Since then, the airline has modernized its fleet and as of 2008 operated only Western-built airliners. The growth in passenger traffic was also suppressed in 1998 following the Asian Financial Crisis and in 2003 following the SARS epidemic. However, the airline's operations and profits grew in 2001 despite the global decline in demand following the September 11th attacks on the U.S.

Several factors helped stimulate Vietnam's air passenger development: economic liberalization reforms which encouraged foreign direct investment, development of the tourism industry, growth and modernization of the state-carrier Vietnam Airlines. The following factors briefly suppressed the air passenger growth: accidents and safety issues prior to fleet modernization in the 1990s, Asian economic crisis in 1997 which decreased regional travel demand, and the SARS epidemic in 2003 which affected international leisure passenger arrivals.

Vietnam: Change Factors Summary

Stimulating:

- Government support of the national carrier
- Fleet modernization of the state-owned carrier
- Economic liberalization
- Institutional and political reforms
- Supporting infrastructure investment

Suppressing:

- Perceived airline safety
- Exogenous demand shocks: Asian Financial Crisis in 1997, the SARS epidemic in 2003

A.8 Stimulated Growth: Lao People's Democratic Republic

Lao People's Democratic Republic had one of the highest air passenger growth rates over the last two decades: between 1985 and 2005 the number of people carried by Laos's airlines grew from 16 to 300 thousand passengers. As can be seen in Figure A-10, the growth of air passengers in Laos has been discontinuous. In particular, the number of air passengers changed little between the discontinuous increases in years 1990, 1999 and 2004. The factors responsible for these changes are identified below.

Air and road travel are the only means of accessing this landlocked country. Laos has three international airports: the largest airport (Wattay International Airport) is located in the nation's capital Vientiane. Lao Airlines is the national carrier which in 2008 operated a small domestic network and had several international destinations in Thailand, China, Vietnam and Cambodia [6]. The airline is fully state-owned. Lao Airlines is a small airline whose fleet in 2008 consisted of two ATR 72-200 and four Xian MA60. Due to its small size, a

[6]The primary source for the following description is the company's website: *www.laoairlines.com*

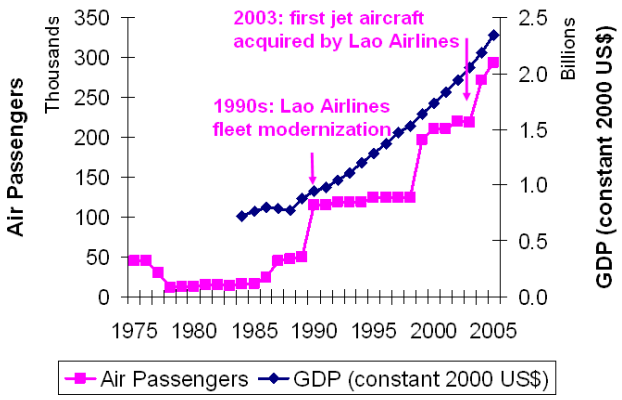


Figure A-10: Laos: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Laos's airlines and GDP were 15.7% 5.8%.

purchase of a single aircraft may have a substantial impact on the country's airline statistics. For example, a purchase of one 70-seat aircraft by Lao Airlines resulted in a two-fold increase of air passengers in 1990.

Laos is one of the few official communist states and was largely closed to international visitors and markets until the early 1990s. The government of Laos initialized reforms liberalizing laws on foreign investment and private enterprise in 1986 [41]. Since then, the country's growth averaged 6% per year [212]. However, despite the high growth rate, Laos remains a country with an inadequate infrastructure and a largely unskilled work force. In 2007, agriculture accounted for 80% of total employment and GDP per capita was estimated to be $710 [41]. However, foreign investment and labor migration have been growing from the neighboring Thailand, China and Vietnam in recent years [192]. Tourism is one of the fastest growing industries and an important source of foreign exchange [192]. According to the Lao National Tourism Administration website, Laos joined ASEAN in 1997 and has opened its doors to welcome international tourists from every continent around the world in 1998. The increase in the number of international visitors to Laos in 1999 has been one of the changes following the government's promotion of the industry.

However, non-compliance with the international aviation safety standards and poor aviation safety record of Lao Airlines have traditionally been a deterrent for international tourists traveling to Laos. Between 1990 and 2007, Lao Airlines was involved in four aviation accidents which resulted in a total of 52 fatalities [13]. All of the accidents occurred on domestic routes and involved Russian and Chinese-built aircraft [13]. As a result of these accidents, several international aviation safety advisories were issued stating that only Western-made aircraft are safe for travel to Laos. To improve the country's safety record and the airline's image, Laos Airlines upgraded its fleet to Western-built ATR-72's on all of its international routes. In addition, in 2003 the government invested into leasing their first jet aircraft, Airbus A320, for its international operations which resulted in the growth of passenger traffic in the following years. However, due to the lack of funds for maintenance, the lease had to be terminated two years later reducing the airline's vehicle capability and the resulting perceived airline safety [7].

In conclusion, the high air passenger growth rate in Laos was partially a reflection of the fact that the nation's airlines have been growing from a very small base. In particular, the country's statistics, shown in

[7] Airline fleet statistics are available at *http://airfleets.net/*

Figure A-10, represent only the traffic carried by the nation's state-owned carrier and its fleet of six turboprop aircraft. The analysis illustrated that changes pertaining to airline operations, such as purchase or sale of a single aircraft, were primarily responsible for the largest changes in the growth rates. This behavior is often observed for countries with small aviation markets. The growth in the number of air passengers was also influenced by the government's commitment to tourism development and improving Laos's aviation safety record. In particular, as part of this commitment, the national carrier's level of safety was raised through fleet modernization programs. However, further development may be hindered by the government's lack of funds.

Laos: Change Factors Summary

Stimulating:

- Government support of the national carrier
- Fleet modernization of the state-owned carrier
- Supporting infrastructure investment

Suppressing:

- Air Traffic Management capability
- Perceived airline/fleet safety
- Vehicle capability: insufficient fleet capacity due to lack of capital

A.9 Stimulated Growth: Ireland

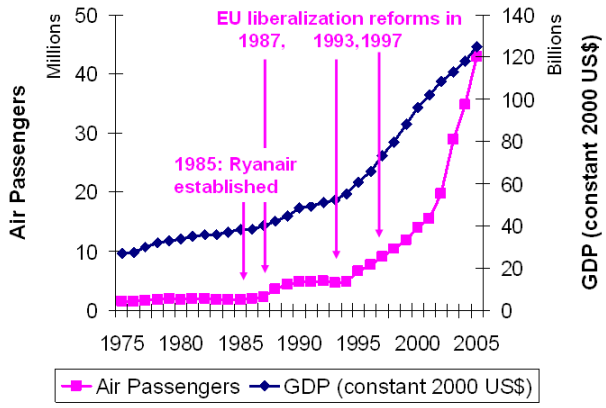


Figure A-11: Ireland: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Ireland's airlines and GDP were 17.1% and 6.1%.

The dramatic growth in Ireland's traffic over the last twenty years can be attributed to the growth of the Dublin-based low-cost carrier Ryanair. Ryanair was established in 1985 with a staff of 25 people [8]. The airline rapidly grew its network and by 1995 carried more than 2 million passengers a year and came to

[8]The primary source for the following description is the company's website: *http://www.ryanair.com*

play a prominent role in the region. For example, in 1995 Ryanair became the largest passenger airline on the Dublin-London route (the biggest international scheduled route in Europe) overtaking Aer Lingus and British Airways. The airline expanded further in 1997 after additional provisions were introduced into the Single European Aviation Market initiative which gave any airline in the European Union a right to operate routes within other member states. To raise capital Ryanair became a public company after a successful flotation on the Dublin and New York Stock Exchanges in May 1997.

Between 1995 and 2005, Ireland's traffic, as shown in Figure A-11, grew from 7 to 43 million passengers [212]. During the same period, Ryanair's traffic grew from 2 to 31 million passengers as the airline grew its network in twenty-six European countries. The rest of the country's traffic was carried by Ireland's flag carrier Aer Lingus, whose passenger traffic in 2005 was 8 million passengers, and several small regional carriers. In the meantime, there was only a two-fold increase in the number of passengers embarking and disembarking in Dublin airport [110]. Therefore, the dramatic traffic increase during those years is not indicative of the increase in the number of passengers traveling to and from Ireland, but rather the effect of growth of international operations of Dublin-based Ryanair.

As part of its expansion strategy, Ryanair established several bases in underutilized secondary airports across Europe. Their first base was established in 2001 at Brussels Charleroi Airport where by 2004 the airline had a 93% market share [16]. Secondary airports are particularly attractive to low-cost carriers because they usually have lower aeronautical charges and greater operational efficiency when compared to major airports [16]. In addition, airport authorities may provide direct financial incentives to the airlines in order to derive positive economic benefits due to increase in air transportation connectivity.

For example, Charleroi airport offered Ryanair financial incentives for the use of the airport. Compared to published rates for regional airports, Ryanair enjoyed a 50% discount in landing fees and paid 10% of the published handling charges [16]. However, following a complaint from the main airport in Brussels, the legality of such incentives from a publicly-funded airport was questioned by the European Commission. In 2004, The European Commission found that some of the incentives offered by Charleroi airport authorities to Ryanair are illegal under the EU law because they distort the competitive environment [16]. Ryanair contested the ruling and, as of 2008, the legal battle between Ryanair and the European Commission continues.

In conclusion, the high air passenger growth rate in Ireland can be attributed to the growth of the Dublin-based low-cost carrier Ryanair. The airline began to pursue an aggressive expansion strategy following the EU liberalization of air services in the 1990s. In particular, the airline developed an extensive intra-European route network after the changes in the framework allowed foreign carriers to operate routes within other member states. This expansion strategy was supported in part by the ready availability and incentives provided to the airline by secondary airport authorities throughout Europe.

Ireland: Change Factors Summary

Stimulating:

- International liberalization
- Airline strategy
- Low-cost carrier development
- Availability and/or incentivization of secondary airports

A.10 Stimulated Growth: Slovakia

The recent growth behavior shown in Figure A-12 for Slovakia is representative of several other Eastern European countries. As the time-series trends in the appendices show, several Eastern European countries and former Soviet republics have had very high passenger growth rates between 2000 and 2005. In Slovakia, the air passenger numbers have been increasing since 2001. The major stimulating factor behind these growths has been the establishment and expansion of home-based airlines. For example, in Slovakia, the increase in the air passenger growth rate can be primarily attributed to the growth of the low-cost carrier SkyEurope — Slovakia's first airline.

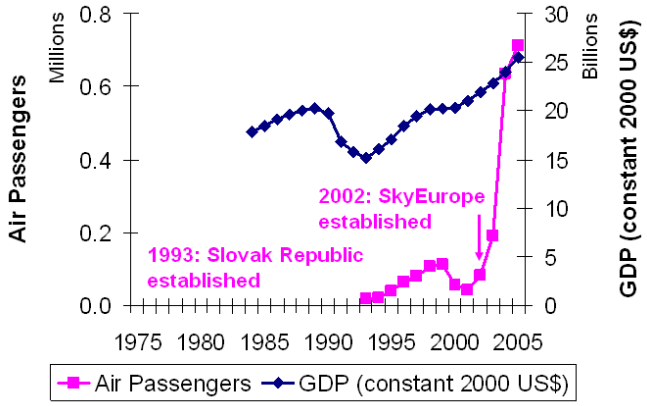


Figure A-12: Slovakia: growth in air passenger traffic and GDP. Between 2000 and 2005, the average growth rates for the number of passengers carried by Slovakia's airlines and GDP were 66.6% and 4.6%.

The low-cost carrier SkyEurope started operations in February 2002 from Bratislava Airport following a capital investment of $20 million [9]. The services were launched with a single 30-seat Embraer 20ER aircraft operating a domestic route between Bratislava and Kostice. Since then, the airline has been pursuing an aggressive expansion strategy and as of 2008 operated a fleet of fifteen brand new 149-seat Boeing 737s and flew to more than 30 destinations across Europe. Over the years, the airline established bases in Austria, the Czech Republic, Hungary, Slovakia and Poland and competed with several network rivals including CSA Czech Airlines, Malev and Poland's LOT [159]. One of SkyEurope's advantages over the rivals has been its low labor costs which historically have been as little as half of the network carriers [175]. Slovakia is a relatively low-cost country compared to the other countries in the European Union. For example, Slovakia's GDP per capita in 2007 was $20,200 while Ireland's was $46,600 which translates into a cost-advantage for SkyEurope over Ireland's low-cost carrier Ryanair [41].

The demand for air travel has been helped by Slovakia's rapidly growing economy. Slovak Republic was established in January 1993 and since then has been undergoing a gradual transformation from a centrally-planned to a market-oriented economy [192]. Between 2001 and 2004 the government implemented a series of macroeconomic stabilization and structural reforms including simplification of the tax system, reforms of the labor code and pension systems, and a large number of privatizations [41, 192]. Slovakia's economic growth exceeded expectations in 2001-07 despite the general European slowdown [41]. Foreign direct investment

[9] The primary source for the following description is the company's website: *http://www.skyeurope.com/*

(FDI) has been particularly strong with FDI inflows growing more than 600% between 2000 and 2007 [192]. Slovakia is an attractive business investment opportunity for foreign investors due to the availability of cheap and skilled labor force, low taxes, a 19% flat tax for corporations and individuals, no dividend taxes, a relatively liberal labor code and a favorable geographical location [192].

In conclusion, the rapid growth of air passenger traffic in Slovakia was stimulated by the expansion of the home-based low-cost carrier SkyEurope and country's economic and institutional reforms which have encouraged privatization and foreign investment. The airline expansion strategy was enabled in part by the liberalized provisions of the Single European Aviation Market initiative which allow any airlines in the European Union a right to operate routes within other member states. However, despite SkyEurope's growing revenues and Slovakia's growing economy, the airline has not yet been able to reach an operating profit [175]. The airline was originally funded by private investors, but went public on the Vienna and Warsaw stock exchanges in September 2005 to raise capital. Future growth, however, may be problematic in view of the growing number of other low-cost competitors in Central Europe, such as Hungary's Wizzair and Ireland's Ryanair, and the slowing global economy. For example, early in 2008, SkyEurope has renegotiated its contract with Boeing to slow down the delivery of 737s until the market conditions improve [205].

Slovakia: Change Factors Summary

Stimulating:

- International liberalization
- Airline strategy
- Low-cost carrier development
- Availability and/or incentivization of secondary airports

A.11 Stimulated Growth: Chile

Chile is an upper middle income economy in Latin America whose compound annual GDP growth rate of almost 6% between 1985 and 2005 was the highest in the region. As Figure A-13 shows, the high economic growth rate was accompanied by high air passenger growth rate, particularly in the 1990s. Air cargo also grew substantially during this period. According to the ICAO airline database, air cargo traffic carried by airlines registered in Chile grew at a compound annual growth rate of 11.8% between 1985 and 2005 [212].

Air cargo transportation has played an important role in Chilean economy since the early 1960s and has grown substantially starting in the 1970s after the government began to pursue market-oriented policies and began to encourage foreign trade. Access to air transportation enabled Chile diversify its agricultural sector because air transportation allowed Chilean producers to gain access to international markets of affluent consumers. Air transportation has also been an enabler of tourism inflows and resulted in the growth of the tourism industry. While inbound flows of business passengers have enabled foreign investment, their impact has been small compared to the flows of leisure passengers.

Both air transportation supply and demand factors helped stimulate the growth of air passenger and cargo traffic in Chile. Factors which affected air transportation supply included changes in the aviation regulatory framework and privatization reforms which resulted in more competition between airlines and development

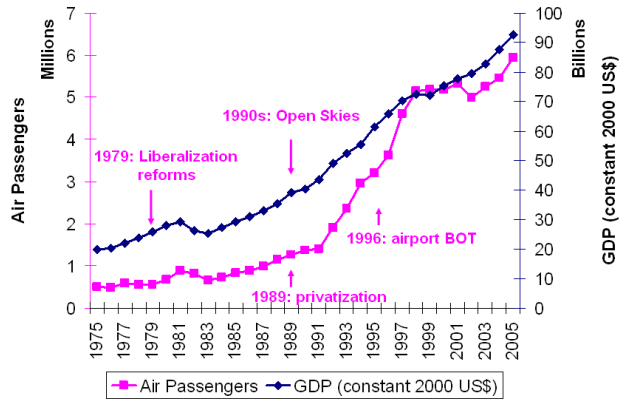


Figure A-13: Chile: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Chile's airlines and GDP were 10.4% and 5.9%.

of the aviation infrastructure. Factors which affected the demand included economic liberalization reforms, trade agreements, tax incentives for foreign investors and promotion of various industries by the government.

A.11.1 Chile: Air Transportation System Development

Chile is one of the most advanced countries with regard to regulation of air services. Air transport liberalization and deregulation reforms were initiated in 1979 [203]. Since then, the country's international air transport policy has been based on the principles of free market entry, freedom of pricing, open skies and minimum government intervention [81]. Some of the current provisions include absence of foreign ownership restrictions, which allows 100% foreign-owned airlines into Chilean domestic markets, absence of barriers to market entry for carriers, and a public auction for allocation of international traffic rights [81]. As part of the liberalization reforms, Chile signed several Open Skies agreements including those with Argentina, Brazil, Spain and the U.S. starting in the early 1990s. A study of liberalization impacts revealed that the traffic growth rate has generally increased following liberalization, but exogenous demand shocks of September 11 and Argentina's economic crisis at the turn of the century had a detrimental effect on passenger traffic growth [203].

The airlines of the private LAN Airlines group are the dominant players in the country's aviation. In 2006, LAN accounted for 54% of international passengers, 74% of domestic and 56% of air cargo services [60]. However, competition on both domestic and international routes has risen strongly in recent years. In particular, arrival of three low-cost airlines, Brazil's Gol in 2006, Spain's Air Comet and Germany's LTU in 2007 and formation of LAN's low-cost subsidiary, have resulted in demand stimulation because of the decrease in the air fares[60].

Privatization reforms also helped improve the air transportation industry and enabled the flow of capital investment to aviation infrastructure. The government underwent airline privatization of LAN in 1989 and privatization of all commercial airports through build-operate-transfer concessions between 1996 and 1998 [60]. As a result of these reforms, the airport sector became open to private investment [81]. Build-operate-transfer concessions have facilitated the expansion and modernization of the main regional airports, and allowed the government to allocate funds for maintenance and gradual expansion of smaller airports.

The country's main airport in Santiago also underwent expansion. Santiago International Airport opened a new terminal in 2002 and a second runway in 2005 at a cost of US$70m [60].

A.11.2 Chile: Economic Impact of Air Transportation

In Chilean market-oriented economy, industry earnings account for half of the country's GDP as a result of the major role played by minerals in the economy, while services account for 45% of GDP, and agriculture, forestry and fishing contribute 3.8% [60]. Chile's geography and difficult terrain make air transport essential for fast and reliable connections both within the country and for access to major consumer markets in North America, Europe and Asia. Economic activity in Chile is heavily concentrated in the central region around the country's capital Santiago. In fact, the 2002 census showed that more than 50% of the population lives in the Santiago metropolitan area and the adjoining regions [60]. The north region is dominated by mining, the south by salmon-farming, tourism and large-scale methanol production. Tourism and export agriculture are strong engines of growth in the center-north, while forestry, tourism, fruit production and traditional agriculture are important to the center-south regions [60].

Goods Flows

Chile has a market-oriented economy characterized by a high level of foreign trade. As of 2007, the country has had free trade agreements with over fifty countries including those with the E.U., the U.S., South Korea and China [60]. As a result of market diversification reforms in the 1980s and the diversification of Chile's export products, the share in GDP of exports of goods and services has increased from 26.3% in 1998 to 45.4% in 2006 [60]. While foreign trade is still dominated by copper exports, accounted for 60% of all exports in 2006, Chile has made an effort to expand into the nontraditional exports as well [108]. The most important non-mineral exports are forestry and wood products, fresh fruit and processed food, fishmeal and seafood, wine and menthol [192]. Because of the high value to weight ratio, some of these exports are routinely shipped by air.

The development of air transport infrastructure enabled Chilean producers to gain access to affluent consumers worldwide and prompted a shift in agricultural production. Before 1974, Chile's primary agricultural exports were traditional crops: beans, lentils, and wool. However, starting in the 1970s, the Chilean government has provided incentives for agricultural diversification as air cargo became a cost-effective transportation mode. As a result of these incentives, Chilean farmers planted apple orchards and table grape vineyards, and by 1975 Chile began exporting large quantities of the nontraditional crops. These new crops helped diversify agriculture, provide employment, and generate foreign exchange [198]. In the early 1960s, South American states began to export fresh produce by air [202]. The growth in air cargo trade has increased in the last two decades because of improved trade conditions. For example, the signatory of the Andean Trade Preferences Act (ATPA) between the U.S. and Andean countries which was ratified by the U.S. Congress in 1991 easing the trade between Chile and the United States [202].

A comprehensive survey of Chilean firms found that 28% of sales were directly dependent on good air transport links [108]. Air cargo exports from Chile to the U.S. include fresh or frozen fish, seeds for sowing, fruit, vegetables and flowers [94]. In comparison, air cargo imports to Chile from the U.S., based on the data for the state of Florida, include high-value goods including computers and peripherals, motor vehicle

parts and other machinery, medical equipment, telecommunications equipment, agricultural machinery, video games, and pharmaceuticals [94]. The air cargo imports to Chile on average are higher in value and smaller in weight when compared to Chilean exports to the United States. According to Delta Airlines statistics, perishable goods can account for 90% of the cargo load in some Latin markets [84].

Cost is a major parameter in providing a feasible transportation mode for perishable products. For example, high fuel prices in 2008 prompted some Chilean producers to ship seafood frozen by sea instead of using the traditional air cargo services [45]. The demand is also sensitive to economic recessions at the destination. For example, the 2001 economic recession in the U.S. had a negative impact on demand for imports and the resulting demand for air services from many Latin carriers including LanChile [84].

Tourism Flows

In addition to shipping, air transport supports diversification of economic activity particularly in tourism and other service-based industries. International Air Transport Association estimates that air transport (including tourism) contributes 2.9% to Chile's export earnings both through the activity of airlines and facilitation of exports by other sectors and supports 3.2% of the country's jobs [108].

According to World Tourism Organization, international tourism receipts account for around 1% of Chile's GDP. Over 2.2 million international tourists arrived to Chile in 2006 of which around 45% arrived by air. In 2006, Argentina and other South American countries accounted respectively for 31% and 34% of the international tourist arrivals to Chile, followed by Europe (17%), North America (12%) and Asia (2%) [108]. Leisure travel is the primary purpose of visit for the majority of the international tourists. Because it is dependent on international demand, the tourism industry is particularly sensitive to economic recessions at the originating countries and exogenous demand shocks. For example, inbound tourism and air travel to Chile declined during the Argentine economic crisis between 1999 and 2002 with the greatest decline in 2002. As a result of the economic downturn, the share of Argentinian tourists to Chile fell from 50% in 2000 to 33% in 2003 or from 859 to 536 thousand people [108].

Investment Flows

Access to air transportation enables time sensitive people, including investors and high-skill professionals, to seek opportunities in new markets. Business travel to Chile is expected to expand following the launch of an investment program by the Chilean government in 2003 which may help to attract multinational firms because of taxation and other incentives [108]. Currently, Chile continues to attract foreign direct investment, but most foreign investment goes into gas, water, electricity and mining [41]. It is hoped that the new tax reforms and promotion of industries by the Council on Innovation and Competition will encourage domestic and foreign investment in research and development. Unfortunately, poor record of copyright protection may undermine Chile's efforts to develop innovative, knowledge-based sectors [192]. As a result, travel for business purposes currently plays a minor role in the Chilean economy.

A.11.3 Chile: Conclusions

While the number of air passenger carried on airlines registered in Chile's has been rapidly growing in the last two decades, air transportation in Chile is used primarily to export perishable food and horticultural goods,

which constitute a relatively small share of the country's earnings but account for a large share of country's export air cargo. Air cargo has been utilized to transport Chilean exports to affluent consumers worldwide since the early 1960s. Air passenger travel enables the inflows of leisure passengers who represent the majority of international visitors to the country and support the growing tourism industry. Air transportation also enables flows of foreign investors which have been growing following institutional and economic liberalization reforms in the last decades.

The high air transportation growth rates in Chile were supported by economic reforms and liberalization reforms in the aviation sector. Both air transportation supply and demand factors helped stimulate the development. International liberalization agreements and privatization reforms were two major factors which have stimulated air transportation supply development since the 1990s. These reforms helped promote competition among airlines and assured availability of funds for infrastructure investment projects. Trade liberalization reforms, governmental incentives for production of certain products have affected the competitiveness of Chilean goods and stimulated the growth in demand, particularly for air cargo services. Development of good transportation infrastructure, including air transport, allowed Chile to break the distance barrier and export products to all regions equally. The geographical distribution of Chilean exports is balanced between Asia, Europe and the Americas, with each taking around a 30% share [60]. In comparison, the trade data for many countries supports the traditional gravity model where the economic interaction between economies decays non-linearly with distance.

However, the Chilean passenger and cargo demand is particularly susceptible to exogenous demand shocks since it is dependent on international consumers for leisure tourism and demand for agricultural and other goods. As a result, economic recessions and substantial increases in the cost of fuel have suppressed industry's development in recent years. For example, economic recession in Argentina between 1999 and 2002 suppressed the demand for leisure passengers from Argentina, while the economic recession in the U.S. in 2001 resulted in the decrease of demand for high-value agriculture products.

Chile: Change Factors Summary

Stimulating:

- International liberalization
- Airline privatization and ownership
- Economic liberalization

Suppressing:

- Economic downturn at the tourists' country of origin
- Economic downturn which reduced the demand for Chilean exports

A.12 Average Growth: The United States of America

The United States of America is the largest economy in the world. The country's GDP has experienced steady growth over the last thirty years as shown in Figure A-14. Over the last several decades, the economic growth has been marked by low unemployment and inflation, and rapid advances in technology [41]. As a

consequence of these economic attributes, the Global Competitiveness Report gives the U.S. economy its highest rank [165]. According to the report, the primary strengths of the U.S. market-oriented economy are its ability to innovate and the presence of factors which support innovation such as education, capital investment and sophisticated business institutions [165].

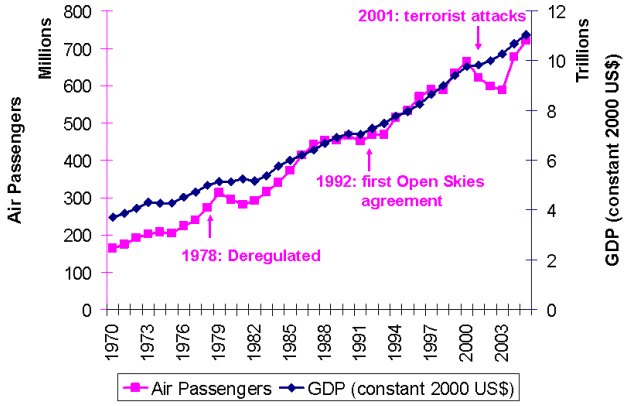


Figure A-14: USA: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by U.S. airlines and GDP were 3.4% and 3.1%.

Since the U.S. is a geographically large and economically diversified country, the country's major economic activity areas are spread geographically. Due to the lack of rail infrastructure and long distances, air travel is the only feasible transportation mode for longer trips. Consequently, the U.S. air transportation system is the largest in the world and the majority of air travel takes place on domestic routes.

A.12.1 The United States: Air Transportation System Development

The U.S. has the largest air transportation system in the world. In 2005, the U.S. airlines accounted for 36% of all air passengers transported worldwide. The majority of these passengers, almost 90% in 2000, used air services to travel domestically [208]. As Figure A-14 shows, air travel in the United States has been growing on average over the last several decades. The system experienced two periods of suppressed development: between 1979 and 1981, and between 2000 and 2003.

Historically, the U.S. has been at the forefront of the aviation reform. The U.S. was the first country to pursue domestic deregulation in 1978 and to promote open skies agreements starting in the early 1990s. The deregulation of airline industry in 1978 allowed free-market competition by removing regulation of entry, routes, and fares. Following deregulation, the domestic traffic, as measured using Revenue Passenger Miles (RPMs), grew faster [185]. Specifically, between 1954 and 1978, RPMs grew at an average annual rate of 5.8 million RPMs per year, but in the period between 1978 and 2002, the average rate increased to over 11.7 RPMs per year [185].

Since the 1978 deregulation, several major structural changes have occurred in the U.S. airline industry. Prior to deregulation, the government limited the market share of an individual airline at any single airport in order to preserve local competition. After deregulation, the airlines developed a comprehensive national hub-and-spoke system to expand the scope and connectivity of their route networks. The hub-and-spoke system allowed airlines to connect a maximum number of city-pairs with a minimum number of flights. In

particular, development of the hub-and-spoke network enabled airlines to provide services to smaller cities where local demand levels would otherwise not be able to support the point-to-point services [185].

After deregulation, the industry underwent significant consolidation so that airlines could optimize their route networks and maximize profits. In particular, comprehensive network coverage at both regional and national levels was developed as the largest airlines developed regional feeder services and underwent mergers and acquisitions to create nationwide and/or regional networks [185].

Liberalization of market entry and exit allowed formation of new airlines and growth of low-cost carrier operations. For example, after deregulation Southwest Airlines, which was established in Texas in 1971 [10], was able to expand its successful point-to-point network model beyond Texas. Southwest Airlines became a major airline in 1989 when its revenues exceeded one billion dollars. As of 2007, Southwest was the largest domestic U.S. carrier based on the annual number of carried passengers [200].

Throughout the last several decades, the growth in passenger travel was also stimulated by the continuing decrease in the airline ticket prices. As Figure A-15 shows, the airline yield (the average price paid per passenger-mile) on domestic operations has been continuously declining in real terms for several decades. The international yields, despite the evidence of growth since 2002, also decreased substantially in real

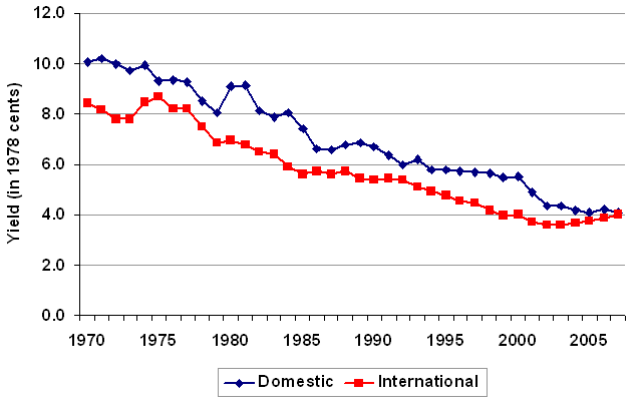


Figure A-15: Declining real yields of U.S. airlines (in 1978 cents per passenger-mile). Data source: Air Transport Association (ATA) website *http://airlines.org*.

terms when compared to historic figures. At the same time, the disposable incomes of the U.S. population grew as the country's GDP increased. As a result of a decrease in the ticket prices and an increase in disposable incomes, air travel became an affordable and an attractive alternative for a larger share of the U.S. population.

While the airline passenger traffic in the U.S. has been on average growing over the last several decades, as shown in Figure A-14, it has experienced two periods of negative air passenger growth rates: between 1979 and 1981, and between 2000 and 2003. Both of these declines coincided with the U.S. economic recessions: a two-year long recession in January-July 1980 and July 1981-November 1982, and an eight-month long recession between March 2001 and November 2001 [199]. The industry's decline in the early 1980s was exacerbated by the record fuel prices which soared as a result of Iran-Iraq war [57] and the air traffic controllers strike in 1981 which affected the air traffic management system and cut the system's operating

[10]The primary source for the following description is the company's website: *www.southwest.com*

capacity to 80% for at least a year [150, p. 155]. The economic downturn and the resulting decrease in air travel demand of early 2001 were further exacerbated by the September 11 attacks which lead to a crisis in the U.S. airline industry [185]. As can be seen in Figure A-14 this decrease in air travel demand resulted in negative air passenger growth rates between 2000 and 2003 while the country's GDP was increasing, or quadrant Q3 behavior as it was defined in Chapter 4.

To support the growth of traffic, there have been efforts to increase the capacity of the U.S. air transportation system through operational and infrastructural improvements. The U.S. air transportation system is composed of 5,280 public airports. Figure A-16 shows the geographical distribution of airports. The largest number of airports are located in densely populated urban areas especially on the East and West coasts. While the number of airports in the United States is high, only a few airports play a significant role in the nationwide air transportation system. In fact, almost 90% of the traffic is handled by 70 airports [24, p. 55]. While there have been infrastructure investment projects at many of the country's largest airports,

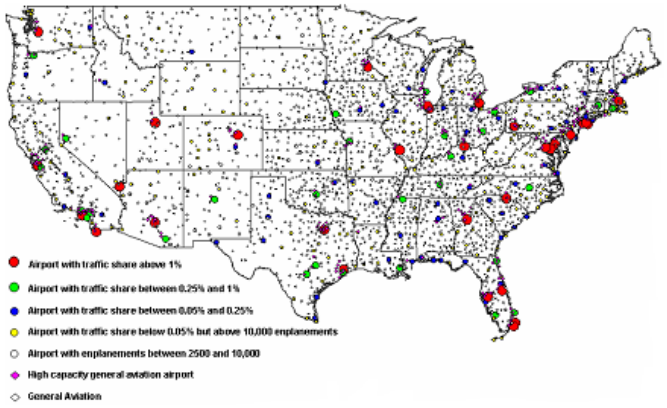


Figure A-16: Geographical distribution of airports in the United States from [24].

only two new major airports were built in the United States in recent decades: Denver International Airport in 1995 and Dallas/Fort Worth International Airport which was completed two decades earlier [50].

Air transportation has been growing as evidenced by the growing passenger numbers in Figure A-14, but the growth has slowed at several airports around the country in recent years. Comprehensive analysis of the U.S. airport infrastructure by Bonnefoy showed that over the last three decades airports which are slot-restricted or which have exhibited evidence of delays have had sub-linear growth rates [24, p. 99]. These airports include Washington/Reagan (DCA), New York/La Guardia (LGA), Chicago/O'Hare (ORD), New York/Kennedy (JFK), New York/Newark (EWR), Atlanta (ATL), Boston/Logan (BOS), and San Francisco/Intl (SFO). In comparison, the highest air passenger growth rates have been observed at the airports which became connecting hub airports during that time period.

Capacity expansion at some of the major airports is often limited by physical, environmental, and political constraints. Since physical expansion is often not possible, the airport operations at congested airports have been expanding to multi-airport systems [11]. Analysis of growth patterns of multi-airport systems showed that the growth has been linear over the last thirty years [24, p. 100]. In other words, even though the

[11] Multi-airport systems are defined as a set of two or more airports that serve more than 500,000 passengers each in a single metropolitan region.

growth of Boston/Logan (BOS) airport has been sub-linear, at the aggregate multi-airport system level, which also includes secondary airports in Manchester and Providence, the traffic has been growing at the rate comparable to other multi-airport systems in the United States [24, p. 94]. The only notable exception is the New York multi-airport system which includes three of the most congested airports in the United States: almost 40% of gate arrivals were delayed at La Guardia (LGA), Newark (EWR) and Kennedy (JFK) airports in 2007 [12].

The United States was one of the first countries to pursue a liberalized international aviation framework referred to as "Open Skies". These agreements remove the majority of the restrictions found under the traditional bilateral air services agreements, such as capacity and fare restrictions [154]. The first agreements were signed with Netherlands and Singapore in 1992. Since then, the U.S. signed a number of agreements with other countries which included the 2007 Open Skies agreement with the EU. The agreement went into effect on March 30, 2008 and allowed airlines based in the United States and Europe to fly across the Atlantic between any two airports in each region. Before the pact, trans-Atlantic flights were governed by bilateral agreements between the individual countries and allowed European carriers to operate trans-Atlantic flights only between their home countries and the United States [172]. The route between New York's JFK and London's Heathrow airports was one the lucrative markets which opened up to increased competition following the agreement. However, because both airports operate at nearly full capacity which cannot easily be expanded by infrastructural or operational means, the airlines could not take advantage of the new opportunities provided by the agreement. In particular, even though the agreement liberalized the trans-Atlantic market by allowing airlines based in the United States and Europe to fly across the Atlantic between any two airports in each region, the only way to gain access to Heathrow was to buy landing and take-off slots or acquire an airline which already operates there [172].

Even though the U.S. liberalized many of the operational aspects in aviation, it still has rather stringent restrictions on foreign ownership. In particular, the current foreign ownership rules limit foreigners to 25% of voting equity in the U.S. airlines while the EU limits non-EU ownership to 49%. The original EU-US Open Skies treaty included changes to foreign ownership rules because several European carriers, including Virgin, Lufthansa and Air France-KLM, expressed interest in trans-Atlantic purchases or mergers [172]. However, the United States delayed further foreign ownership negotiations until the second phase talks which are scheduled for 2010.

A.12.2 The United States: Economic Impact of Air Transportation

The U.S. is a large high-income economy with a well-developed air transportation infrastructure. Because of the ubiquity and maturity of the air transportation system and variability in the economic activity across geographic regions, the key enabled flows vary substantially between the regions. Therefore, the enabling impact of air transportation is best evaluated at the airport or regional levels. For example, one can use the tools developed by Regional Economic Models, Inc. (REMI). REMI uses statistical tools to evaluate the enabling impact of air transportation at a country or regional level by analyzing the region's mix of industries and the available transportation infrastructure. Numerous studies are also available in the literature including those evaluating the impact of Logan and Baltimore International Airports [58, 36] and econometric studies

[12] Data source: Federal Aviation Administration Airline Service Quality Performance (ASQP) database.

which were reviewed in Chapter 2. The description below provides only a brief analysis of the enabled flows at the aggregate country level.

Goods Flows

The Federal Aviation Administration study of the economic impact of civil aviation in the United States found that civil aviation has the greatest impact on the following three industry groups: Accommodation and Food services, Manufacturing, and Transportation and Warehousing sector [82, p. 28]. In recent decades, manufacturing and transportation sectors became particularly dependent on readily available access to air transportation with the increased use of supply chain management techniques, including "just-in-time" shipping practices, as evidenced by the growth of the express air cargo industry [82, p. 22].

The majority of air cargo is transported by integrated air-truck carriers such as FedEx and UPS. In general, the U.S. domestic cargo market is dominated by the express business which accounted for 61% of domestic Revenue Ton Kilometers (RTKs) in 2001, followed by 20% of freight on scheduled services, 15% of mail and 4% of freight on chartered services [36, p. 6]. Since 1980, express carriers were the primary drivers for growth of the U.S. air cargo industry. In comparison, in 1980, express carriers represented less than five percent of domestic RTKs [36, p. 10].

Air cargo express services are particularly important for firms working with global suppliers and partners and firms in high-technology sectors. For example, in 2000 $25 billion of exports from New England were shipped by air. And while Canada was the leading receiving nation with the majority of the goods shipped by surface transportation modes, almost 80% of exports destined for Asian and European markets were shipped by air [58, p. 17].

Services Flows

The U.S. economy is dominated by service industries which contribute almost 80% to the country's GDP [41]. Business passenger travel is an important operational component of some service industries. For example, producers of high-tech products, business services, insurance and computer-oriented firms spend at least 25% more on air services than an average industry in the United States [58]. Business travel is also essential for finance, educational and legal services industries because these industries depend on air travel for delivering their expertise to clients at their respective locations [58, p. 12]. Because of local specialization, the air travel needs of local business vary among the regions. For example, because New England's economy relies on high-tech and knowledge-based industries, more than half of the passengers using Logan International Airport are business travelers [58, p. 27]. In comparison, the share of business passengers nationwide has dropped to below 50% of all trips since the late 1980s [21].

Knowledge Flows

Business passenger travel for consulting and other services enables technology transfer and knowledge spillovers in the local economy. Knowledge sharing is one of the beneficial outcomes of face-to-face contact both in individual meetings and professional conventions. It is estimated that business passenger travel in the United States for meetings, conventions, exhibitions, and incentive travel accounts for nearly 17%

of the air transportation industry's operating income and generates more than 36% of the hotel industry's revenue [44].

Investment Flows

Air transportation provides access to financial capital by allowing investors an opportunity to oversee and monitor their investment. In 2006, the United States was the largest single receipt of global Foreign Direct Investment flows which amounted to US$175 billion [195]. The United States was also listed as the second most-favored location for foreign affiliates of the largest Transnational Corporations, behind the United Kingdom [195].

Labor Flows

International labor flows play an important role in the U.S. economy. As of 2005, immigrants accounted for 13% of the country's population and the top five source countries were: Mexico, Philippines, Germany, India, and China [211].

Tourism Flows

Since the United States is a very large country, it offers leisure destinations to suit nearly every taste. Given the choices, Americans often choose to travel domestically instead of venturing abroad. As a result, the U.S. has a very strong domestic tourism industry [75]. In 2004, domestic travel expenditure was US%340 billion while international incoming tourism receipts amounted to US$93 billion [75]. These numbers include travel for all purposes: leisure, business, visiting relatives and friends, and other.

The United States is also a popular destination for international leisure travelers. In 2006, inbound international travelers outspent U.S. travelers abroad resulting in the tourism trade surplus for the U.S. economy [82, p. 28]. The majority of inbound tourists come from high-income economies and declare leisure as the primary purpose of their travel. In comparison, inbound visitors from China, which have had the highest growth rate in recent years, declare either business (60%) or conference attendance (13%) as their major travel purpose [82, p. 28].

Access to affordable air services is often necessary for domestic and transnational seasonal retirement migration. The ability to travel lets families maintain contact affecting their quality of life. Seasonal retirement migration has a major impact on the resident populations of both sending and receiving communities. In the United States, the largest impact of seasonal migration occurs in the Sunbelt states, particularly Florida, Arizona and Texas. It is estimated that Arizona is a winter home to 273,000 long-term seasonal residents, while Florida had more than 800,000 elderly temporary in-migrants in 2005 from Canada and the United States [174, 98].

A.12.3 The United States: Conclusions

Because the United States is a large and economically diverse country, many of its economic activities are dependent on having access to both passenger and air cargo services. In particular, business passenger travel is important to some service industries, such as business services, finance and legal industries since they depend on travel to locally deliver expertise to the clients. Business travel is also essential to support

knowledge sharing and collaboration in high-tech and innovative sectors. Leisure passenger travel supports an extensive domestic tourism industry and lets families maintain contact affecting their quality of life. Access to express air cargo services is essential to ensure reliable delivery of components and products to support high-tech manufacturing and cost-saving manufacturing practices such as just-in-time inventory production. In general, because of specialization between different regions, it is best to evaluate the enabling impact of air transportation at a local, rather than nationwide level. Numerous studies and proprietary models are available to achieve this objective.

The U.S. air transportation system is the largest in the world and is characterized by mature infrastructure with limited physical expansion opportunities at the country's largest airports. Both the U.S. economy and air passengers have been steadily growing over the past several decades. Air passenger demand growth has been stimulated by the domestic deregulation which increased competition between carriers and enabled the growth of low-cost carriers and their point-to-point networks. The growth in demand has also been supported by the availability of alternative secondary airports which enabled the growth of traffic at the aggregate level of multi-airport systems. The demand has also been stimulated by the continuing decline in the airline ticket prices when compared to the historical levels and adjusted for inflation. The growth in air travel demand has been suppressed by the economic recessions and several exogenous shocks which included oil crises, the air traffic controller strike in 1981 which affected the capacity of the air traffic management system, and terrorist attacks on September 11, 2001.

Historically, the U.S. has been at the forefront of aviation reform such domestic deregulation in 1978 and the promotion of open skies agreements since the early 1990s. These regulatory changes helped stimulate air transportation development. However, as of 2008, the aviation regulatory framework is more conservative compared, for example, to the EU framework. In particular, the U.S. still has more stringent foreign ownership restrictions compared to its European counterparts.

Even though the U.S. traffic continues to grow at the aggregate level, there are indications that there are limits to further growth at the individual nodes of the U.S. air transportation system. In particular, even though the total system capacity has been increasing through operational and infrastructural improvements, capacity expansion at some of the airports is often limited by physical, environmental, and political constraints. In 2007, almost 20 percent of total domestic flight time in the United States was wasted in delays [171]. These delays may have an adverse economic impact on the regional economy because they affect the location decisions of businesses dependent on having reliable access to air services, such as freight forwarders, computer and electrical equipment industries, insurance, and business services [58]. In fact, in places where the system experiences persistent delays and is not reliable, alternative business and leisure locations may become more attractive resulting in significant changes in regional employment and industry composition.

The United States: Change Factors Summary

Stimulating:

- Domestic deregulation
- International liberalization
- Low-cost carrier development

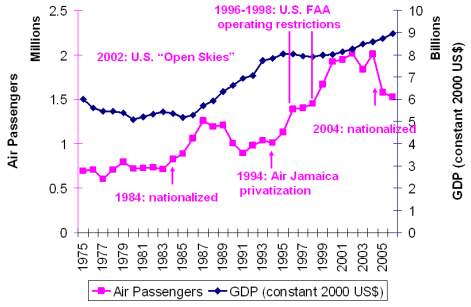
- Airport infrastructure: availability of secondary airports

Suppressing:

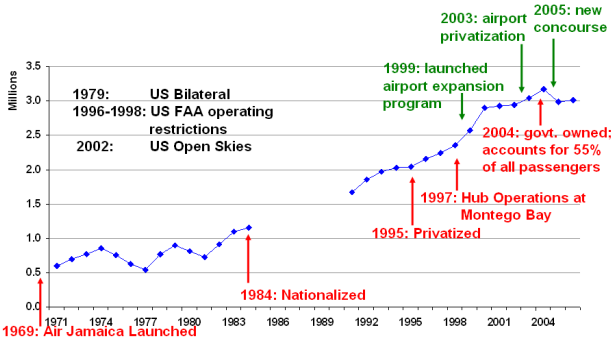
- Ownership restrictions
- Airport infrastructure capacity
- Air Traffic Management: shortage of air traffic controllers
- Airline business factors
- Economic downturns
- Exogenous demand shocks: September 11 attacks

A.13 Average Growth: Jamaica

Jamaica is a developing island economy in the Caribbean. Because of its geographical isolation, the island's economy is particularly dependent on having access to air transportation services. Air transportation enables access to leisure travelers from high-income countries which account for the overwhelming majority of the people visiting the island. In addition to leisure passengers, air transportation helps sustain the links among the Jamaica's global community and enables flows of remittances which account for a substantial share of GDP. Business passengers represent the smallest share of arrivals to the island.



(a) Between 1985 and 2005, the average growth rates for the number of passengers carried by Jamaica's airlines and GDP were 2.9% and 2.6%.



(b) Passenger Embarked + Disembarked for Sangster International Airport in Montego Bay, Jamaica. Airport and airline developments are noted in green and red respectively. The primary data sources are ICAO statistics, news sources and the official airport website: *http://www.aaj.com.jm/*.

Figure A-17: Growth in air passenger traffic and GDP for Jamaica. The air transportation data for the country as a whole exhibit large volatility since they represent effectively only Air Jamaica. The Montego Bay airport data reflect the actual number of visitors into Jamaica's largest airport.

The island is a popular tourist destination and is served by many carriers including a national carrier, Air Jamaica, whose operational statistics are reflected in Figure A-17(a). The passenger data for the country's largest airport are shown in Figure A-17(b). These data reflect the airport's operational statistics and therefore include passengers carried on all of the airlines using the airport facilities.

During the last several decades, both the country's air transportation industry and economy grew at an average rate of under 3%. Air transportation development has been subject to several change factors

noted in Figure A-17. Several factors suppressed air transportation development in recent decades. They included operating restrictions placed on Air Jamaica by the U.S. Federal Aviation Administration due to safety and oversight concerns and exogenous demand shocks which affected inbound leisure passenger traffic. Jamaica's air transportation development was also suppressed by its stringent bilateral aviation agreements which may have prevented the low-cost carrier development that occurred in other Caribbean markets following liberalization reforms in recent years. However, despite the fact that Jamaica's air transportation development has been subject to several suppressing factors, its usage has been increasing through the years even when the country's GDP growth stagnated between 1995 and 1998 as shown in Figure A-17(a). Sustained air transportation development has been supported by the Jamaican government. In particular, to ensure air access and sustainability of the tourism industry, the government has been maintaining a policy of underwriting a national carrier Air Jamaica and stimulating its development through infrastructural and institutional changes.

A.13.1 Jamaica: Air Transportation System Development

Jamaica's air transportation development is closely tied to the growth of its national airline Air Jamaica which was launched in 1969 and has played an important role in providing air transportation access to the island ever since. As of 2007, according to the Air Jamaica website, the carrier operated a total of twenty-six destinations worldwide including the U.K., Canada, and the United States and accounted for 55% of all passengers to Jamaica. In an effort to improve carrier's productivity, the government privatized the national carrier: Air Jamaica was sold to a private Jamaican corporation in 1994 [131]. As Figure A-17(a) shows, the carrier's operations grew for several years following privatization. However, Air Jamaica began to experience financial difficulties around the turn of the century which were in part attributed to high fuel prices and reduced tourism demand from the U.S. following the U.S. economic recession exacerbated by the 9/11 attacks [131, 143]. To keep the carrier solvent, the government re-nationalized Air Jamaica in 2004 to ensure continued air transportation linkage of Jamaican economy to the rest of the world which would otherwise be dependent solely on the foreign carriers.

Figure A-17(a) indicates that Air Jamaica growth was suppressed by the operating restrictions from the United States between years 1996 and 1998. Airlines flying to international destinations are subject to safety restrictions which may be placed on them by international (e.g., ICAO) or local (e.g., U.S. FAA) authorities. Air Jamaica traditionally operated an extensive network to the United States and was listed under Category 1 by the United States Federal Aviation Administration (FAA) international aviation safety assessment program for abiding to proper civil aviation standards. However, in 1996 FAA placed operating restrictions on Air Jamaica by downgrading the country to Category 2 for partial compliance with the FAA safety standards. The FAA assessment program examines the quality not of individual foreign carriers but of the civil aviation authorities and, as a result of the assessment, may restrict or ban the airlines from the United States until the aviation standards are improved at home [139]. The restrictions were removed in 1998 following the upgrading of Jamaica's Civil Aviation Authority oversight procedures and maintenance management controls [2]. During the two-year period of operating restrictions from the U.S. Air Jamaica could continue to fly to the United States, but it had to keep to its existing fleet and could not open new routes [2]. These restrictions suppressed carrier's network development and profitability during this period. Meanwhile, Air Jamaica has never been involved in an aviation accident [12, 13].

The government of Jamaica supports air transportation system development and competition on international routes as long as its airlines have a sustainable competitive position in their main markets and are not marginalized [114]. To promote air transportation development, Jamaica established its first set of bilateral air service agreements with the U.S. in 1979 and further liberalized services by signing the Open Skies agreement in 2002. However, the agreement is more conservative when compared to more liberal air services agreements between the U.S. and other tourism-dependent economies in the Caribbean [206]. For example, Jamaica–U.S. market has some entry and fare restrictions. The presence of these restrictions may have had an adverse impact on further development of tourism flows between the island and the U.S. because low-cost carriers have been avoiding certain city-pairs between the U.S. and Jamaica while establishing routes between the U.S. and other Caribbean destinations [206].

Continued growth of the air transportation industry has been supported by aviation infrastructure investment in the country's two international airports: Norman Manley International Airport in the country's capital Kingston and Sangster International Airport in Montego Bay — Jamaica's primary tourism destination. Montego Bay airport accounts for about 60% of Jamaica's air travelers and, as shown in Figure A-17(b), has experienced moderate growth and incremental efforts in infrastructure improvements which were aligned with the national carrier's expansion strategy.

A.13.2 Jamaica: Economic Impact of Air Transportation

Jamaica's economy is dependent on imported consumer goods and raw materials, and on foreign exchange earnings from tourism, remittances, bauxite/alumina and agricultural exports. Over the last three decades, the economy experienced several periods of stagnation. Specifically, in recent years, the economic development has been suppressed by high crime rates, high unemployment, and a debt-to-GDP ratio of 135% which prevented the government to channel funds into social and physical, including aviation, infrastructure [192]. Because of these issues the cost of operations in Jamaica increased reducing Jamaica's international and regional competitiveness and reducing export earnings in several sectors of Jamaica's economy [192]. These sectors included garment assembly, light manufacturing and data entry by foreign firms. As a result, service industries, which account for more than 60% of the country's GDP and employment, have come to play an even greater role [41]. Air transportation is essential for sustaining the country's large tourism industry and providing access to capital flows through access to foreign investors and Jamaican expatriate community.

Tourism Flows

The tourism industry dominates the Jamaica's service sector with tourism revenues contributing 20% to the country's GDP [41]. While air travel is the primary means of reaching the island for the overnight visitors, the island's tourism industry also relies on those arriving by cruise ships. However, cruise passengers do not use Jamaica's accommodation facilities and their contribution to Jamaica's economy is a lot smaller. The majority (almost 80%) of the people arriving to the island by airplane declare leisure as the primary purpose of their visit [213]. Jamaica's inbound tourism industry is dependent on the tourists from the United States: U.S. nationals account for more than 70% of all tourist arrivals [37]. Since the industry depends on exogenous demand, it is particularly susceptible to economic downturns and demand shocks, such as the September 11 attacks, at the tourists' country of origin.

The majority of the tourists visiting Jamaica are attracted by the island's beaches, good climate and tourism infrastructure. One of the major changes in the Jamaican tourism industry since the 1970s was the introduction of all-inclusive hotels, which in 2004 accounted for 53% of all rooms available [99]. The all-inclusive concept was first introduced to Jamaica in 1976 as a full service tourism product designed to eliminate extra charges which may typically be incurred during a vacation. In the Caribbean today, the all-inclusive resorts cover practically everything a resort has to offer including accommodation and all food, land and water activities, transportation, equipment with instruction, drinks and tips [121]. Currently, there are different types of all-inclusive accommodations in Jamaica which appeal to different types of tourists including singles, couples, families, and high-end vacationers. While the cost of staying at all-inclusive accommodation is comparable to other hotels, the economic and environmental impact of different types of hotel infrastructure differ substantially [99, 27]. The implications of these differences on the overall attractiveness of Jamaica as a tourism destinations are explored further in Chapter 7.

Jamaica's tourism industry was one of the few industries which continued to expand during the country's economic recession in the 1990s. During those years, the country's economy was characterized by high unemployment and crime rates which limited foreign investment [67]. At the same time, high government debt limited the loans available to the private sector, limited social and physical infrastructure investment, and eroded confidence in the production sector [192]. As a result, the country's GDP growth stagnated after 1995 and grew at a modest year-on-yea rate in the 0.5% to 2.5% range since then [192]. However, as a result of continued investment in the tourism industry, the number of leisure travelers to Jamaica continued to grow during those years resulting in positive air passenger growth rates, as evidenced in Figure A-17(a), and an increase in tourism expenditure despite the country's economic recession [213].

Despite the general growth in the number of inbound leisure passengers, the Jamaica's share of the tourism market and the year-on-year growth rates have been decreasing since the mid-1990s. In particular, in terms of the world tourism expenditure, between 1983 and 2000, Jamaica's share declined from 0.39 to 0.28 percent [209]. While several factors affected Jamaica's attractiveness as a leisure destination and are explored further in Chapter 7, the World Bank study found that the most recent declines in the tourism expenditure growth rate have coincided with the periods of appreciation of the Jamaica's local currency which effectively increased the cost of staying in Jamaica for foreign visitors. The general decline of the Jamaica's tourism growth rates does not reflect the growth pattern of the Caribbean region as a whole. For example, while Jamaica's market share decreased during the late 1990s, the inbound tourism expenditure grew substantially in other popular destinations in the Caribbean, such as the Dominican Republic, Cancun and Aruba [209, p. 154].

The demand for goods and services produced by the economy is influenced by exchange rates and trade agreements with the rest of the world. Fluctuations in exchange rate change the relative price of imports and exports. For example, if the local currency appreciates, or increases in value, then the local demand for imports increases because they become less expensive while the demand for exports decreases because their relative price increases. Local currency appreciation makes the country more expensive compared to other economies. As a result, it may have a negative impact on inbound tourism demand and capital investment. Jamaica's government is burdened by a large foreign debt. The Jamaican dollar had a relatively stable exchange rate relative to the U.S. dollar until 1990 when it was floated and radically devalued. In the late 1990s a crisis in the financial sector obliged the government to intervene in the operations of several banks

and insurance companies [67]. Since then, the Jamaican dollar continued to slip despite the government's attempts to prevent any abrupt drops in the exchange rate through periodic intervention in the market [192]. These fluctuations in the exchange rate and poor macroeconomic management may have had a negative impact on inbound tourism demand and foreign capital investment. In particular, the World Bank study found that the declines in the tourism expenditure growth rates in Jamaica coincided with the periods of appreciation of the Jamaica's local currency [209, p. 154].

Remittances Flows

In addition to tourists, air travel is essential for the expatriates living abroad whose remittances contribute substantially to the GDP. Remittances contribute up to 20% to the GDP since at least one out of four Jamaican citizens currently lives abroad [128, 41]. The top three destinations for Jamaica's emigrants are United States, United Kingdom and Canada. While emigrants consist of both low-skill and high-skill workers, as of year 2000, more than 80% of the country's population with tertiary education did not reside in Jamaica [211]. Over the years, this outflow of skilled workers has had a substantial impact on the overall competitiveness level of Jamaica's economy.

Investment Flows

Jamaica's government supports economic diversification and encourages foreign investment in areas that earn or save foreign exchange, generate employment, and use local raw materials [192]. However, the county's factor conditions rank poorly on the international competitiveness scale reducing its attractiveness for business investment. The Global Competitiveness Report places the Jamaica's competitiveness index at 78 among the 131 countries [165]. This modest ranking is due to crime, inefficient government bureaucracy and poor macroeconomic conditions which hinder investment. The foreign investment is also hindered by inadequate social and physical infrastructure levels because the government lacks sufficient investment funds due to a high public debt burden [63]. As a result, even though the government encourages economic diversification, the country's economic growth is currently tied to the development of its tourism industry. In fact, only 6% of air passengers declare business as the primary purpose of their visit [213].

A.13.3 Jamaica: Data Sources Comparison

Analysis of the two air transportation trends in Figure A-17 illustrates some of the issues endemic to sources of air transportation statistics. The data in Figure A-17(a) show the scheduled passengers traveling on airlines registered in the country. Since Air Jamaica is the country's only major carrier, the data reflect the national carrier's passenger statistics. The data in Figure A-17(b) show the total number of passengers using the country's largest airport. The Air Jamaica data have large volatility since the carrier's operations are subject to the available airline resources, strategy and operating restrictions. The airport data do not exhibit such volatility since they represent the data for all the carriers using the airport and hence reflect only the changes affecting passenger demand as a whole. Therefore, airport data more accurately depict the actual number of visitors to the island. However, airport statistics database from ICAO is incomplete: it is missing data for many countries and years. However, airport statistics, where available, have been used in this work to supplement analysis of specific airports and countries.

A.13.4 Jamaica: Conclusions

Jamaica's economy depends heavily on exploitation of natural resources, especially tourism and bauxite. While the government encourages economic diversification and foreign investment, the country's global competitiveness ranks poorly compared to other nations. As a result, international business flows are lacking despite government efforts to promote financial and manufacturing industry development and leisure passengers at 80% and personal business passengers at 15% account for most of the air transportation arrivals to the country [214].

To ensure air access and sustainability of the tourism industry, the government currently underwrites a national carrier Air Jamaica and stimulates its development through infrastructural and institutional changes. Some of the most recent changes included expansion of Montego Bay airport to support Air Jamaica's hub operations and changes in bilateral aviation agreements which opened the markets to international competition. However, Jamaica's bilateral aviation agreements are designed to protect the national carrier Air Jamaica suppressing low-cost carrier development which occurred in other Caribbean markets following liberalization reforms. In addition, Air Jamaica development was suppressed during a two-year period between 1996 and 1998 by the operating restrictions placed on Jamaica by the United States due to safety and oversight concerns.

The air travel to and from Jamaica is primarily generated by foreign holidaymakers. In fact, the majority of the tourists to the island originate in the United States. Since travel need is mostly generated by the consumers in the United States and other developed economies, Jamaica's air transportation and tourism sectors are subject to competition from other leisure destinations, the growing cruise industry, and exogenous demand shocks such as economic downturns in the tourists' countries of origin.

Jamaica: Change Factors Summary

Stimulating:

- Government support of the national carrier

Suppressing:

- Safety and environmental restrictions: airline ban/services suspension
- Economic downturn at the tourists' country of origin
- Political and/or macroeconomic instability
- Exchange rate fluctuations

A.14 Average Growth: Kuwait

Kuwait's air passenger traffic grew at below-average rates when compared to the world's growth rates over the last several decades. As Figure A-18 shows, Kuwait's air passenger and GDP growth trends had several discontinuities in their growth behaviors over the last three decades. In particular, the country had two periods of declining GDP levels: between 1979 and 1982, which was followed by a period of slow growth, and between 1990 and 1991. It can be seen in the figure that after the first decline, the country's GDP reached its 1979 level only in 1997. At the same time, the number of air passengers carried on Kuwait's airlines kept

increasing, with the exception of a two-year period in the early 1990s when the country was involved in the military conflict with the neighboring Iraq.

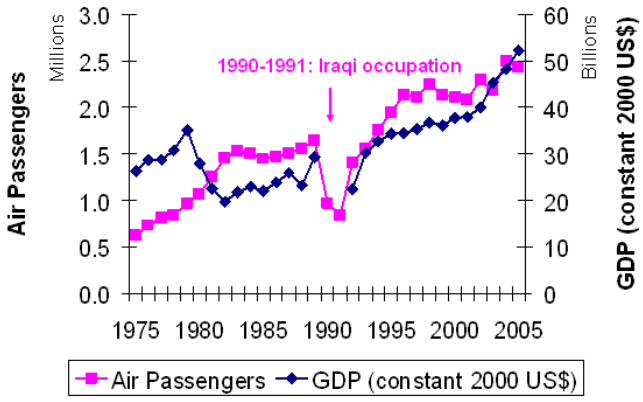


Figure A-18: Kuwait: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Kuwait's airlines and GDP were 2.6% and 4.4%.

Kuwait is a small, rich, relatively open economy whose economic development is closely tied to petroleum extraction and refining with oil accounting for more than 90% of the country's exports and 60% of GDP [192]. Similar to other Gulf states, the country's economic development is dependent on having access to foreign labor flows which are enabled by air transportation. In 2007, foreign labor force, which accounted for 90% of the private sector workers, accounted for 68% of the Kuwait's total population [192]. In addition to enabling access to foreign labor, air transportation enables access to knowledge and foreign investment flows. In particular, knowledge flows are encouraged by the government which sponsors the foreign study of qualified students abroad, and, while private investment is still largely limited to Kuwaiti citizens, in recent years the government began promoting an economic diversification strategy to attract additional foreign investment [192].

While air transportation plays an enabling role in providing access to flows of foreign labor, knowledge and investment, the impact of air transportation on the total GDP level is small when compared to the impact of petroleum sector which accounts for more than half of Kuwait's GDP. As a result of the economy's dependence on the oil sector, the correlation coefficient between Kuwait's air passengers and GDP for years 1975 through 2005 was 0.68, which is relatively low compared to other countries whose airlines carried more than one million passengers in 2005. In fact, according to the U.S. Department of State, the following factors affected Kuwait's economic development over the last three decades: a 1982 securities market crash, the mid-1980s drop in oil prices, and the 1990 Iraqi invasion and occupation [192]. In addition to these factors, the Kuwait's security and oil production were affected by the Iran-Iraq War of 1980-1988 [68].

As can be seen in Figure A-18, the GDP data were not collected during the Iraqi occupation which lasted from August 1990 to February 1991. The war negatively affected both the Kuwait's oil production and capital reserves: the oil capacity was restored in 1993 and capital reserves increased only in recent years following the general increase in the world oil prices [192]. In addition to having a negative impact on the overall GDP levels, the Gulf War suppressed the development of air transportation in the early 1990s. In other years, the air passenger growth was supported by both high and low-skill foreign labor flows which

grew after the free-market reforms were initiated in the late 1970s.

Kuwait Airways is the country's primary carrier whose operations accounted for the majority of the air passengers in Figure A-18. Kuwait Airways is a growing state-owned airline which, as of 2008, operated scheduled international services throughout the Middle East, to the Indian subcontinent, Europe, Southeast Asia and the United States [13]. The airline was established in 1954 and expanded its network to include the United States and Southeast Asia countries after the 1978 acquisition of wide-body aircraft. This acquisition enabled the airline to pursue a growth strategy which resulted in an increase of the air passenger growth rate in the late 1970s, as can be observed in Figure A-18, despite the country's declining GDP levels during that time period. The airline growth was suppressed following the Iraqi invasion by the destruction of its premises and 15 of its aircraft. Following the invasion, the airline services were relaunched and its fleet modernized and, as of 2008, Kuwait Airways began competing with the long-haul Gulf carriers such as the Emirates Airline and Qatar Airways.

To summarize, Kuwait is a small economy in the Middle East with a high reliance on earnings and exports from the oil industry. Air transportation is used primarily to gain access to foreign labor flows and increasing flows of knowledge and foreign investment. Kuwait's air transportation development has been subject to several suppressing factors which included suppression of demand due to the military conflict with Iraq and reduction in supply due to the destruction of Kuwait Airways aircraft. The growth has been stimulated by the fleet modernization and airline expansion strategy of Kuwait Airways both in the late 1970s and in recent years.

Kuwait: Change Factors Summary

Stimulating:

- Airline strategy
- Fleet modernization

Suppressing:

- Vehicle capability: insufficient fleet capacity due to external factors
- War

A.15 Suppressed Growth: Libya

Libya's air transportation industry has experienced two periods of contraction which can be observed in Figure A-19. The first period was between 1983 and 1986, and the second contraction occurred between 1992 and 2003. Since 2003, Libya's air passenger growth rates have been positive and strong. Even though the economic data are not available for some periods, Figure A-19 shows that there has been a general increase in Libya's GDP compared to the levels observed in the 1980s while the air transportation industry experienced a period of decline and stagnation.

During this time period, the country's air transportation development was suppressed by political and economic sanctions. The first sanctions were imposed in the early 1980s as the U.S. imposed controls on its

[13]The primary source for the following description is the company's website: *http://www.kuwaitairways.com*

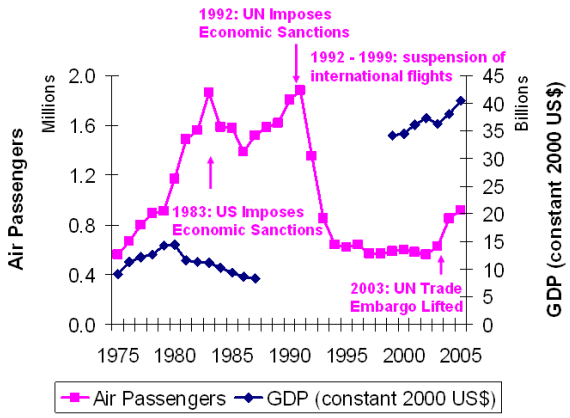


Figure A-19: Libya: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Libya's airlines and GDP were -2.7% and 7.6%.

exports and recalled U.S. personnel working in the country because of Libya's support of terrorism. Further restrictions were imposed from 1992 to 2003 as a result of UN sanctions which followed the 1988 bombing of Pan Am flight 103 over Lockerbie, Scotland and UTA Flight 772 which exploded over the Sahara desert in 1989 [192]. As a result of these sanctions, Libya's airlines could not modernize their fleet and were denied access to some international airports. In addition, all flights were suspended to and from Libya between 1992 and 1999. Meanwhile, the country's GDP was growing because of the growing oil revenues which account for about a quarter of GDP earnings [41].

In the late 1990s Libya began making policy changes including accepting the responsibility for the aircraft bombing along with surrendering the Lockerbie suspects for trial and compensating the families of the victims [69]. These actions led to removal of UN sanctions in September 2003 [41]. In December 2003, when Libya announced that it would abandon programs to build weapons of mass destruction, the United States responded by dropping most of its sanctions as well [41]. Since then, air transportation development has been an integral part of Libya's economic strategy as the country tried to reduce its dependence on oil and integrate into the global economy. Air transportation enables access to low-skill labor, and increasing number of leisure and business passengers from high-income countries as the government tries to diversify economic activity.

A.15.1 Libya: Air Transportation System Development

Libya's air transportation system development was suppressed by economic and political sanctions for twenty years starting in the early 1980s. First, Libyan Arab Airlines — the nation's flag carrier — could not modernize its fleet because of the U.S. embargo on the export of high-technology equipment [201]. The embargo prevented the airline from buying new aircraft, obtaining spares and other high-tech equipment [71]. Second, all international flights to and from Libya were suspended between 1992 and 1999 as a result of UN sanctions [64].

As a consequence of these sanctions, during those years the airline managed to sustain only domestic services with just four airworthy aircraft [71]. However, many of the domestic routes were unprofitable because the government imposed artificially low domestic fares. The fares were kept low because many of

the domestic passengers were involved directly and indirectly with oil and natural gas industries which are vital to the country's wealth [201].

To revamp services following the embargo, the government established a second national carrier Afriqiyah in 2001 to fly between Libya and Sub-Saharan Africa [64]. Afriqiyah has been steadily expanding since then with new services being introduced in 2008 to Dubai, Delhi, Istanbul and Beirut and plans to expand to China and several destinations in East and Central Africa [71]. Both airlines serve destinations in Africa, Europe and the Middle East. The government has plans to eventually merge and privatize the two state-owned carriers [71].

Even though the majority of services are dominated by the two state-owned carriers, a number of domestic flights are also operated by private carriers and by oil companies [69]. Under the current bilateral aviation framework, only the state-owned carriers are allowed to operate international routes.

Since 2002 the government has been investing in upgrading aviation infrastructure and modernizing the fleet of the national airlines. In particular, the government invested $4.8 billion in airport and airspace infrastructure to bring the country back up to international standards [71]. Current investment projects also include expansion of the Tripoli International Airport and modernization of the country's 13 civil airports [64]. In addition to infrastructure investment, the funds have been provided for the national carrier Afriqiyah to modernize its fleet: the program took off in 2006 when Afriqiyah placed an order for new Airbus aircraft after 25 years of embargo [64].

A.15.2 Libya: Economic Impact of Air Transportation

Oil revenues are Libya's main source of income. They contribute about 95% of export earnings, about one-quarter of GDP, and 60% of public sector wages [41]. The government controls many of the sectors of Libya's economy: the petroleum industry was nationalized in the 1970s while state trade unions and industrial organizations run most other industries and utilities [69]. In the past five years, Libya has begun to implement a number of economic reforms as part of a broader campaign to reintegrate the country into the global economy [41]. In particular, recent economic policy has emphasized agricultural, industrial and private sector development and reduction of country's dependence on oil [69, 197]. Air transportation is vital for future economic growth since the country is lacking sufficient local low-skill and high-skill labor to support the development and relies on air transportation for access to affluent leisure markets and foreign investors. In addition to international services, air transportation plays an important role domestically since Libya — the third-largest country in Africa — has variable road infrastructure and lacks railway service [41].

Labor Flows

International migrant workers account for a substantial share of Libya's labor force. In fact, nearly one-fifth of Libya's total population in the late twentieth century was composed of foreign workers temporarily residing in the country [69]. Most of the workers came from other North African countries, western Africa, and the Middle East by air. Inflows of migrant workers, however, have been decreasing since the mid-1980s as Libya's government attempted to reduce the number of foreign workers because of the drain the remittances to their home countries have on Libya's reserves of foreign exchange [69].

In addition to the low-skill workers, air transportation provides access to high-skill labor which plays an

important role in furthering Libya's development. For example, in recent years air transportation enabled the flows of health professionals from abroad because the rapid expansion of healthcare facilities in Libya necessitated the hiring of expatriate staff [69].

Tourism Flows

In the early 1980s Libya began an effort to attract foreign tourists: the country invested into the construction of dedicated tourism infrastructure and relaxed visa requirements [201]. However, development of the sector was hindered first by the 1983 U.S. embargo on the export of high-technology equipment which prevented the national airline from adding services and sustaining the current level of operations. In particular, the U.S. embargo prevented the national airline from purchasing new aircraft, obtaining spares and other equipment [201]. The tourism development was further constrained in the early 1990s when all international flights to and from Libya were suspended following the UN sanctions [71].

Since 2003, the number of tourists to the country has been increasing owing largely to Libya's attractiveness as a leisure destination: the country has a beautiful Mediterranean coastline, numerous archaeological sites and Sahara desert [197]. The majority of these leisure passengers arrive to the country by air. Libya tourism focus is on high-end visitors as opposed to the mass tourism models in neighboring Egypt and Tunisia [197]. In addition, to encourage tourism development, the government has been providing incentives for foreigners investing into tourism infrastructure [197].

Knowledge and Services Flows

Air transportation enables access to international educational institutions for Libyan citizens. Even though the country has several universities, a significant number of Libyans attend universities abroad, mainly in Egypt, western Europe and the United States [64, 69]. When foreign relations deteriorated after 1982 the number of students studying abroad decreased, but it has recently been on the rise again with a growing number of Libyan students traveling to the U.S. in particular to obtain education [64].

Due to the limited range of high-skill services in Libya, many Libyans rely on air transportation access to obtain quality healthcare abroad. Many Libyans travel to Tunisia, or, if they can afford it, to Europe for medical services despite the availability of free healthcare in the country [64]. In recent years the government began to invest heavily into the healthcare industry which resulted in an increase in demand for medical personnel [69]. Air transportation impacted the growth of the healthcare industry by providing access to international medical professionals and by enabling graduate medical students to study abroad [69].

Investment Flows

Foreign investment flows have been growing in recent years in large part due to the changes in Libya's law regulating foreign investment. Libya established a law regulating foreign investment in Libya's non-oil sectors in 1997 aiming to attract foreign capital. Nonetheless, most of the foreign direct investment still goes into the oil and gas sectors [197]. Since 2003, the government has been encouraging privatization of national enterprises which range in value from $50,000 to $3 billion [197]. Even though a number of large enterprises are available for purchase to the foreign investors, the government is putting more emphasis on transferring ownership to local entrepreneurs [197]. Therefore, foreign investment flows and business

passenger flows, though growing, play a minor role in Libya's economic development. Libya air cargo industry is also underdeveloped since the country's the primary export is oil, and imports consist of low value-to-weight goods such as equipment for the oil and construction industries, farm machinery, consumer goods, and agricultural products [69].

A.15.3 Libya: Conclusions

The negative growth rate of Libya's air passenger traffic reflects the period of economic and political isolation which the country experienced from early 1980s to 2003. The traffic development was first suppressed by sanctions on aircraft sales which prevented the national carrier from expanding and maintaining its operations, and later by complete removal of all international flights between 1992 and 1999 as a result of additional UN sanctions. Meanwhile, the country's GDP was growing because of the growing oil revenues which accounted for about a quarter of Libya's GDP earnings.

The sanctions were removed in 2003 and Libya's airline industry has been growing since then. The growth of Libya's airlines has been supported directly by the government through infrastructure investment, establishment of the new state airline and fleet modernization programs. In addition, the growth has been influenced by the government indirectly by affecting the demand as the government began to promote the development of the tourism industry and to provide incentives for foreign entrepreneurs.

Air transportation development is perceived by the government as integral for furthering Libya's economic growth in the global economy. While the flows of international leisure and business passengers have been growing in recent years, the flows of migrant workers have been the most significant to Libya's economy. Low- and high-skill labor flows have always been important since Libya is a large country with a small native population. In particular, high-skill labor flows, such as medical personnel, have been growing in recent years following privatization reforms and some incentives for foreign investment into non-oil sectors.

Libya: Change Factors Summary

Stimulating:

- Government support of the national carrier
- Aviation infrastructure investment
- Fleet modernization
- Institutional and political reforms
- Supporting infrastructure investment

Suppressing:

- Geopolitical and security restrictions: airline ban/services suspension
- Vehicle capability: insufficient fleet capacity due to external factors
- Political/economic sanctions

A.16 Suppressed Growth: Algeria

Figure A-20 shows that the number of air passengers carried by Algeria's airlines declined between 1985 and 2005 while the country's GDP increased. Unfortunately, the analysis conducted in this study did not identify the reasons behind the decline in the number of air transportation passengers until the early 1990s. In December 1991, the country's political stability quickly deteriorated when a military conflict started between the Algerian army and the Islamaic Salvation Front (FIS). The fighting escalated into an insurgency which saw intense fighting between 1992 and 1998 and resulted in over 100,000 deaths [41]. Since 1999, the security situation in Algeria has improved markedly. Terrorism, however, has not been totally eliminated, and terrorist incidents still occur [192].

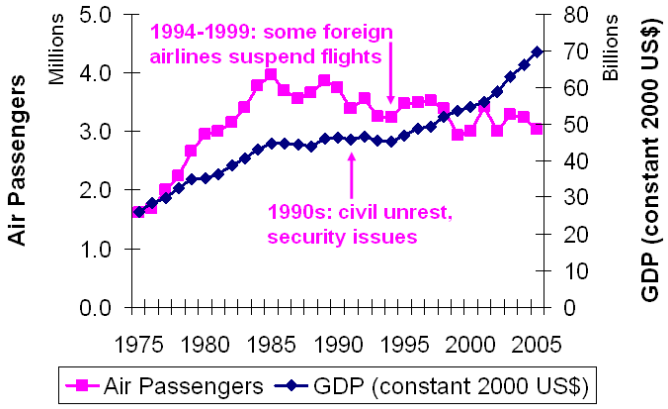


Figure A-20: Algeria: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Algeria's airlines and GDP were -1.3% and 2.3%.

The passenger data in Figure A-20 show that the number of air passengers increased between 1994 and 1998. However, the airport passenger data for the country's major airport show otherwise. The data for Houari Airport located in the country's capital Algiers show that the traffic exceeded 1993 levels only in 2001 [14]. In 1994, all foreign airlines suspended flights to Algeria following the hijacking of an Air France plane on December 24, 1994 by radical Islamic militants [14]. As a result of these suspensions, Air Algeria increased the number of operations, but the total number of passengers visiting the country decreased after 1994. The carrier's growth was also suppressed by operating bans. For example, French aviation authorities banned Air Algerie from operations at Paris Charles de Gaulle Airport between 1995 and 1997 due to the unstable political situation in Algeria and the resulting security concerns [83]. In addition to operating bans placed on Air Algeria, foreign airline services were suspended until 1999 when several countries, including Turkey, Saudi Arabia, Italy and Germany, resumed operations to Algeria [14]. France resumed its services only in 2002 [14].

Meanwhile, the country's air transportation regulation underwent some changes [15]. The country established its first airline in 1947. Following independence from France in 1962 the company became Air Algerie. Over the years, the Algerian government took possession of the company's assets nationalizing the airline in 1974. In 1998, the industry was partially deregulated which resulted in formation of several small carriers

[14]The airport data are available only starting in 1991 from the ICAO Airport database [110].
[15]The primary source for the following description is the company's website: *http://www.airalgerie.dz*

after 1999. Since then, most of these carriers have ceased operations. As of 2008 Air Algerie remained the country's primary carrier. It serviced 37 destinations in 24 countries and had a domestic network connecting 31 cities. The airline's fleet consisted of 29 Western-built aircraft and was modernized between 2000 and 2005. However, despite these initiatives, the country's total air passenger traffic did not increase over the years as reflected in Figure A-20.

Algeria's GDP had a positive growth rate starting in 1994. The hydrocarbons sector is the backbone of the Algerian economy, accounting for roughly 60% of budget revenues, nearly 30% of GDP, and over 97% of export earnings [192]. Faced with declining oil revenues and high-debt interest payments at the beginning of the 1990s, Algeria implemented a stringent macroeconomic stabilization program in 1994[192]. Sustained high oil prices in recent years and market liberalization reforms helped improve Algeria's financial and macroeconomic indicators. In particular, real GDP rose due to higher oil output and increased government spending [41]. However, economic diversification and foreign direct investment outside the energy sector have been slow and the country is still faced with many social and infrastructural problems. The problems include the ethnic minority Berbers' ongoing autonomy campaign, large-scale unemployment, a shortage of housing, unreliable electrical and water supplies, government inefficiencies and corruption, and the continuing terrorist activities of extremist militants [41].

In conclusion, both supply and demand-side factors suppressed air transportation development in Algeria over the last two decades. Air transportation supply was affected by services suspension by foreign airlines following a hijacking and an operating ban placed on the Algerian national carrier by some aviation authorities. Air transportation demand was negatively affected by security issues related to terrorism and overall political instability and violence in the country.

Algeria: Change Factors Summary

Suppressing:

- Geopolitical and security restrictions: airline ban/services suspension
- Political and macroeconomic instability
- Civil unrest

A.17 Suppressed Growth: Zimbabwe

Zimbabwe, formerly Southern Rhodesia, is a landlocked country located in the southern part of Africa. President Mugabe and the ruling party ZANU have been in power starting in 1980 following Zimbabwe's first free elections after independence. The government managed to suppress organized political opposition through most of the 1990s [192]. However, starting in 1999 Zimbabwe began to experience a period of considerable political and economic turmoil. The country's 1998-2002 involvement in the war in the Democratic Republic of the Congo drained the budget reserves [41]. Further economic decline followed the government's land reform program in 2000. The reform, characterized by forced expulsion of white farmers and violence against both farmers and farm employees, badly damaged the commercial farming sector, which was the traditional source of exports and foreign exchange and the provider of 400,000 jobs, and turned Zimbabwe into a net importer of food products[192, 41]. Since 1999, the national economy contracted by as much as

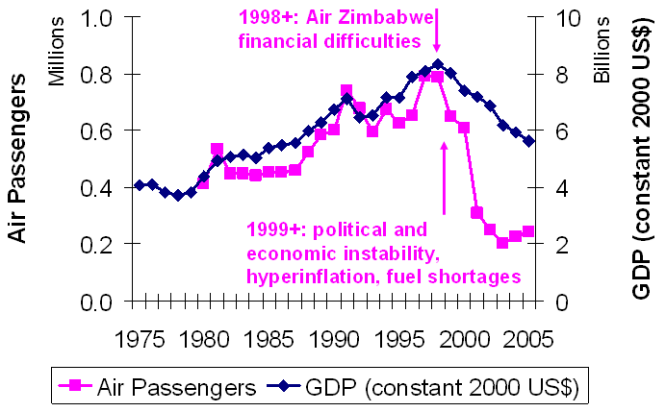


Figure A-21: Zimbabwe: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Zimbabwe's airlines and GDP were -16.8% and -5.4%.

40%; inflation rate rose from 32% in 1998, to 133% in 2004, to 585% in 2005, passed 1000% in 2006, and 26000% in November 2007 [192, 41]. In addition, there have been shortages of foreign exchange, fuel, and food and direct foreign investment has been withdrawn from the country [192]. Despite these problems, according to the U.S. Department of State, properly managed, Zimbabwe's wide range of resources should enable it to support sustained economic growth provided that there is access to foreign direct investment.

Since the late 1980s, tourism industry was one of Zimbabwe's fastest growing sectors. The industry contributed up to 6% to the country's GDP and was an important earner of foreign exchange [135]. Zimbabwe most popular tourist attractions are Victoria Falls, the Great Zimbabwe stone ruins, Lake Kariba and extensive wildlife reserves [192]. However, the sector contracted sharply after 1999 due to the country's declining international image [192]. Several international carriers, including Quantas, Lufthansa and British Airways, stopped offering air services to and from Zimbabwe because of the declining international leisure passenger demand and increases in the operating costs due in part to jet fuel shortages [135, 140].

Zimbabwe's air transportation needs are served by Air Zimbabwe, the country's largest carrier based in Harare International Airport [16]. It was established in 1967 as Air Rhodesia and became Air Zimbabwe in 1980 when the Republic of Zimbabwe was formed. The airline is a parastatal company which was nominally privatized in 1997. The airline upgraded its fleet in the 1980s but since then did not order any Western-built aircraft. Instead, the airline leased three Chinese MA60 aircraft in 2005 and ordered two Russian IL-96 in 2006. Since 1998 the airline has been struggling financially. In particular, Air Zimbabwe has experienced shortages of hard currency, new equipment and jet fuel [155]. In recent years, fuel shortages and problems with electricity provision in Zimbabwe have caused delays and groundings of flights [140] and financial shortages have resulted in temporary suspension by IATA (International Air Transport Association) over unpaid debt. The IATA suspension meant that the carrier could no longer book its passengers onto onward flights with other airlines [189]. As a result of these problems both internal and external flights with Air Zimbabwe have been generally unreliable.

Figure A-21 shows that between 1998 and 2005 the number of air passengers carried by Zimbabwe's airlines fell from 790,000 passengers to 243,000 passengers [212]. The airline's acting chief executive blamed

[16]The primary source for the following description is the company's website: *http://www.airzimbabwe.com/*

the decline on negative publicity on political and economic turmoil in the country and a perception of safety concerns [155]. Meanwhile, the airline itself had an excellent safety record and had no fatal accidents since 1979 [13]. However, some international travelers were wary of traveling on Air Zimbabwe's aircraft which, according to Flight International, had an average age of 20.3 years. In addition, the tourists were deterred by the general safety concerns which prompted several Western governments to issue adverse travel advisories on Zimbabwe to their nationals [140].

Summarizing, air transportation development in Zimbabwe has been suppressed due to the country's overall economic and political instability after 1999. Since then, the reliability of the national carrier Air Zimbabwe has declined due to the shortages of hard currency, new equipment and jet fuel. The decrease in the air services was also precipitated by the pull-out of several international carriers which was largely due to the declining international leisure passenger demand and fuel shortages which dramatically increased the airlines' operating costs. At the same time, Zimbabwe's economy has contracted as well. The decline was marked by deterioration of basic services, such as electricity provision, food shortages and unemployment.

Zimbabwe: Change Factors Summary

Suppressing:

- Perceived airline/fleet safety
- Vehicle capability: insufficient fleet capacity due to lack of capital
- Political and macroeconomic instability
- Economic downturn
- Civil unrest

A.18 Suppressed Growth: Belgium and Switzerland

The air passenger data for Belgium in Figure A-22 and Switzerland in Figure A-23 exhibit large discontinuities at the turn of the century. As a result of this behavior, the correlation coefficient between air passengers and GDP during the 1975–2005 time period is lower compared to other countries. The primary reason for these changes in the data were the bankruptcies of the national carriers which occurred during that time. However, as further analysis shows, the data may not necessarily reflect the changes in the actual number of passengers traveling to and from the country.

After signing the European Open Skies agreement in the mid-1990s, several national carriers found it difficult to compete in the new environment. Among these carriers were Belgium's Sabena and Switzerland's Swissair [183]. In the early 1990s Swissair was a profitable company. Following changes in the EU regulatory environment, the SAirGroup (Swissair's parent company) adopted an external growth strategy called the "Hunter Strategy" [15]. This airline growth strategy resulted in a positive change in air passenger growth rates in the early 1990s as reflected in Figure A-23. This strategy led to acquisitions of non-controlling minority stakes in several foreign airlines including Belgium's Sabena, Polish flag carrier LOT, South African Airways, and German charter carrier LTU [15]. Since Switzerland was not a member of the EU, the SAirGroup could acquire no more than 49.9% of EU-affiliated airlines which resulted in limited management scope and lack of ability to take corrective action when operational or financial performance deteriorated [179, 15].

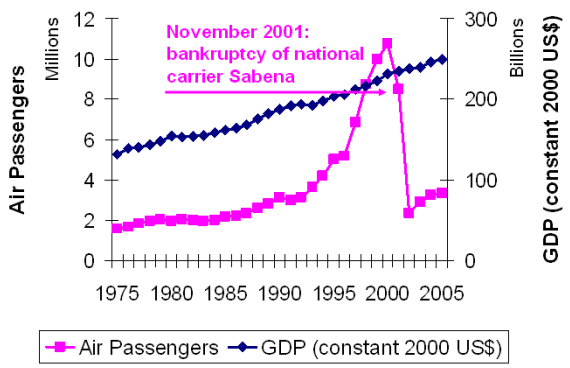


Figure A-22: Belgium: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Belgium's airlines and GDP were 2.1% and 2.2%. The correlation coefficient between air passengers and GDP during 1975-2005 time period is 0.62.

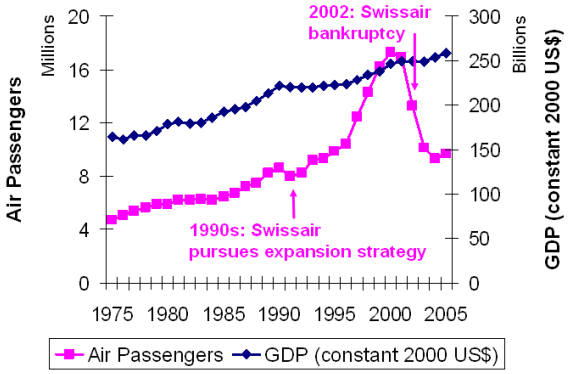


Figure A-23: Switzerland: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Switzerland's airlines and GDP were 2.0%and 1.5%.The correlation coefficient between air passengers and GDP during 1975-2005 time period is 0.81.

The high-growth expansion strategy resulted in a cash flow crisis at the turn of the century which was exacerbated by the crisis following the September 11 attacks. As a result, Swissair, a legacy carrier established in 1931 and considered for decades to be the European airline industry's best economic model, asked for government protection in 2001 and declared bankruptcy on March 31, 2002 [179].

While Swissair has been a model airline until a few years before its bankruptcy, by the early 1990s the state-owned Sabena had accumulated a large debt and survived only due to government's subsidies [179]. As part of the "Hunter Strategy", in 1995 SAirGroup acquired a 49.5% share in Sabena with the Belgian government retaining the 50.5% share [183]. Following the sale, Sabena underwent cost-saving measures including job cuts and fleet restructuring which resulted in the growth of Belgium's air passenger traffic in the late 1990s as can be observed in Figure A-22 [183]. Despite these measures, Sabena ceased operations on November 7, 2001 and its bankruptcy left 12,000 employees and flight crews without jobs [178]. Several factors were found to be responsible for the airline's demise: Sabena's mismanagement, the Belgian government's lack of judgment and vision, labor disputes, and post-September 11 economic crisis [178]. Some of the management issues were blamed on the co-owner SAirGroup which (1) was responsible for a 1997 decision to rejuvenate Sabena's fleet that led to an order for significantly more aircraft than the airline's capacity projections and which (2) failed to provide a US$123 million capital injection in 2001 to avoid bankruptcy [178]. Other factors that influenced the carrier's competitive position were high labor costs, small home market, and unprofitable code-share agreements [178].

The bankruptcy of Sabena in 2001 decreased the overall number of passengers traveling on Belgium's airlines as reflected in Figure A-22. After 2002, the country had only two major airlines: a new national carrier SN Brussels Airlines formed from the remnants of Sabena and its regional affiliate Delta Air Transport, and Virgin Express — Richard Branson group's Belgium-based subsidiary [34]. Even though the collapse of the national carrier caused some activity loss at the nation's primary airport in Brussels, several foreign carriers increased their presence in other regional airports. In particular, in 2001 a rapidly growing Ireland's

low-cost carrier Ryanair established their first Continental European base at Brussels Charleroi Airport [34].

Similarly, the bankruptcy of Swissair in 2002 resulted in substantial decrease in traffic carried by the airlines registered in Switzerland as reflected in Figure A-23. A new airline Swiss was founded in 2002 after the bankruptcy of Swissair. Although the airline had to substantially cut capacity at the beginning, by 2007, according to Swiss's website, it carried almost as many passengers as Swissair ten years ago. Unfortunately comparison between airline and airport data was not possible because the airport data for Zurich International and Brussels National airports were not available in the ICAO airport database during those years [110].

Air transportation is the only feasible long-distance transportation mode for high-value perishable commodities and time-sensitive people and is often the only means of access for geographically isolated areas. However, demand for short and medium haul air services is subject to competition from surface transportation modes such as road and rail. In particular, improvements in non-aviation transport infrastructure or changes in the quality of air services affect the perceived attractiveness of other transportation modes. For example, in Europe, high-speed rail services, such as TGV, have long provided an alternative to short/medium-haul air travel. However, in recent years trains became an attractive alternative to air travel because door-to-door travel times for air travel increased due to tight security regulations and the resulting security checks after 2001 terrorist attacks [101].

In conclusion, following relaxation of ownership and operating restrictions in the EU in the early 1990s, Swissair began to pursue an expansion strategy. As a result of this strategy, the number of passengers carried by Switzerland's airlines grew substantially in the early 1990s. As part of this strategy, Swissair acquired Belgium's Sabena in 1995. Following the sale, Sabena underwent fleet modernization and network restructuring which resulted in the growth of air passengers carried by Belgium's airlines in the late 1990s. However, the expansion strategy was unsustainable in the long run due in part to poor management decisions which were exacerbated by the decrease in demand in 2001. As a result, both Swissair and Sabena had to declare bankruptcy resulting in substantial decline of the air passenger data carried by airlines registered in Swtizerland and Belgium. However, the actual number of services to and from those countries did not decline to the extent shown in Figures A-22 and A-23. In particular, as a result of the liberalization of the EU aviation markets, airlines registered in other countries, such as Ireland's Ryanair and British EasyJet, could continue satisfy the local travel demand in Belgium and Switzerland without the traffic being reflected in the ICAO airline database. Therefore, in liberalized environments the changes in traffic patterns should be best observed at the airport as opposed to the airline level. Unfortunately, the data for Belgium and Switzerland were not available in the ICAO airport database.

Belgium and Switzerland: Change Factors Summary

Stimulating:

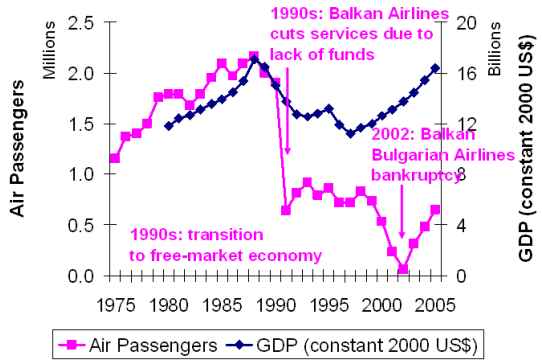
- International liberalization
- Privatization and ownership
- Airline expansion strategy following liberalization

Suppressing:

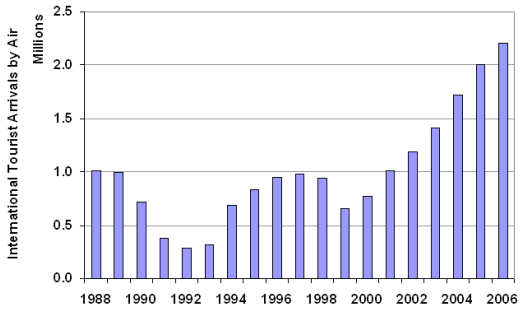
- Airline business factors

- Economic downturn
- Competition from other transportation modes

A.19 Suppressed Growth: Bulgaria



(a) Bulgaria: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Bulgaria's airlines and GDP were -5.7% and 0.8%.



(b) Bulgaria: international tourist arrivals by air. Source: data compiled by Euromonitor International from World Tourism Organization [213].

Figure A-24: Bulgaria Growth Trends.

The data in Figure A-24(a) show at least two types of long-term behaviors between Bulgaria's air passengers and GDP. The first type of behavior was a mutual decline in air passengers and GDP between 1988 and 1997. The second type of behavior occurred between 1997 and 2002 when Bulgaria's air passengers continued to decline while GDP was monotonically increasing.

The mutual decline in the early 1990s was primarily due to the economic recession, political instability and the resulting lack of demand and funds for the nation's state-owned carrier Balkan Bulgarian Airlines. Bulgaria's economy contracted dramatically after 1989 following the loss of the Soviet support and trading partners. In addition to political instability at home, the UN sanctions against Yugoslavia and Iraq took a heavy toll on the Bulgarian economy [192]. During the 1990s the standard of living fell by about 40% [192]. Due to political instability, the demand for tourism and foreign investment declined as well as reflected in Figure A-24(b). In 1997 a series of reforms were initiated that helped stabilize the country's economy and put Bulgaria on the Euro-Atlantic path [192]. Measures introduced by the government were targeted at reducing corporate and individual taxes, curtailing corruption and attracting foreign investment. With the help of the international community, the county restructured its foreign debt, revived the local stock market, and moved ahead with long-delayed privatization of several major state monopolies [192]. The economy has been growing since then. According to the World Bank, in 2006 Bulgaria attracted the highest levels of foreign direct investment, as a share of GDP, among Eastern European countries. Bulgaria joined NATO in 2004 and the European Union in 2007.

While Bulgaria's economy continued to grow following the reforms initiated in 1997, the national flag carrier Balkan Bulgarian Airlines continued to decline. Balkan Airlines was once one of the largest airlines in Europe: in the 1980s it served 55 regular flights and had 78 international route assignments [146]. The

airline began experiencing problems in the early 1990s as it attempted to service its debts and realign its management strategy. Starting in the 1990s, the airline had trouble obtaining loans and was faced with the lack of modern Western-built aircraft [146]. As a result, it had to cut service on of its most profitable routes which included summer charter operations [147]. As the airline continued its decline at the beginning of the century it tried to raise cash to cover its operating costs and lease two Boeing aircraft by selling four of the five slots at London Heathrow to British Airways [23]. In return, the airline received slots at Gatwick and netted a total profit of 2.4 million pounds and an open condemnation by the country's Transport Minister [23].

The airline also suffered from a lack of direction and leadership during the economy's transitional period [23]. In 1999 Balkan Airlines was sold to Israeli investor Gad Zeevi, who purchased a 75% share of the company [146]. However, because of Israeli's ownership several Middle Eastern countries, including Lebanon and Syria, banned the airline from flying and landing in their airspace [184]. Meanwhile, several insolvency proceedings were launched against Balkan for debts which had accumulated since 1993. In addition, Zeevi Holdings launched a $230 million lawsuit against the state alleging that the Bulgarian Government had covered up millions of dollars worth of the airlines debts before privatization [146]. Finally, in October 2002, Balkan Airlines was declared bankrupt. By then, its network was reduced to only 14 short-haul flights [146]. The airline was immediately replaced by Bulgaria Air which originally operated as a state-owned company, but was privatized in 2006 [144].

Even though the air passenger data in Figure A-24(a) show that air travel has been decreasing until 2002, the international tourism arrivals by air in Figure A-24(b) tell a different story. In fact, as Bulgaria continued its market liberalization reforms and the national carrier continued to experience financial struggles, more international carriers began serving the country. For example, in 2005, Bulgarian airlines transported about two million passengers, while the foreign operators, around three million [144]. In particular, foreign operators came to dominate Bulgaria's air transportation network after Bulgaria joined the EU Open Skies agreements in 2006 [80]. In addition, according to Euromonitor analysis, in 2006 charter flights accounted for more than 60% of the seats sold and had the highest growth rates as Bulgaria's tourism industry continued to grow [80]. However, these charter operations may not have been included in the statistics in Figure A-24(a) because they are not classified as scheduled operations. In other words, the data in Figure A-24(a) reflect only the passenger statistics for Balkan Airlines until its bankruptcy in 2002 and the data for several smaller operators which emerged after 2002 and do not accurately reflect the air passenger flows to and from Bulgaria because those services were provided by foreign and/or charter operators.

In conclusion, the airline passengers and GDP both declined as Bulgaria transitioned to market-oriented economy in the early 1990s. During this time, both domestic and international air travel demand declined because of the decline in the domestic standard of living and political instability which deterred international tourists and investors. The economy underwent a series of reforms in 1997 and continued to grow since then while Bulgaria's national airline deteriorated. In the 1990s, the profitability of Balkan Airlines was hindered by the lack of management consensus, operating restrictions due to ownership issues, lack of funds for modern Western-built aircraft and poor public image. The airline was declared bankrupt in 2002. However, despite the evidence of declining air transport usage in Figure A-24(a), there is also evidence that air passenger traffic to and from the country may have been growing since the 1990s due to the increasing role of foreign airline operators. Charter flights in particular continued to grow as Bulgaria expanded its tourism sector. However, the international flights operated by the foreign carriers and unscheduled charter flights are not

reflected in the data gathered by ICAO and hence are not captured in Figure A-24(a).

Bulgaria: Change Factors Summary

Suppressing:

- Geopolitical restrictions: airline ban/services suspension
- Airline business factors
- Vehicle capability: insufficient fleet capacity due to lack of capital
- Economic downturn
- Political and macroeconomic instability

A.20 Suppressed Growth: Maldives

The data in Figure A-25 show that the number of passengers carried by the airlines registered in the island nation of Maldives increased dramatically during the late 1990s until it abruptly declined after 2000. The data in Figure A-26 show both the airline and airport passenger data. The airport data represent the passengers embarked and disembarked at Malé International Airport. The primary data source for airport data are ICAO airport statistics and the official airport website. The figure shows that the airline data are more volatile than the airport passenger data. In addition, the number of passengers carried by the airlines registered in Maldives is almost a magnitude smaller than the number of passengers who use the country's international airport. Also note that Maldives air passenger data, like Laos, have smaller magnitude when compared to other countries reviewed in this work.

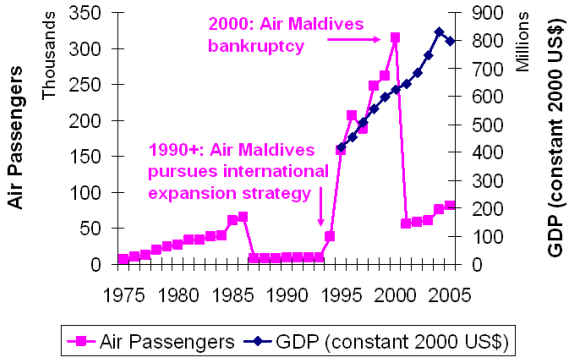


Figure A-25: Maldives: growth in air passenger traffic and GDP. Between 2000 and 2005, the average growth rates for the number of passengers carried by Maldives' airlines and GDP were -23.6% and 5.0%.

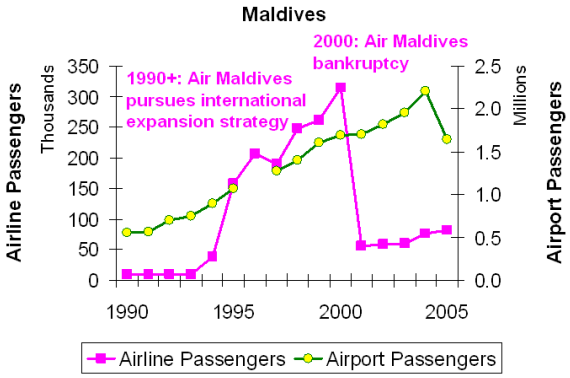


Figure A-26: Airline passenger data effectively represent the traffic carried by Air Maldives. Airport data account for the traffic transported both by Air Maldives and foreign carriers.

Until the early 1990s, the Maldives' airlines supported only domestic operations between the islands. In mid-1990s, the country's national flag carrier Air Maldives began to pursue an expansion strategy by flying to international destinations but was declared bankrupt in 2000 [118]. As a result of these new operations and the bankruptcy, the number of passengers carried by airlines registered in Maldives in Figure A-26

grew during the late 1990s and declined abruptly after 2000. Following Air Maldives' bankruptcy, the country's air transportation network was again reduced to domestic operations. Meanwhile, the island's air transportation needs have been served by several foreign carriers. Because the airport passenger data include both the Maldives' airline passenger and foreign carriers, the airport passenger traffic has greater magnitude and less volatility.

Maldives' economy relies on air transportation for access to international tourism markets. In 2007, tourism accounted for 28% of GDP and more than 60% of the Maldives' foreign exchange receipts [41]. Despite Maldives' reliance on international tourism, the developing economy does not have sufficient funds to support its own airline. The country had a mobility coefficient, that is the number of passenger trips per capita, is 0.25. This coefficient is relatively low compared to several other island tourism-dependent economies that have their own airlines. However, as the airport data show, the low mobility coefficient in such a case misrepresents the actual air passenger traffic to and from the island because foreign airlines are the primary providers of air transportation services to the country.

The decline in airport passenger traffic in 2005 reflects the decline in the number of international tourist arrivals. The decline in terms of tourist arrivals was due to the tsunami disaster which occurred on December 26, 2004 during the peak of the holiday season. Despite the fact that the damage to the Maldives' resorts has been minimal, the tourist arrivals declined and many retailers reported losses in 2005 [77].

To summarize, some small developing countries, like Maldives, sometimes have difficulty sustaining their own air passenger airlines. Therefore, they rely on foreign carriers for air transportation access. However, the airline passenger data available from ICAO capture only the passengers carried by the airlines registered in a given country. In particular, because the airline passenger data represent effectively only one airline, they exhibit large volatility: rapid growth when the airline follows an aggressive expansion strategy to international markets and decline when the airline declares bankruptcy. In other words, these data reflect only the operational statistics of small domestic operators and misrepresent the actual number of passengers visiting the country. In such a case, it is important to cross-check the ICAO airline data with other data, such as the number of passengers embarking and disembarking at the country's airports. Unfortunately, these data are rarely available.

Maldives: Change Factors Summary

Stimulating:

- Airline strategy
- Government support of the national carrier

Suppressing:

- Airline business factors
- Vehicle capability: insufficient fleet capacity due to lack of capital
- Exogenous demand shocks: 2004 tsunami

A.21 Suppressed Growth: Indonesia

Air travel in Indonesia is an important transportation mode because it provides an efficient way to link thousands of islands spread across the archipelago. As Figure A-27 shows, air passenger growth in Indonesia experienced a set of discontinuous behaviors in recent years. The number of air passengers grew through the early 1990s, declined rapidly between 1996 and 1999, grew at above average rates between 1999 and 2001, and then increased rapidly between 2003 and 2004.

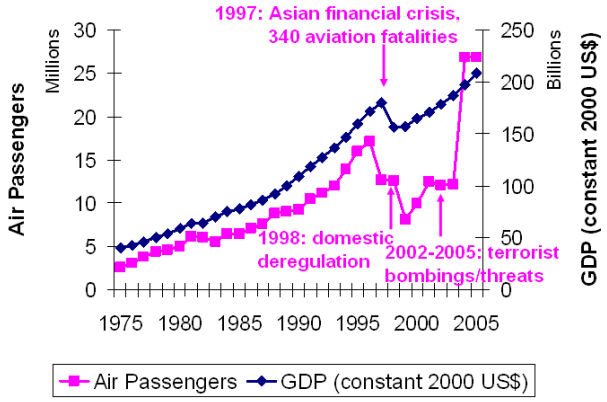


Figure A-27: Indonesia: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by Indonesia's airlines and GDP were 7.4% and 5.1%.

Starting in the mid-1980s, the government of Indonesia began eliminating regulatory obstacles to economic activity, stimulating employment, encouraging foreign investment and growth in the non-oil export sectors [192]. As a result, between 1987 and 1997, the annual GDP growth averaged nearly 7% and many analysts recognized Indonesia as a newly industrialized economy and an emerging major market [192]. As the economy grew, so did the number of passengers transported by the airlines registered in Indonesia. During that time, air passenger needs were satisfied by both private and state airlines whose operations were supported by the government.

In mid-1997, Indonesian economy suffered from the Asian financial and economic crisis which was accompanied by the worst drought in 50 years and falling prices for commodity exports [192]. The crisis resulted in the drop of air travel demand both in domestic and regional markets. In order to stimulate demand growth following the crisis, the government decided to proceed with domestic deregulation in 1998. Since then, a number of private operators have emerged with most of them competing under the low-cost carrier business model [52]. Following the introduction of these services, the domestic passenger traffic grew from 6.4 million in 1999 to more than 30 million passengers in 2007 [167].

Indonesia has traditionally been one of the more open nations in Asia when it comes to aviation deregulation and liberalization [119]. However, despite the success of private operators, the government continues its support of the state-owned carriers Garuda Indonesia and Merpati Nusantara. The support has been manifested through the years through government bailout loans and regulatory changes which helped the carriers avoid competition, particularly on international routes [119, 105]. As of 2008, the international aviation framework in Indonesia was still based on bilateral air service agreements. As a result, the scope of

low-cost carriers and their further development was suppressed because they were restricted to operations only on domestic and on specific international routes [89]. While there has been talk of multilateral aviation reform among the ASEAN countries, the international regulatory framework is still restrictive and protective of the countries' national carriers [89]. In fact, to circumvent the ownership and operating restrictions, some foreign carriers succeeded at gaining access to foreign domestic networks through cross-border joint venture opportunities and establishing subsidiaries.

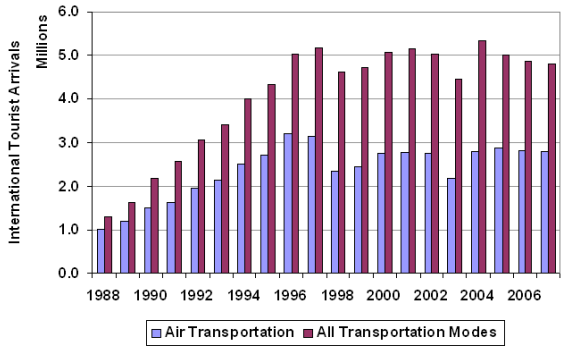


Figure A-28: Indonesia: international tourist arrivals by air. Source: data compiled by Euromonitor International from World Tourism Organization [213].

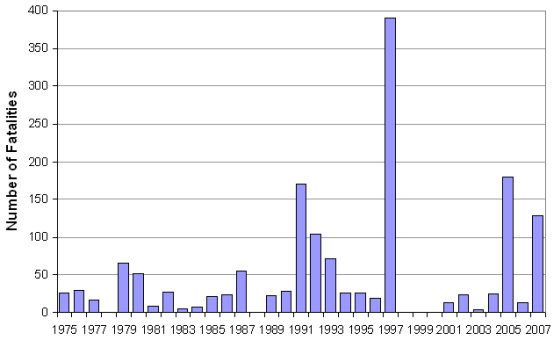


Figure A-29: Each bar represents the number of on-board and ground fatalities due to the aviation accidents of the airlines registered in Indonesia [13].

In recent years, aviation safety concerns had a major influence on the development of Indonesia' civil aviation. As Figure A-29 shows, the number of aviation fatalities peaked in 1997. In 1997, Indonesia had 390 aviation fatalities following a series of accidents which included two crashes in September and December that claimed respectively 104 and 234 lives [13]. These accidents exacerbated the effects of the financial crisis and resulted in the suppression of air passenger demand starting in 1997. This decrease in demand is reflected in the decrease of international air passenger arrivals in 1997 and 1998 in Figure A-28. At the same time Figure A-28 shows that the total number of tourists arriving by all transportation modes decreased only in 1998.

While Indonesian authorities spoke about improving aviation safety oversight, only marginal improvements have been made since the 1990s. For example, following a string of three crashes that killed at least 123 people in a 10-week period early in 2007, the Indonesian authorities attempted to regulate the nation's deficient air carriers. In particular, the government grounded the low-cost carrier Adam Air and demanded inspections of its aircraft after the airline was involved in an accident in January 2007 which killed 102 people [13, 85]. However, despite these improvement efforts, Indonesia still had 3.77 fatal accidents for every 1 million takeoffs in the three years that ended March 31, 2007 while the global average was 0.25 [142]. Poor regulatory oversight motivated both the EU and the US authorities to restrict activity of Indonesia's airlines. In particular, as a result of deficiencies in airline oversight, maintenance and pilot training, in 2007, the European Union banned, or blacklisted, all of Indonesia's airlines from flying to Europe. Meanwhile, the U.S. Federal Aviation Administration rated the country's aviation authority as Category 2, or not in compliance with ICAO's international safety standards, restricting the U.S. operations of airlines registered in Indonesia [85].

Even though air passenger growth was suppressed due to aviation safety concerns, the overall growth of the airline industry aided in the development of Indonesia's tourism industry. As Figure A-28 shows, the international tourist arrivals grew rapidly in the early 1990s to reach around 5 million annual visitors. However, the growth has been stagnant since 1997 partly due to the suppressed leisure passenger demand following the aviation fatalities summarized in Figure A-29 [213]. In addition to the aviation safety concerns, international visitors were deterred by the poor safety of other transportation modes. In particular, an increase in the number of serious sea ferry accidents may have had a detrimental impact on Indonesia's tourism attractiveness [52].

International tourism development was also suppressed by the terrorism concerns which prompted several governments to issue travel advisories. Between 2002 and 2005 there were several terrorist attacks which targeted tourists sights and were directed against Western citizens: terrorist attacks in Bali (October 2002 and October 2005) and Jakarta (August 2003 and September 2004) [192]. These attacks prompted several governments, including those of the U.K., the U.S. and Australia, to issue travel advisories. These advisories were subsequently removed after the security in Indonesia was improved [192]. Figure A-28 shows that the largest decreases in the number of international tourist arrivals occurred in 1998, following the Asian financial crisis, and in 2003, following the first Bali bombing of 2002. Natural disasters, such as the 2004 tsunami and an earthquake in 2006, may have had a negative impact on tourism development as well.

To summarize, Indonesia's air travel need grew with the growing economy until the Asian financial crisis in 1997. Following the crisis, both domestic and regional air passenger demand decreased. This demand drop was exacerbated further by a deteriorating aviation safety record of several domestic carriers. In fact, as of 2008, the airlines registered in Indonesia remained on the EU blacklist preventing them from operating in the EU airspace and suppressing international tourism demand. Leisure passenger demand was also suppressed by terrorism concerns, which prompted several governments to issue travel advisories, and by natural disasters. However, despite the period of suppressed development between 1997 and 1999, air passenger traffic carried by Indonesia's airlines grew substantially since then. This growth was largely stimulated by a number of new low-cost and other private operators which emerged following the domestic deregulation reform of 1998. In addition to private operators, the air travel needs are served by the state carriers which are directly supported by the government and get preferential routes in international markets. The analysis in this work did not find a clear stimulating factor behind high air passenger growth rates between 2003 and 2004. However, it was likely due to the new services provided by several domestic carriers which were founded during that period. They included Sriwijaya Air and now-defunct Adam Air.

Indonesia: Change Factors Summary

Stimulating:

- Domestic deregulation: Low-cost carrier development
- Low-cost carrier development
- Airline alliances
- Growing consumer demand

Suppressing:

- Safety and environmental restrictions: airline ban/services suspension

- Perceived airline safety
- Exogenous demand shocks: aviation accidents, terrorist attacks, natural disasters
- Economic downturn

Appendix B

Data Sources and Glossary

B.1 Air Transportation Data Sources

Several data sources are available for airline, airport and passenger origin-destination traffic. The most reliable and reputable ones are listed in Table B.1 with x's marking the corresponding data availability. These data are collected by ACI (Airport Council International)[1], IATA (International Air Transport Association)[2], ICAO (International Civil Aviation Organization)[3], MIDT (Marketing Information Data Transfer)[4], OAG (Official Airline Guide)[5]. In addition to these datasets, the data are also collected by the individual state agencies, such as the Department of Transportation of the United States, and regional trade organization like AAPA (Association of Asia Pacific Airlines) and AEA (Association of European Airlines). The data collected by the states and regional associations are usually the most complete, but are not suitable for worldwide cross-sectional analysis of transportation trends because collection methodologies are not compatible across different states. The other sources listed above are suitable for the cross-sectional analysis. These datasets and their limitations are described below.

	Airline	Airport	Origin/Destination
ACI		x	
IATA	x		x
ICAO	x	x	x
MIDT			x
OAG		x	x
State Agencies	x	x	x

Table B.1: The sources and the respective availability of data related to air transportation.

[1] *http://www.airports.org*
[2] *http://www.iata.org*
[3] *http://www.icao.int*
[4] *various companies*
[5] *http://www.oag.com*

B.1.1 Airline Data

Many countries and carriers are members of ICAO and IATA. These carriers submit data on the basis of standard instructions and definitions issued by ICAO and IATA either on a monthly or annual basis [6]. The data include operational, traffic and capacity statistics for all services (passenger, freight and mail) with separate figures for domestic and international flight stages for scheduled, non-scheduled/charter, and all-freight services. The airlines report the hours and kilometers flown, passengers carried, the number of aircraft departures and tonne-kilometers performed, and passenger and weight load-factors. IATA collects statistics of airline's fleet and utilization which include the type and number of owned and leased aircraft as well as their average utilization.

Since the data are submitted by individual carriers, their availability varies from year to year. As a result, in some cases, the data include estimates by ICAO and IATA for the non-reporting carriers. These estimates are usually based on previous submissions supplemented by information published by the air carriers, such as flight schedules. The data are usually available for individual major carriers and are also aggregated to represent national statistics. The historic data is available for select countries and carriers starting in 1971. The limitations of the ICAO airline passenger data are described in detail in Chapter 3.

B.1.2 Airport Data

ICAO and ACI are the primary sources of airport data. The airport passenger data consists of passengers embarked, passengers disembarked and passengers in direct transit. The ICAO definitions are as follows:

- Embarked passengers: Number of revenue and non-revenue passengers whose air journey begins at the reporting airport, including the number of disembarked passengers, other than direct transit passengers, who are continuing their air journey.
- Disembarked passengers: Number of passengers whose air journey terminates at the reporting airport, including the number of passengers, other than direct transit passengers, who will continue their air journey [7].
- Direct transit passengers: Passengers who continue their journey on a flight having the same flight number as the flight on which they arrived. Passengers in direct transit are counted only once. Other transit passengers and stop-over passengers are counted twice: once as embarked passengers and once as disembarked passengers.

ICAO has two publications with airport statistics: *Airport – Traffic* and *Airport – Financial Data*. The *Traffic* publication covers monthly or annual traffic data for major international airports. The data consists of aircraft movements, number of passengers embarked, disembarked and in direct transit, and tonnes of freight and mail loaded and unloaded. These data cover international and domestic operations of both scheduled and non-scheduled carriers. The *Financial Data* publication covers on an annual basis income, expenses, and investments for major international airports. The airports included are selected by the individual countries on the basis of the airports' importance in international air transport. As a result, the data are available only for select years and select airports. Therefore, it is difficult to do national aggregates of the data since airport sample changes from year to year. For example, the data entry for Ireland in years 1990-2007 includes only

[6] The official ICAO form and other information are available at *http://www.icao.int/icao/en/atb/sea/forms.htm*

[7] In a typical entry, the number of embarked passengers is not equal to the number of disembarked passengers.

one airport, Shannon, which accounts for only about 13% of all airport traffic in Ireland, when compared to Dublin and Cork airports. The historic ICAO data goes back to 1976 for select airports.

ACI is another source of airport data and is more complete than the ICAO's database with historical data going back to 1991. As with the airline data, only members submit their statistics to these organizations. However, as opposed to the airlines, very few large airports are not part of these organizations, therefore these statistics can be used to evaluate the national trends. For example, according to the ACI 2006 Annual Report, ACI counts 573 members operating over 1640 airports in 178 countries and territories. These airports represent over 95% of the world's passenger traffic with 4.4 billion passengers and 85 million tonnes of cargo.

B.1.3 Origin and Destination Traffic Data

The origin and destination (OD) data are necessary for any analysis of passenger air traffic flows. These data should capture the flow patterns between the first departure airport and the ultimate arrival airport and differ from segment OD data which may include intermediate destinations en-route.

The United States Bureau of Transportation statistics provides the OD data for free via the DB1B database. The DB1B database, also called the Airline Origin and Destination Survey, is a 10% sample of airline tickets from the reporting U.S. carriers which can be used to determine air traffic patterns, air carrier market shares and passenger flows. The database provides historical data from 1993 and covers traffic patterns in the United States as well as international traffic of the reporting U.S. carriers. The international portion of the database is available only pending the official approval.

The closest equivalent to the BTS DB1B database for international OD traffic data is the MDIT database. MDIT contains information on global airline bookings and is based on the electronic Global Distribution Systems (GDS) used by the travel agencies and airlines. The limitation of MDIT is that many airlines are moving away from traditional reservation through GDS to other channels, such as direct sales on the Internet. In fact, according to the Euromonitor International report *Travel and Tourism – World, 2007*, 15% of all worldwide sales by booking value were made directly online in 2005 [79]. Many of the LCCs, such as Ryanair and Southwest, rely exclusively on their own sites to sell inventory to avoid travel agent commissions and GDS payments.

OAG is an official airline guide to flight schedules worldwide and can be used to estimate the traffic flows. Since OAG database contains flight schedules, as opposed to the real booking data of MDIT, it can be used only as a proxy to reflect the actual passenger flows. In particular, in order to estimate origin-destination traffic, OAG uses connection criteria such as wait times and number of stops. This analysis, while feasible in theory, becomes very expensive very quickly. Therefore, it is best to use this database to analyze traffic from a particular airport to other airports directly connected to the airport of interest. Most of the international air network studies, like the ones referenced in [51] and [95], use the OAG database for their analysis. Alternatively, the MDIT database was used for analysis of air networks for several major airports by a study from Ghent University [55].

ICAO (starting in 1982) and IATA (starting in 1988) both collect origin destination data from their members. ICAO data covers only the international flight segment data and is published only if there are at least two airlines representing two different states reporting their statistics. Analysis of the OD data for Kingston, Jamaica for year ending December 1997 shows that the data presented by the ICAO *On Flight Origin and Destination Survey* accounts for only 59% of passengers using that airport. These data

discrepancies as well as sparse availability of data for certain cities lead us to believe that ICAO is not a suitable database for OD traffic analysis.

IATA collects OD data from its members and claims that those members carry over 70% of total international passenger traffic. However, not all members participate in the IATA's *Origin-Destination Statistics*. The data are available in country-pair and region-pair level. IATA's publishes aggregate regional flow data in the annual *World Air Transport Statistics*. For comparison, in 2005, IATA's Origin-Destination Statistics airline participants accounted for transportation of 64% of the world's 2 billion passengers. Therefore, these data are a reasonable proxy for analyzing international traffic flow patterns. The completeness of this database could not be evaluated for this overview.

The resources listed above are more suitable for generic worldwide analysis of air transportation trends. Comparison of the technical limitations of these datasets shows that it is best to use MDIT for origin-destination analysis, followed by the IATA's Origin-Destination Statistics database. Another important limitation to these datasets is their price. Therefore, if only information pertaining to specific airlines and nations is needed, it is easier and cheaper to use specialized trade unions and publications. For example, *Airline Business* magazine provides historical data for their member airlines.

Freight data are more difficult to obtain. ICAO and IATA databases collect passenger, freight and mail statistics for the passenger flights of member airlines. These data are rather sparse. IATA also collects all-cargo origin-destination flights data in their *Cargo Accounts Settlement System* database for participating airports and carriers. It is also possible to collect the data from the large freight companies, such as the UPS, FedEx and DHL, or publications such as the *Air Cargo World*. As was mentioned before, it is a reasonable proxy to use national carrier data to estimate the nation's traffic volume due to the presence of bilateral agreements between the nations. However, this proxy does not represent the country's freight traffic due to the asymmetry of cargo volume carried on those flights and a different bilateral agreement framework. For example, most of the Asia – North America freight originates in Asia, but, since it is transported by the American carriers, it is recorded only as the U.S. traffic and hence misrepresents the actual Asian freight traffic. Therefore, to estimate cargo volumes for a particular country, it is necessary to use the cargo handled in the country's airports.

In this work the only readily available data source was the ICAO database. Since ICAO airport and origin-destination data are sparse, the national airline carrier combined international + domestic passenger data were used for the cross-sectional analysis. The other data sources, where available, were used to supplement the analysis of individual countries.

B.2 Economic Data Sources

There are many various sources for social science data. The primary data sources in this work are the *The World Bank World Development Indicators*, the *Euromonitor International* and the data compiled by the national accounting agencies. Since local accounting practices are not uniform among the nations, there is often variability in the trends when certain economic indicators are compared between different databases [59]. In particular, oil revenues, while being a major part of economic activity of the largest economies in the Middle East, are sometimes understated in the official national GDP figures. As a result, different organizations do internal adjustment of the official figures. So, for example, the GDP figures for

the United Arab Emirates have around 15% variability when comparing the data between the World Bank and the International Monetary Fund while the variability between these two sources for European countries is less than 5%.

B.2.1 Regional Aggregates

These are the regional aggregates used by the World Bank. They consist of a comprehensive list of countries (208 economies total) in each region. However, data for some countries are not available effectively excluding these countries from the regional aggregate metric.

East Asia & Pacific

American Samoa; Australia; Brunei Darussalam; Cambodia; China; Fiji; French Polynesia; Guam; Hong Kong, China; Indonesia; Japan; Kiribati Korea, Dem. Rep.; Korea, Rep.; Lao PDR; Macao, China; Malaysia; Marshall Islands; Micronesia, Fed. Sts.; Mongolia; Myanmar; New Caledonia; New Zealand; Northern Mariana Islands; Palau; Papua New Guinea; Philippines; Samoa; Singapore; Solomon Islands; Thailand; Timor-Leste; Tonga; Vanuatu; Vietnam.

Europe & Central Asia

Albania; Andorra; Armenia; Austria; Azerbaijan; Belarus; Belgium; Bosnia and Herzegovina; Bulgaria; Channel Islands; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Faeroe Islands; Finland; France; Georgia; Germany; Greece; Greenland; Hungary; Iceland; Ireland; Isle of Man; Italy; Kazakhstan; Kyrgyz Republic; Latvia; Liechtenstein; Lithuania; Luxembourg; Macedonia, FYR; Moldova; Monaco; Montenegro; Netherlands; Norway; Poland; Portugal; Romania; Russian Federation; San Marino; Serbia; Slovak Republic; Slovenia; Spain; Sweden; Switzerland; Tajikistan; Turkey; Turkmenistan; Ukraine; United Kingdom; Uzbekistan.

Latin America & Caribbean

Antigua and Barbuda; Argentina; Aruba; Bahamas, The; Barbados; Belize; Bolivia; Brazil; Cayman Islands; Chile; Colombia; Costa Rica; Cuba; Dominica; Dominican Republic; Ecuador; El Salvador; Grenada; Guatemala; Guyana; Haiti; Honduras; Jamaica; Mexico; Netherlands; Antilles; Nicaragua; Panama; Paraguay; Peru; Puerto Rico; St. Kitts; and Nevis; St. Lucia; St. Vincent and the Grenadines; Suriname; Trinidad and Tobago; Uruguay; Venezuela, RB; Virgin Islands (U.S.).

Middle East & North Africa

Algeria; Bahrain; Djibouti; Egypt, Arab Rep.; Iran, Islamic Rep.; Iraq; Israel; Jordan; Kuwait; Lebanon; Libya; Malta; Morocco; Oman; Qatar; Saudi Arabia; Syrian Arab Republic; Tunisia; United Arab Emirates; West Bank and Gaza; Yemen, Rep.

North America

Bermuda; Canada; United States.

South Asia

Afghanistan; Bangladesh; Bhutan; India; Maldives; Nepal; Pakistan; Sri Lanka.

Sub-Saharan Africa

Angola; Benin; Botswana; Burkina Faso; Burundi; Cameroon; Cape Verde; Central African Republic; Chad; Comoros; Congo, Dem. Rep.; Congo, Rep.; Cote d'Ivoire; Equatorial Guinea; Eritrea; Ethiopia; Gabon; Gambia, The; Ghana; Guinea; Guinea-Bissau; Kenya; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Mauritius; Mayotte; Mozambique; Namibia; Niger; Nigeria; Rwanda; Sao Tome and Principe; Senegal; Seychelles; Sierra Leone; Somalia; South Africa; Sudan; Swaziland; Tanzania; Togo; Uganda; Zambia; Zimbabwe.

B.2.2 Income Aggregates

These are the income aggregates used by the World Bank. They consist of a comprehensive list of countries (208 economies total) in each region. However, data for some countries are not available effectively excluding these countries from the income aggregate metric. The World Bank uses the following classifications to provide aggregate economic data: high income economies are those for which the 2006 GNI (Gross National Income) per capita was $11,116 or more, upper middle income economies are those between $3,596 and $11,115, lower middle income economies are those between $906 and $3,595 and low income economies are those with $905 or less.

High income: 2006 GNI per capita > $11,116

Andorra; Antigua and Barbuda; Aruba; Australia; Austria; Bahamas, The; Bahrain; Belgium; Bermuda; Brunei; Canada; Cayman Islands; Channel Islands; Cyprus; Denmark; Faeroe Islands; Finland; France; French Polynesia; Germany; Greece; Greenland; Guam; Hong Kong, China; Iceland; Ireland; Isle of Man; Israel; Italy; Japan; Korea, Rep.; Kuwait; Liechtenstein; Luxembourg; Macao, China; Malta; Monaco; Netherlands; Netherlands Antilles; New Caledonia; New Zealand; Norway; Portugal; Puerto Rico; Qatar; San Marino; Saudi Arabia; Singapore; Slovenia; Spain; Sweden; Switzerland; United Arab Emirates; United Kingdom; United States; Virgin Islands (U.S.).

Upper middle income: $3,596 < 2006 GNI per capita < $11,115

American Samoa; Argentina; Barbados; Belize; Botswana; Chile; Costa Rica; Croatia; Czech Republic; Dominica; Equatorial Guinea; Estonia; Gabon; Grenada; Hungary; Latvia; Lebanon; Libya; Lithuania; Malaysia; Mauritius; Mayotte; Mexico; Montenegro; Northern Mariana Islands; Oman; Palau; Panama; Poland; Romania; Russian Federation; Serbia; Seychelles; Slovak Republic; South Africa; St. Kitts and Nevis; St. Lucia; St. Vincent and the Grenadines; Turkey; Trinidad and Tobago; Uruguay; Venezuela, RB.

Lower middle income: $906 < 2006 GNI per capita < $3,595

Albania; Algeria; Angola; Armenia; Azerbaijan; Belarus; Bolivia; Bosnia and Herzegovina; Brazil; Bulgaria; Cameroon; Cape Verde; China; Colombia; Congo, Rep.; Cuba; Djibouti; Dominican Republic; Ecuador;

Egypt, Arab Rep.; El Salvador; Fiji; Georgia; Guatemala; Guyana; Honduras; Indonesia; Iran, Islamic Rep.; Iraq; Jamaica; Jordan; Kazakhstan; Kiribati; Lesotho; Macedonia, FYR; Maldives; Marshall Islands; Micronesia, Fed. Sts.; Moldova; Morocco; Namibia; Nicaragua; Paraguay; Peru; Philippines; Samoa; Serbia and Montenegro; Sri Lanka; Suriname; Swaziland; Syrian Arab Republic; Thailand; Tonga; Tunisia; Turkmenistan; Ukraine; Vanuatu; West Bank and Gaza.

Low income: 2006 GNI per capita < $905

Afghanistan; Bangladesh; Benin; Burkina Faso; Burundi; Cambodia; Central African Republic; Chad; Comoros; Congo, Dem. Rep.; Cte; d'Ivoire; Eritrea; Ethiopia; Gambia, The; Ghana; Guinea; Guinea-Bissau; Haiti; India; Kenya; Korea, Dem. Rep.; Kyrgyz Republic; Lao PDR; Liberia; Madagascar; Malawi; Mali; Mauritania; Mongolia; Mozambique; Myanmar; Nepal; Niger; Nigeria; Pakistan; Papua New Guinea; Rwanda; So Tom and Principe; Senegal; Sierra Leone; Solomon Islands; Somalia; Sudan; Tajikistan; Tanzania; Timor-Leste; Togo; Uganda; Uzbekistan; Vietnam; Yemen, Rep.; Zambia; Zimbabwe.

B.3 Glossary

Aircraft Utilization — Represents the average number of block hours operated per each 24-hour period per aircraft for the total aircraft fleet.

Available Seat-Kilometers (ASK) — The sum of the products obtained by multiplying the number of passenger seats available for sale on each flight stage by the stage distance. Also measured in miles and denoted ASM.

Domestic Operations — A flight stage not classifiable as international.

International Operations — For statistical purposes only, a flight stage with one or both terminals in the territory of a State, other than the State in which the air carrier has its principal place of business.

GDP (constant 2000 US$) — Gross Domestic Product at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2000 U.S. dollars. Dollar figures for GDP are converted from domestic currencies using 2000 official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used. World Bank national accounts data, and OECD National Accounts data files.

Passengers Carried — The number of revenue passengers carried (i.e. a passenger for whom the carriers receive commercial remuneration) should be obtained by counting each passenger on a particular flight (one that has the same flight number throughout the journey of the passenger) only once and not at each individual stage of that flight, with the single exception that a passenger flying on both the international and domestic stages of the same flight should be counted as both a domestic and an international passenger. Non-revenue passengers should be excluded.

Passenger-Kilometers Flown — The sum of the products obtained by multiplying the number of revenue passengers carried on each flight stage by the flight stage distance.

Passenger Load Factor — Passenger-Kilometers expressed as a percentage of available seat-kilometers.

Revenue Passenger-Kilometers (RPK) — See Passenger-Kilometers Flown. Also measured in miles and denoted RPM.

Tourism Receipts — Tourism receipts are defined as expenditure of international inbound visitors including their payments to national carriers for international transport. They should also include any other prepayments made for goods/services received in the destination country. They should in practice also include receipts from same-day visitors, except in cases when these are so important as to justify a separate classification.

Yield – Yield denotes the price (in cents) a passenger pays to fly one mile. It is computed by taking the airline Revenue and dividing by the corresponding RPMs. Yield does not include taxes, which are remitted directly to the taxing authority and are not recorded in carrier financial statements.

Sources: [109, 213, 212].

B.4 Freedoms of the Air

First Freedom of the Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State or States to fly across its territory without landing (also known as a First Freedom Right).

Second Freedom of the Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State or States to land in its territory for non-traffic purposes (also known as a Second Freedom Right).

Third Freedom of The Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State to put down, in the territory of the first State, traffic coming from the home State of the carrier (also known as a Third Freedom Right).

Fourth Freedom of The Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State to take on, in the territory of the first State, traffic destined for the home State of the carrier (also known as a Fourth Freedom Right).

Fifth Freedom of The Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State to put down and to take on, in the territory of the first State, traffic coming from or destined to a third State (also known as a Fifth Freedom Right).

Sixth Freedom of The Air [8] - the right or privilege, in respect of scheduled international air services, of transporting, via the home State of the carrier, traffic moving between two other States (also known as a Sixth Freedom Right). The so-called Sixth Freedom of the Air, unlike the first five freedoms, is not incorporated as such into any widely recognized air service agreements such as the "Five Freedoms Agreement".

Seventh Freedom of The Air - the right or privilege, in respect of scheduled international air services, granted by one State to another State, of transporting traffic between the territory of the granting State and any third State with no requirement to include on such operation any point in the territory of the recipient State, i.e the service need not connect to or be an extension of any service to/from the home State of the carrier.

Eighth Freedom of The Air - the right or privilege, in respect of scheduled international air services, of transporting cabotage traffic between two points in the territory of the granting State on a service which originates or terminates in the home country of the foreign carrier or (in connection with the so-called Seventh Freedom of the Air) outside the territory of the granting State (also known as a Eighth Freedom Right or "consecutive cabotage").

Ninth Freedom of The Air - the right or privilege of transporting cabotage traffic of the granting State on a service performed entirely within the territory of the granting State (also known as a Ninth Freedom Right or "stand alone" cabotage).

Source: ICAO: Manual on the Regulation of International Air Transport (Doc 9626, Part 4).

[8] ICAO characterizes all "freedoms" beyond the Fifth as "so-called" because only the first five "freedoms" have been officially recognized as such by international treaty.

Appendix C

Data Summary: East Asia & Pacific

The figure on the left shows the number of scheduled air passengers carried by the airlines registered in a particular country and the country's GDP. The figure on the right is used to compare the country's air passenger and GDP growth rates to the world's: each point in the figure represents the difference between the country's and the world's three-year moving average growth rates for a particular year.

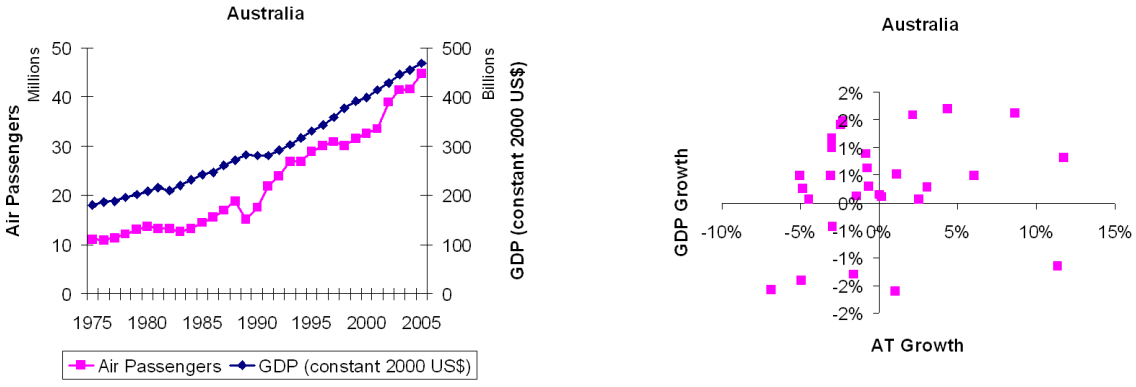
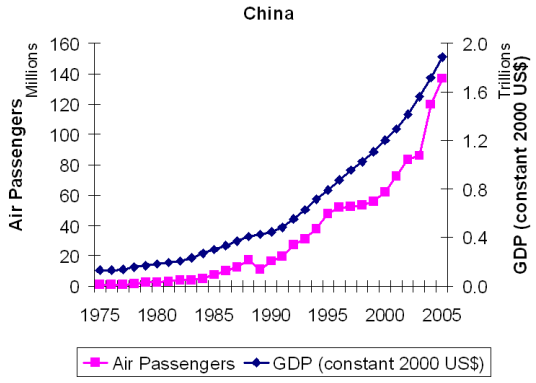


Figure C-1: Australia



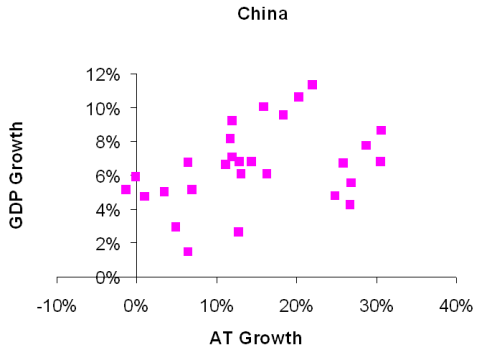
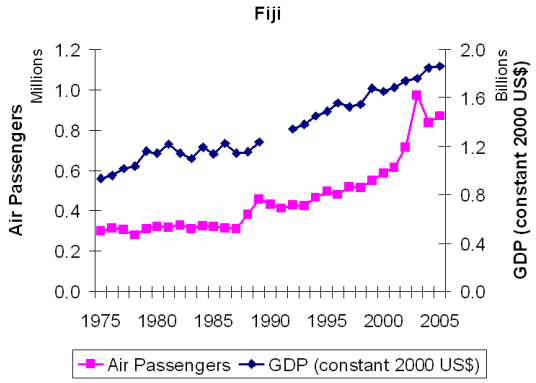


Figure C-2: China



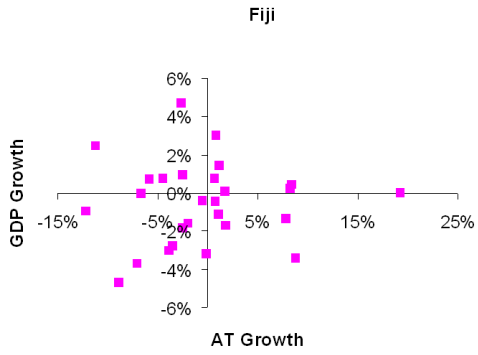
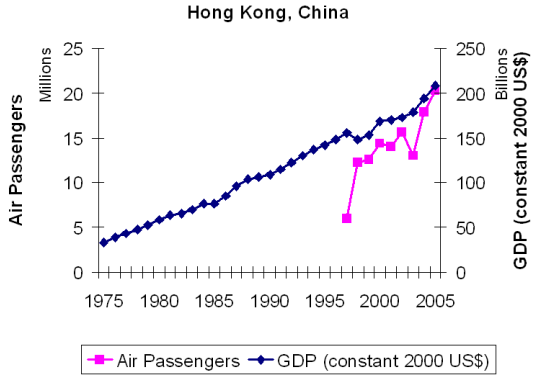


Figure C-3: Fiji



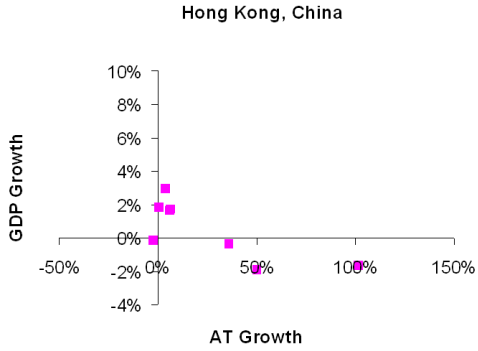
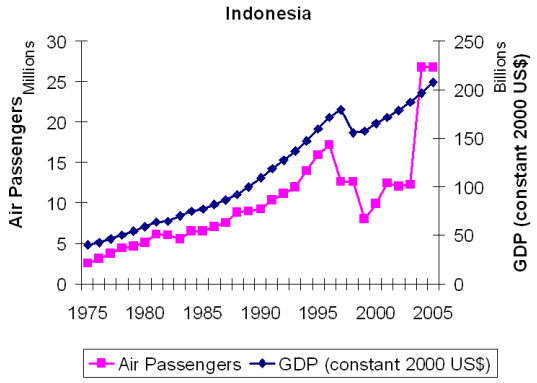


Figure C-4: Hong Kong, China



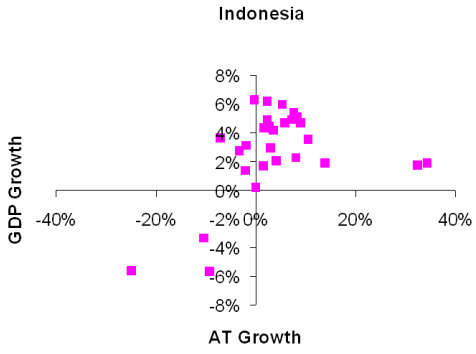
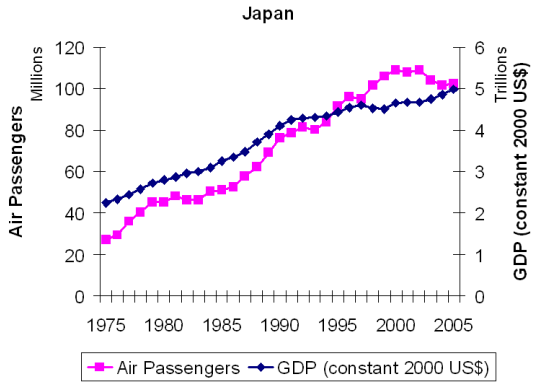


Figure C-5: Indonesia



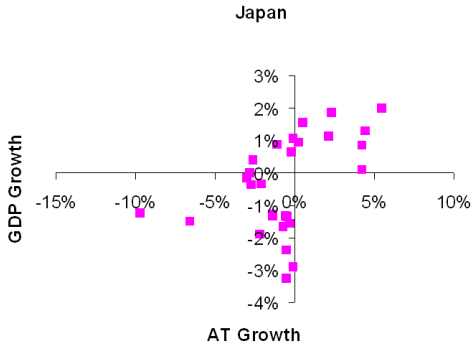
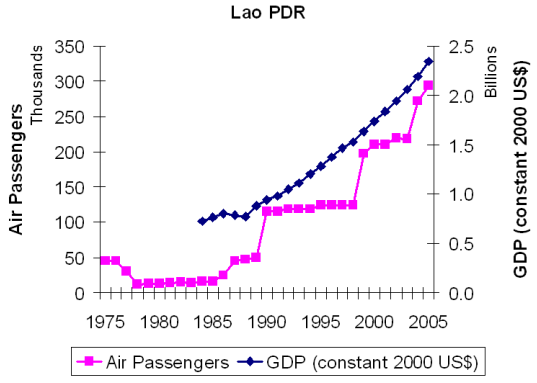


Figure C-6: Japan



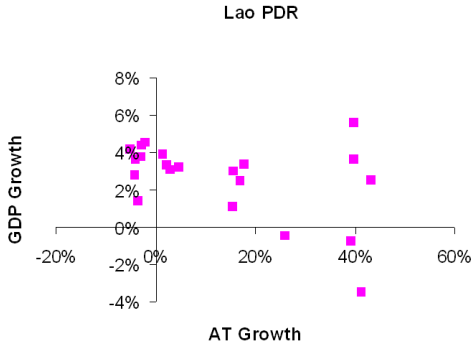


Figure C-7: Lao PDR

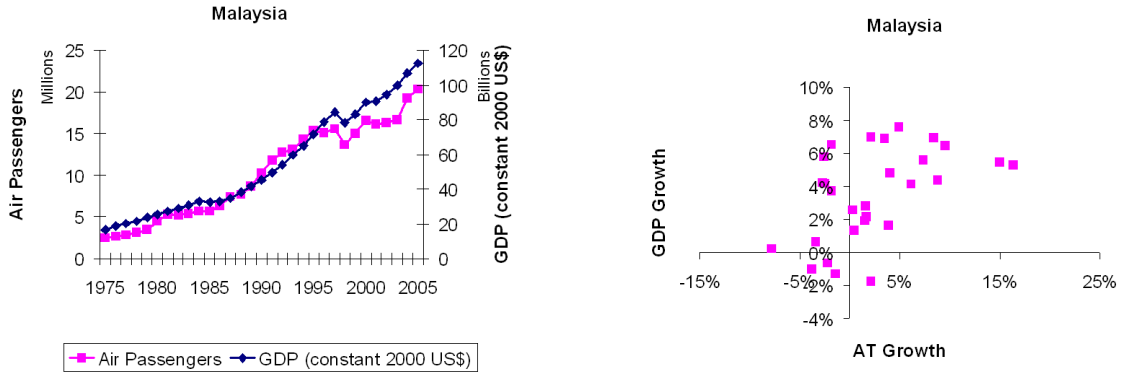


Figure C-8: Malaysia

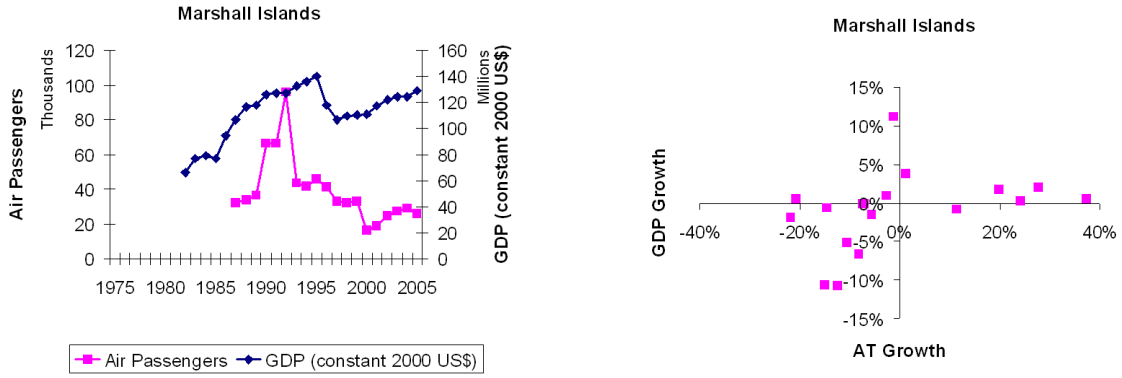


Figure C-9: Marshall Islands

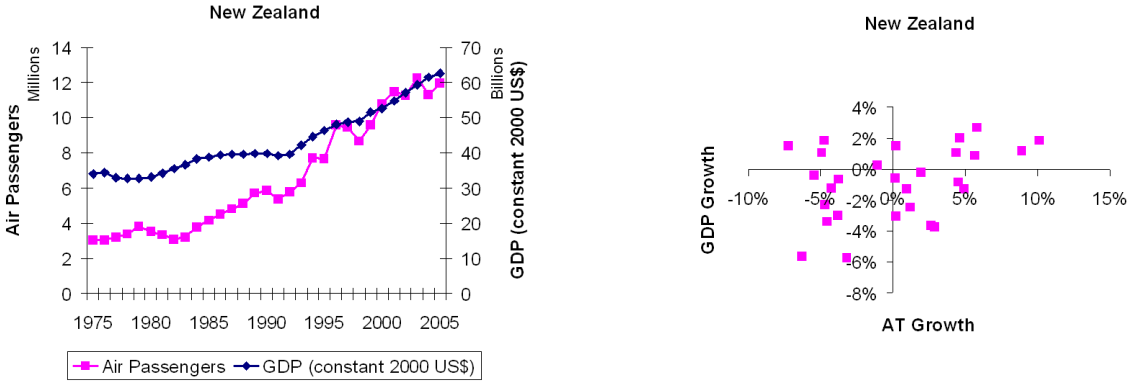


Figure C-10: New Zealand

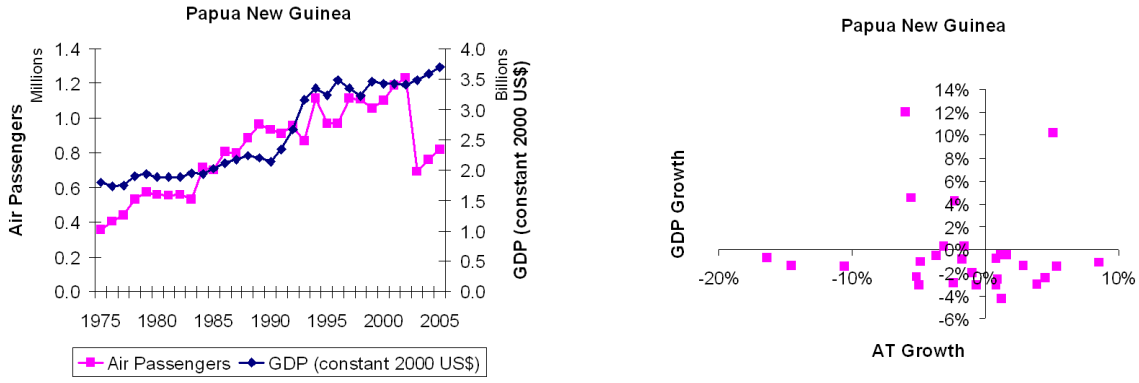


Figure C-11: Papua New Guinea

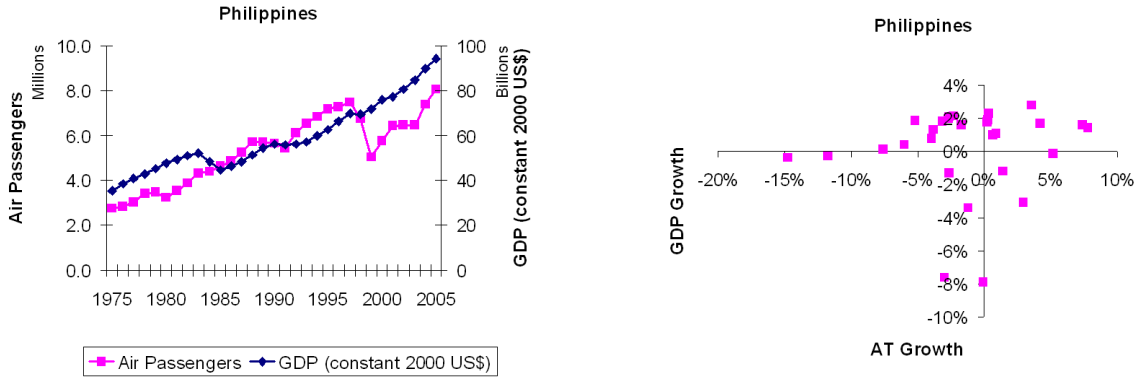


Figure C-12: Philippines

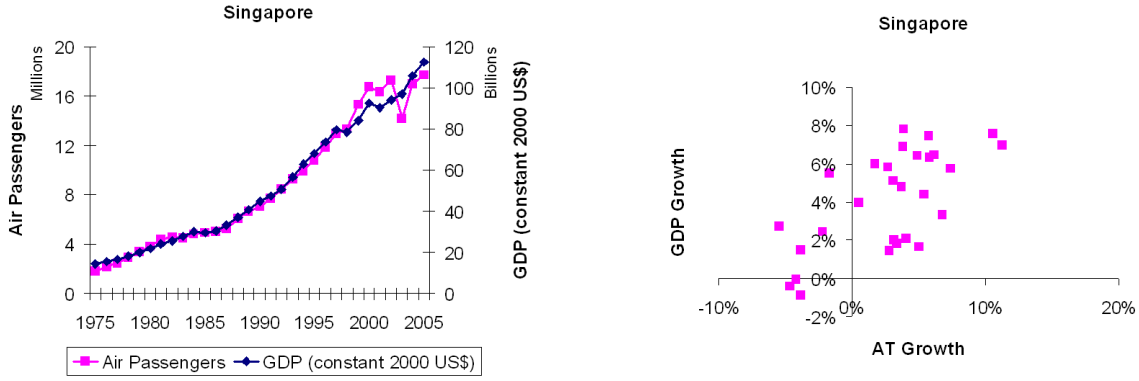
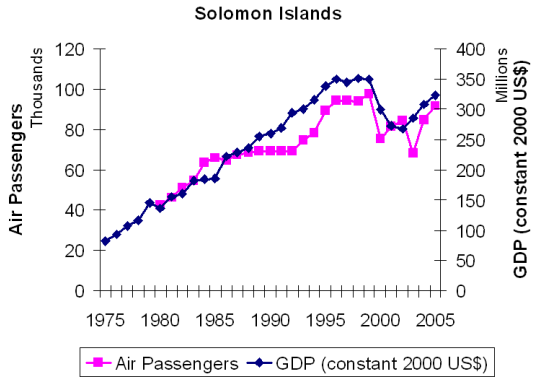


Figure C-13: Singapore



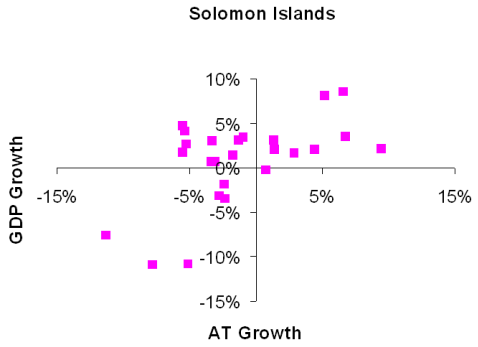
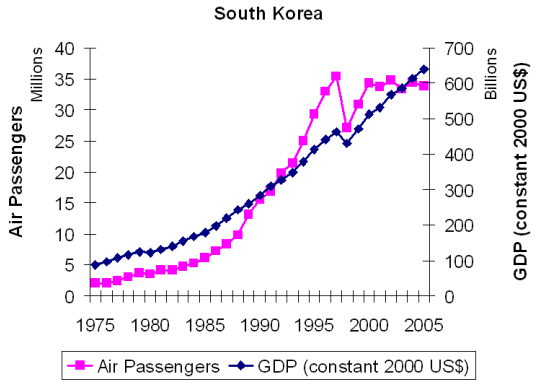


Figure C-14: Solomon Islands



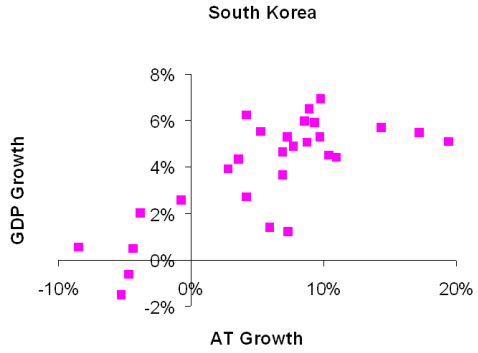
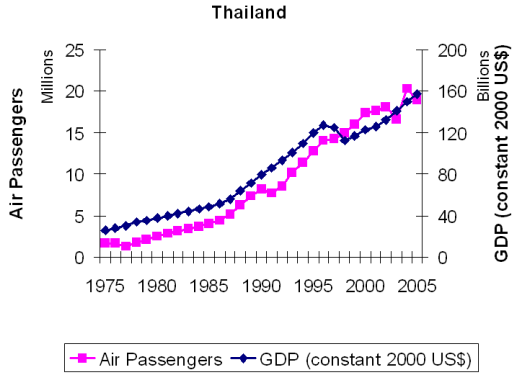


Figure C-15: South Korea



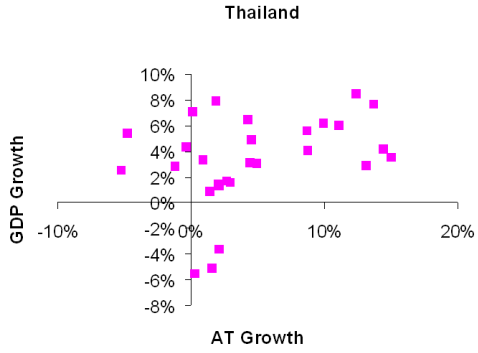
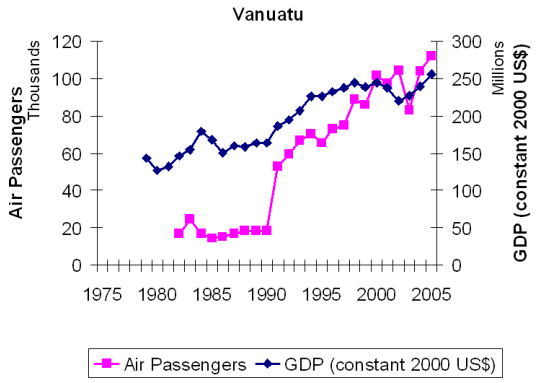


Figure C-16: Thailand



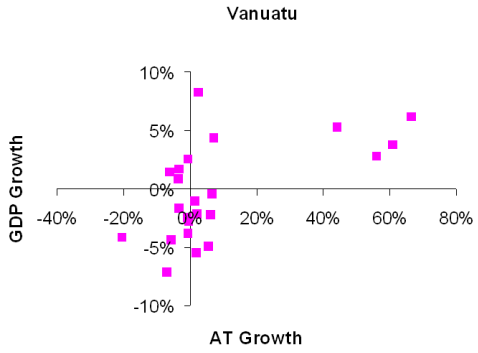
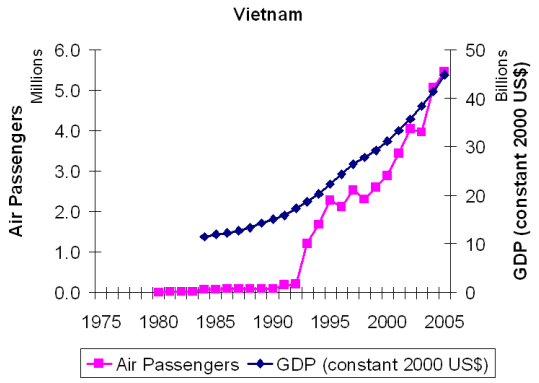


Figure C-17: Vanuatu



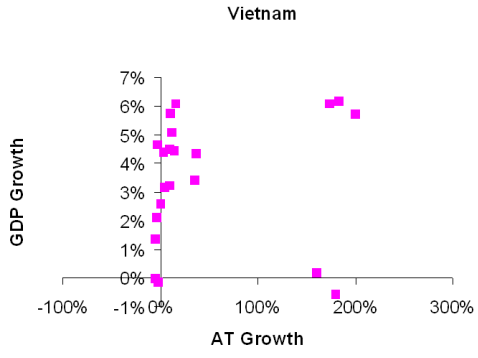


Figure C-18: Vietnam

	Correlation	Total Years	AT Pax	AT per capita	GDP per capita	Population
Australia	0.98	31	4.47E+07	2.20	30,242	2.03E+07
Brunei Darussalam	0.90	22	9.78E+05	2.61		3.74E+05
Cambodia	0.76	7	1.69E+05	0.01	2,426	1.41E+07
China	0.99	31	1.37E+08	0.10	6,014	1.30E+09
Fiji	0.91	29	8.71E+05	1.03	5,384	8.48E+05
Hong Kong, China	0.81	9	2.02E+07	2.91	31,069	6.94E+06
Indonesia	0.86	31	2.68E+07	0.12	3,423	2.21E+08
Japan	0.98	31	1.02E+08	0.80	27,345	1.28E+08
Korea, Rep.	0.98	31	3.39E+07	0.70	19,644	4.83E+07
Lao PDR	0.96	22	2.93E+05	0.05	1,903	5.66E+06
Macao, China	0.54	6	2.04E+06	4.43	32,543	4.60E+05
Malaysia	0.98	31	2.04E+07	0.80	9,685	2.53E+07
Marshall Islands	0.40	19	2.58E+04	0.41		6.33E+04
Mongolia	-0.22	10	2.95E+05	0.12	1,899	2.55E+06
New Zealand	0.97	31	1.20E+07	2.92	22,870	4.10E+06
Papua New Guinea	0.75	31	8.19E+05	0.14	2,280	5.89E+06
Philippines	0.81	31	8.06E+06	0.10	4,573	8.31E+07
Samoa	0.53	10	2.67E+05	1.44	5,489	1.85E+05
Singapore	0.99	31	1.77E+07	4.09	26,550	4.34E+06
Solomon Islands	0.93	26	9.15E+04	0.19	1,806	4.78E+05
Thailand	0.98	31	1.89E+07	0.29	7,740	6.42E+07
Vanuatu	0.95	24	1.12E+05	0.53	2,967	2.11E+05
Vietnam	0.99	22	5.45E+06	0.07	2,737	8.31E+07

Table C.1: East Asia & Pacific: Correlation Coefficients between Air Transport Passengers and GDP (2000 US$); the total Number of Years for which country-level data are available; Mobility and GDP per capita statistics based on 2005 data.

00-05	AT Growth	GDP Growth	Market Share
Australia	6.51	3.22	2.21%
China	17.18	9.54	6.76%
Fiji	8.24	2.43	0.04%
Hong Kong, China	7.07	4.31	1.00%
Indonesia	22.03	4.73	1.33%
Japan	-1.29	1.43	5.06%
Korea, Rep.	-0.26	4.56	1.68%
Lao PDR	6.83	6.25	0.01%
Macao, China	5.90	12.09	0.10%
Malaysia	4.23	4.48	1.01%
Marshall Islands	9.87	3.02	0.00%
Mongolia	3.06	5.84	0.01%
New Zealand	2.08	3.55	0.59%
Papua New Guinea	-5.73	1.57	0.04%
Philippines	6.96	4.45	0.40%
Samoa	10.19	4.32	0.01%
Singapore	1.21	3.99	0.88%
Solomon Islands	3.97	1.56	0.00%
Thailand	1.68	5.06	0.93%
Vanuatu	2.03	0.94	0.01%
Vietnam	13.64	7.51	0.27%

Table C.2: East Asia & Pacific: Air Transport Passenger and GDP growth rates based on data between 2000 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

85-05	AT Growth	GDP Growth	Market Share
Australia	5.82	3.36	2.21%
China	15.78	9.56	6.76%
Fiji	5.13	2.51	0.04%
Indonesia	7.37	5.07	1.33%
Japan	3.51	2.17	5.06%
Korea, Rep.	8.86	6.57	1.68%
Lao PDR	15.73	5.77	0.01%
Malaysia	6.59	6.38	1.01%
New Zealand	5.42	2.44	0.59%
Papua New Guinea	0.78	3.07	0.04%
Philippines	2.83	3.82	0.40%
Singapore	6.63	6.89	0.88%
Solomon Islands	1.64	2.81	0.00%
Thailand	7.99	6.04	0.93%
Vanuatu	10.81	2.13	0.01%
Vietnam	23.20	6.85	0.27%

Table C.3: East Asia & Pacific: Air Transport Passenger and GDP growth rates based on data between 1985 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

Appendix D

Data Summary: Europe & Central Asia

The figure on the left shows the number of scheduled air passengers carried by the airlines registered in a particular country and the country's GDP. The figure on the right is used to compare the country's air passenger and GDP growth rates to the world's: each point in the figure represents the difference between the country's and the world's three-year moving average growth rates for a particular year.

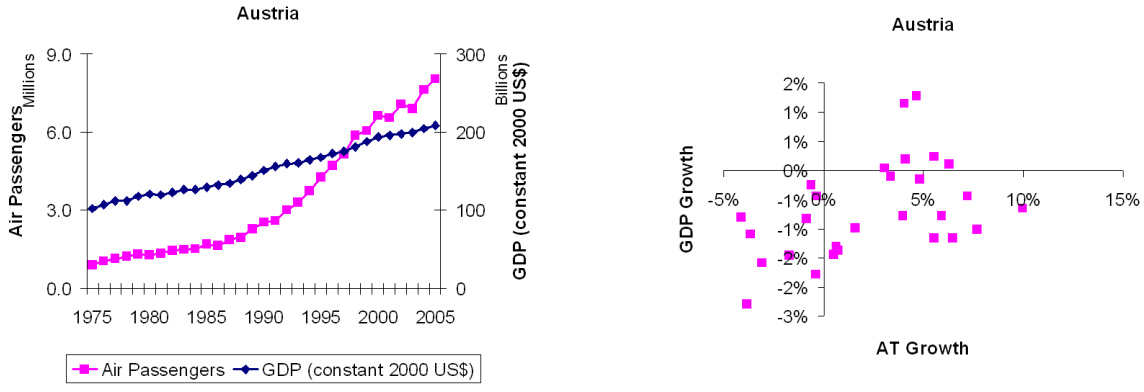


Figure D-1: Austria

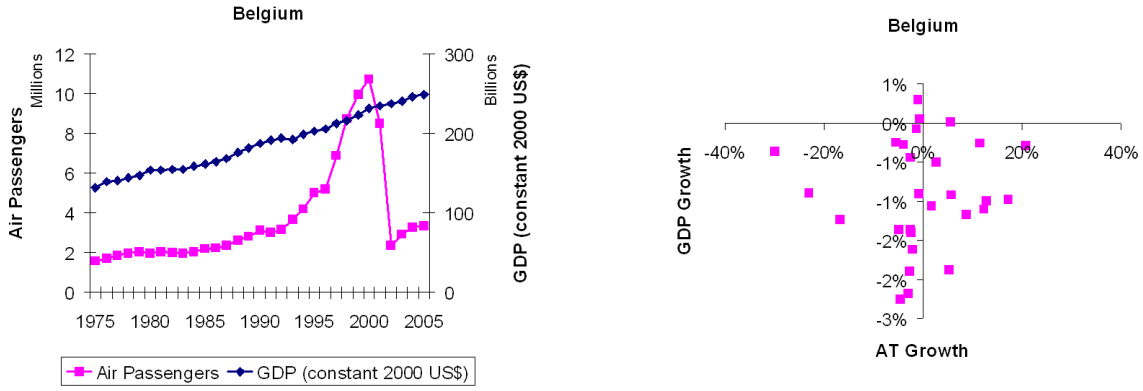


Figure D-2: Belgium

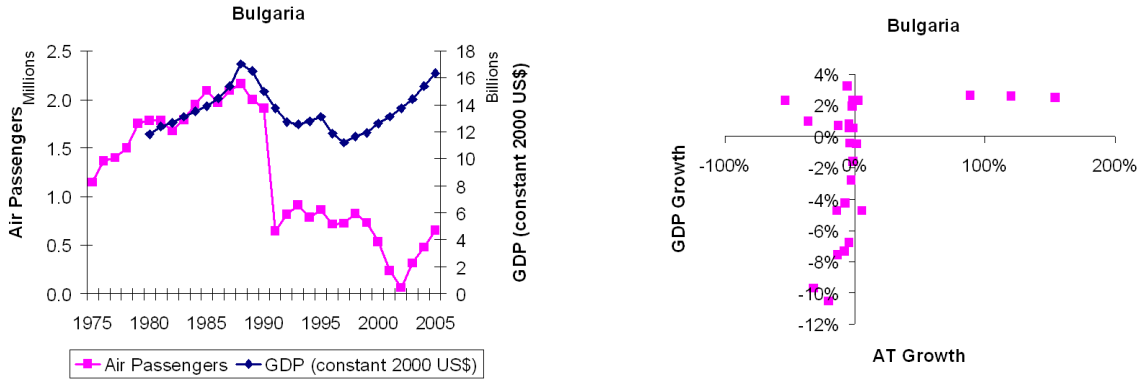


Figure D-3: Bulgaria

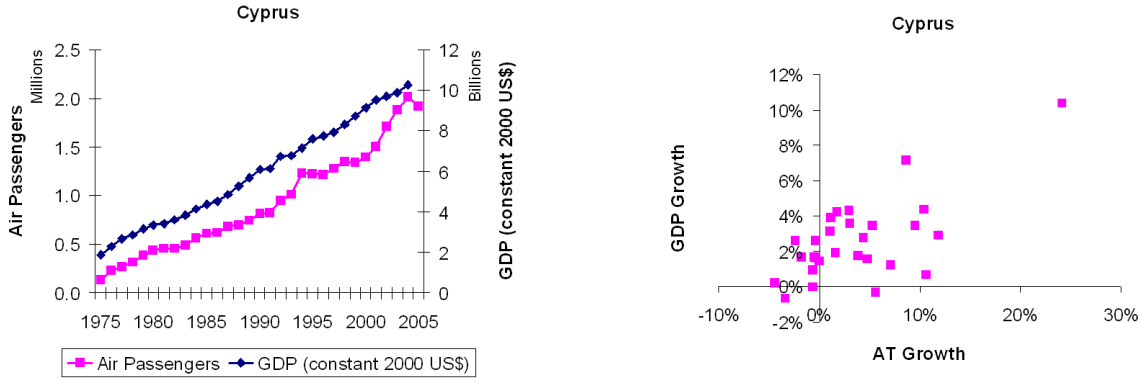
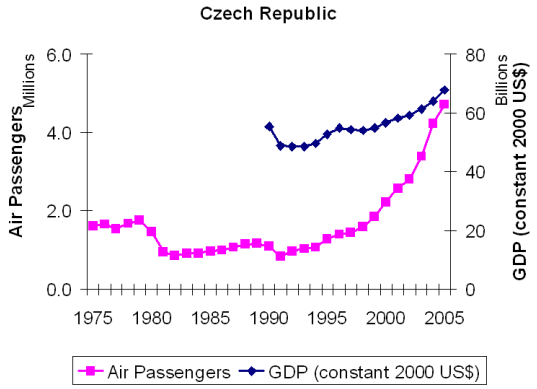


Figure D-4: Cyprus



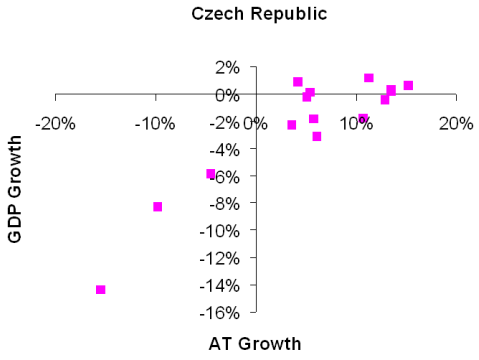
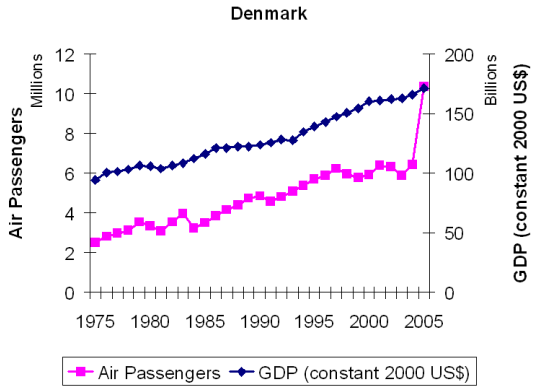


Figure D-5: Czech Republic



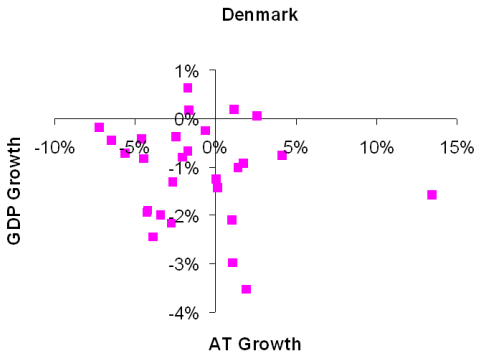
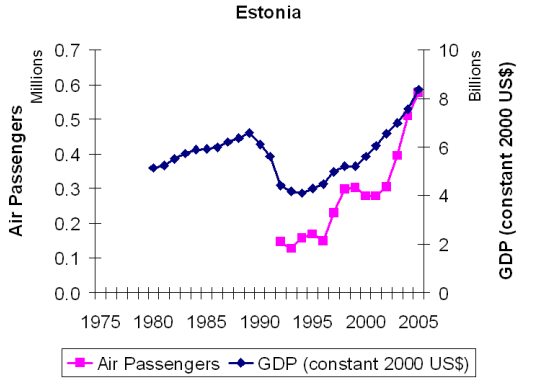


Figure D-6: Denmark



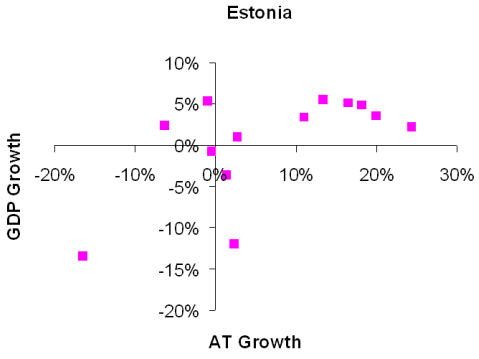


Figure D-7: Estonia

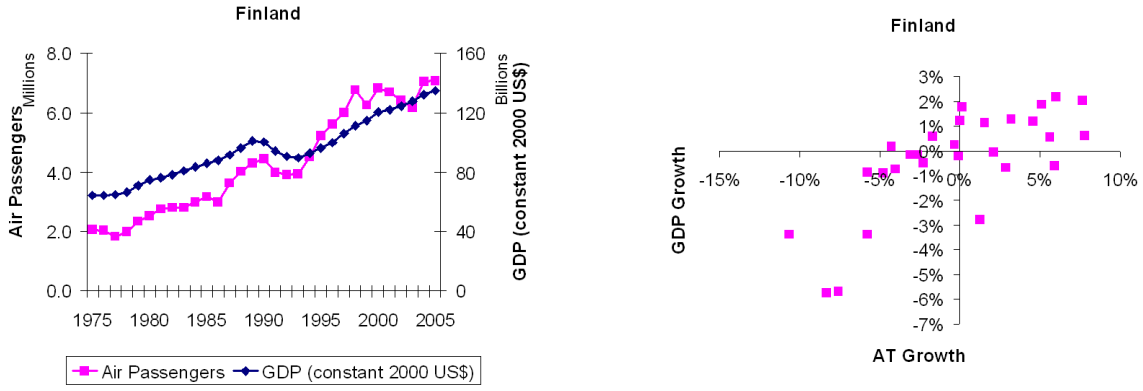


Figure D-8: Finland

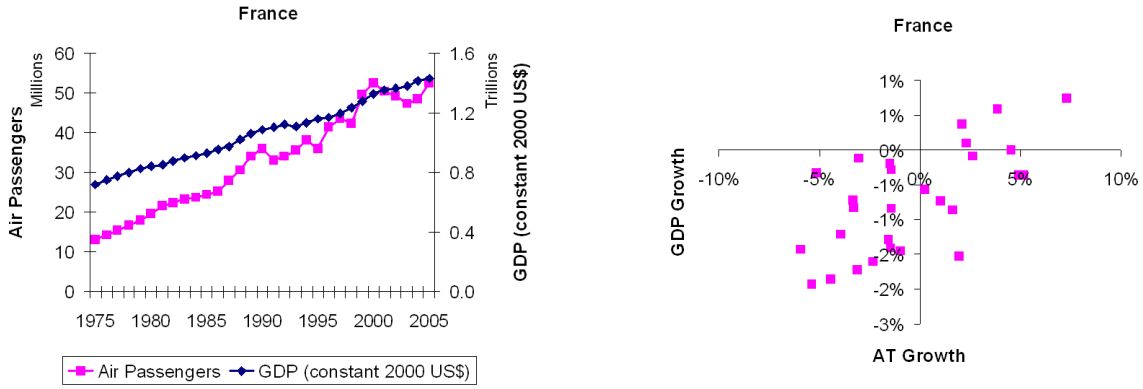


Figure D-9: France

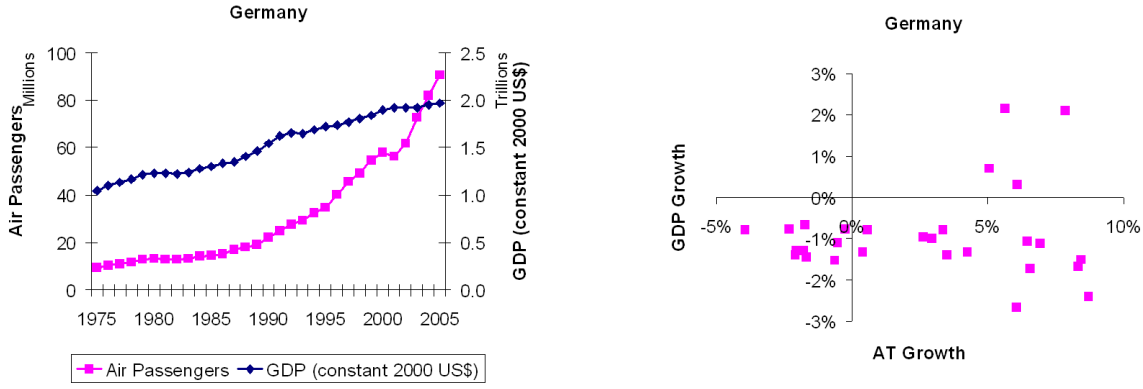


Figure D-10: Germany

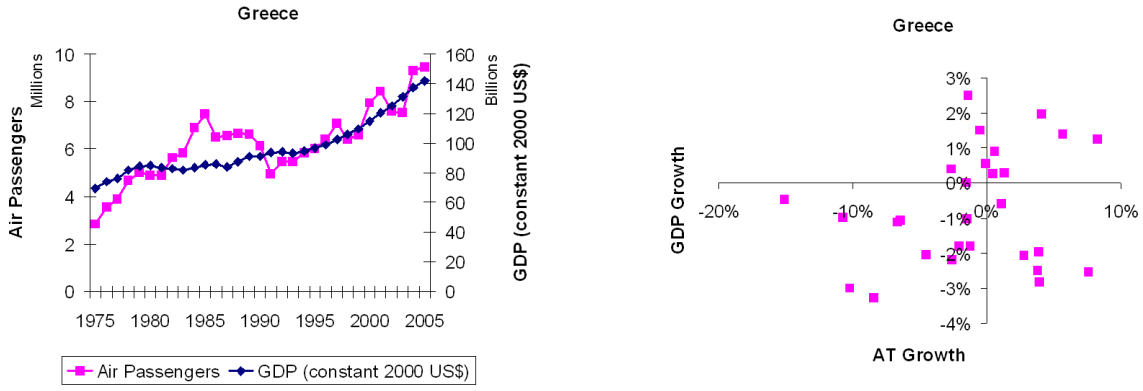


Figure D-11: Greece

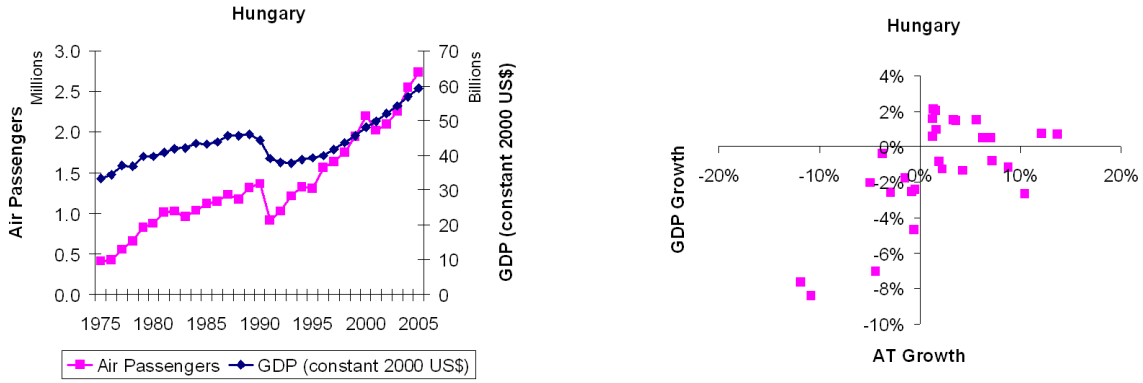


Figure D-12: Hungary

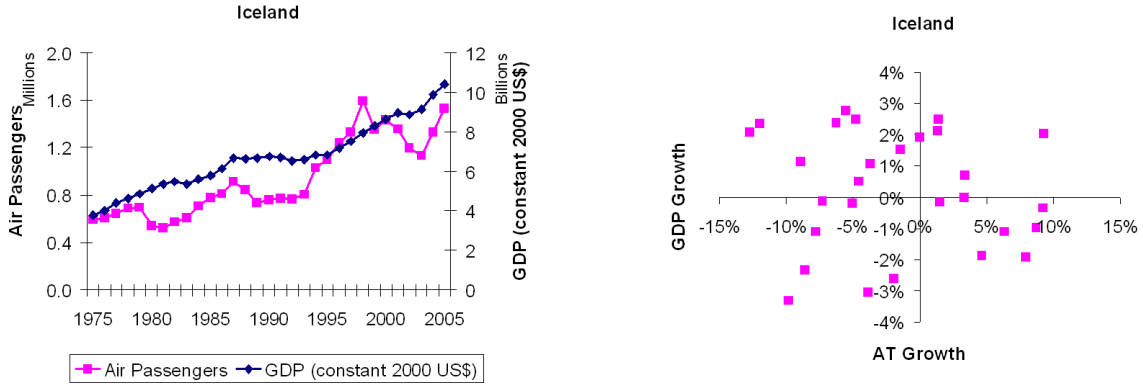
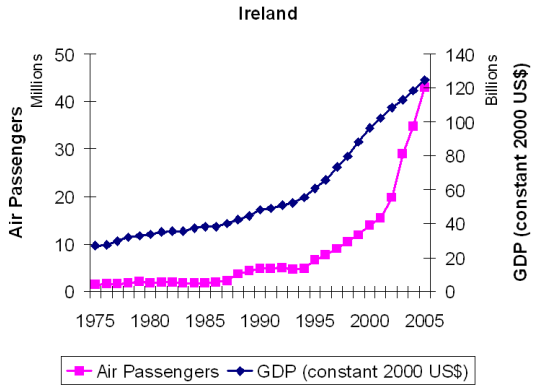


Figure D-13: Iceland



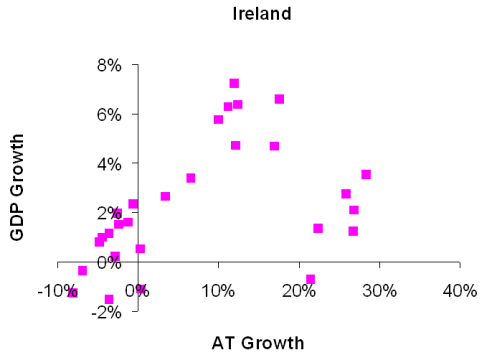
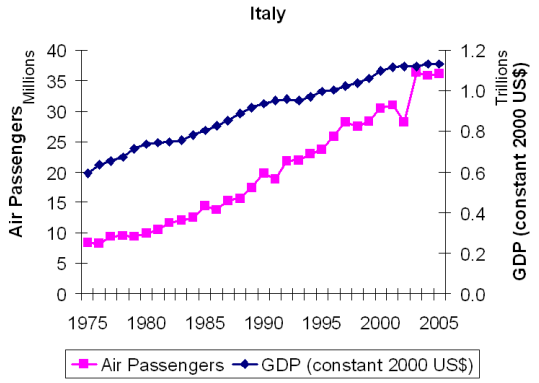


Figure D-14: Ireland



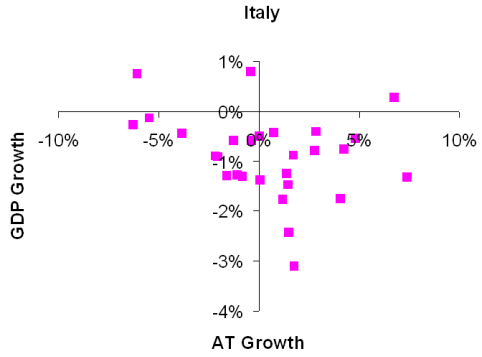
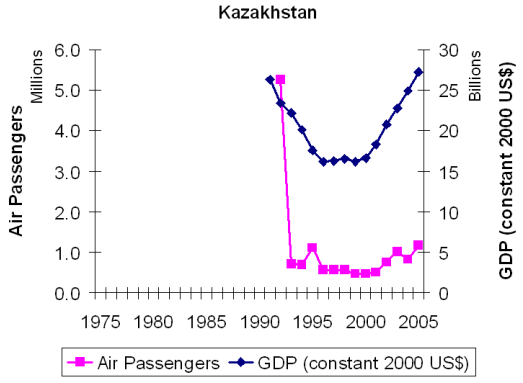


Figure D-15: Italy



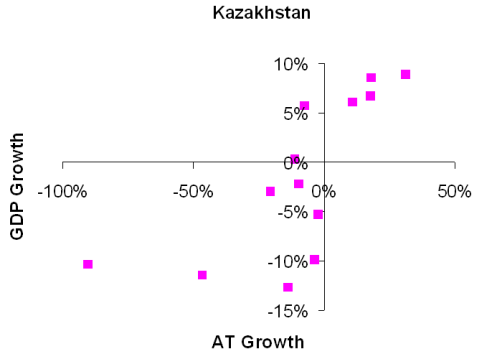
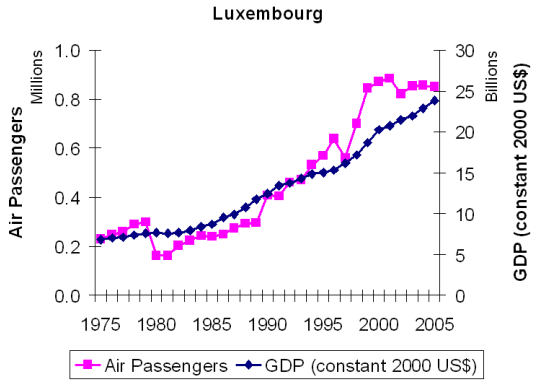


Figure D-16: Kazakhstan



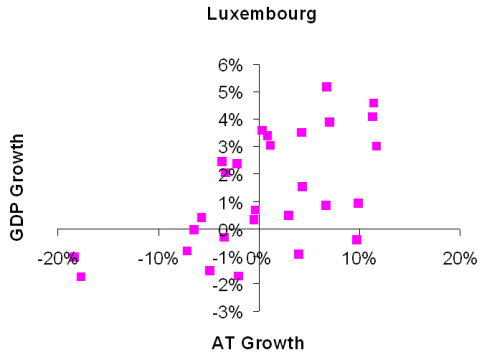
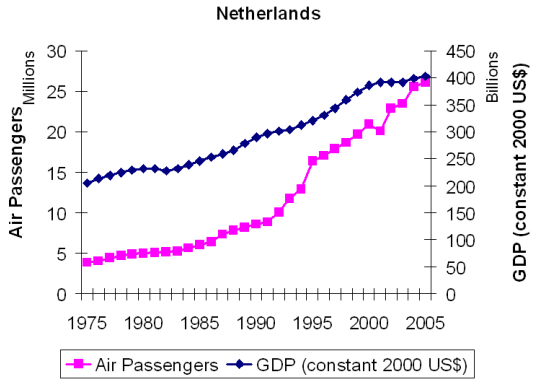


Figure D-17: Luxembourg



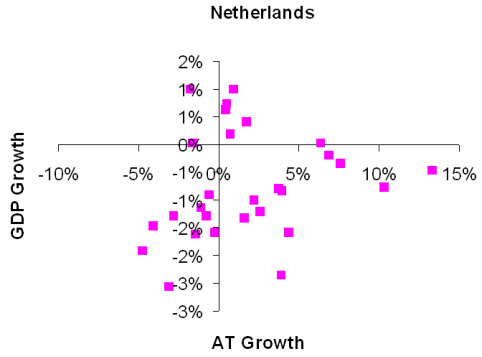
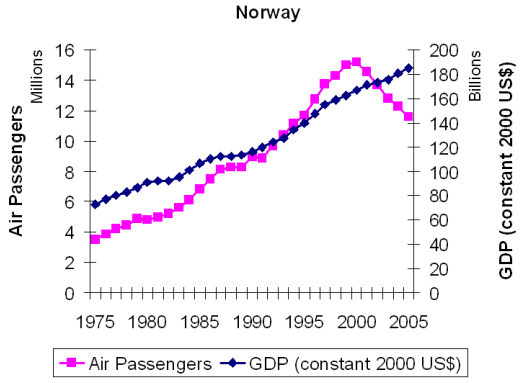


Figure D-18: Netherlands



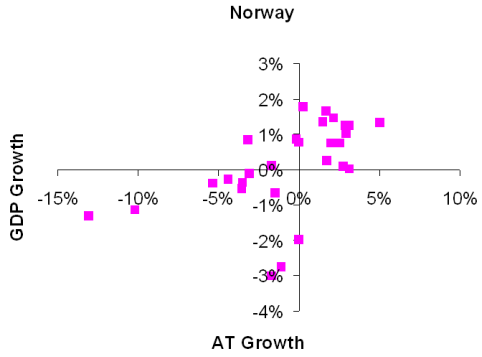


Figure D-19: Norway

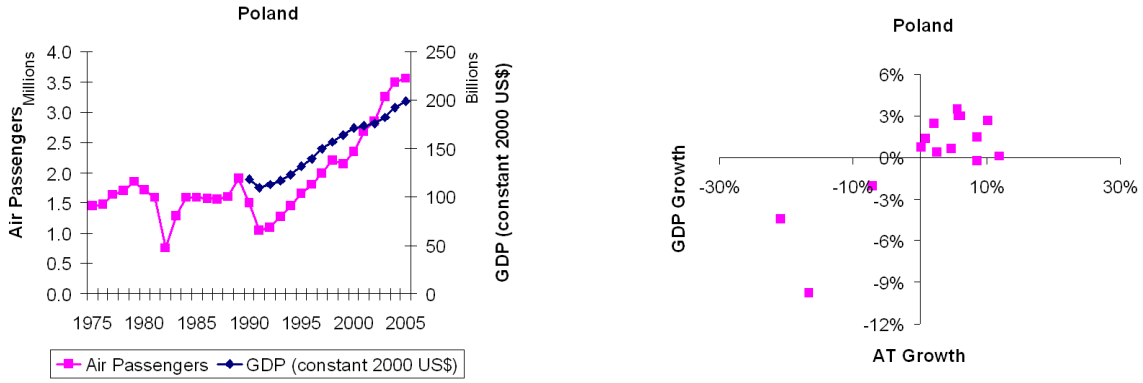


Figure D-20: Poland

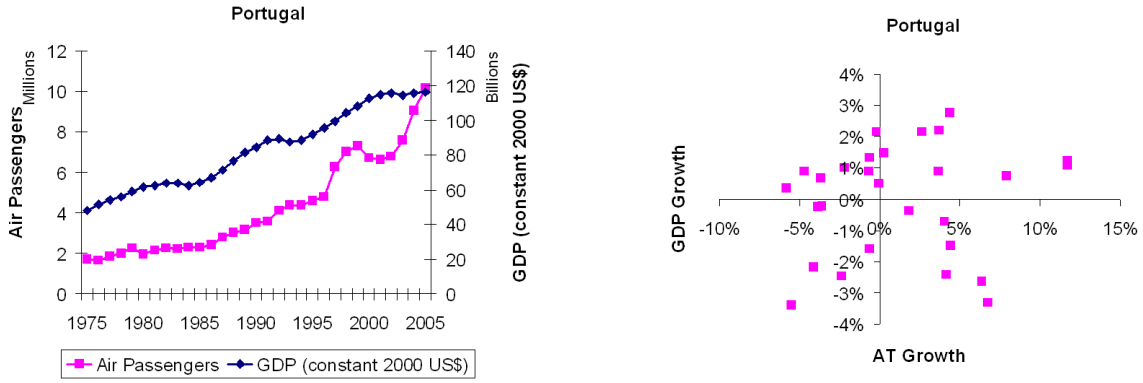


Figure D-21: Portugal

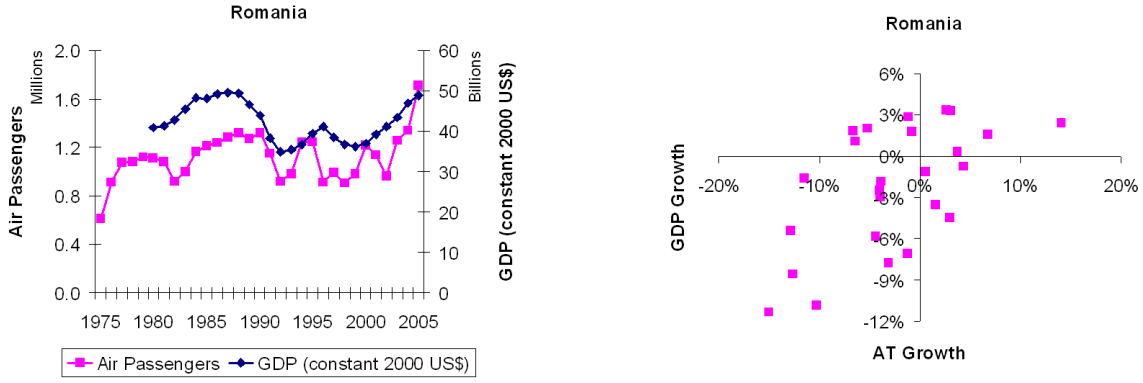


Figure D-22: Romania

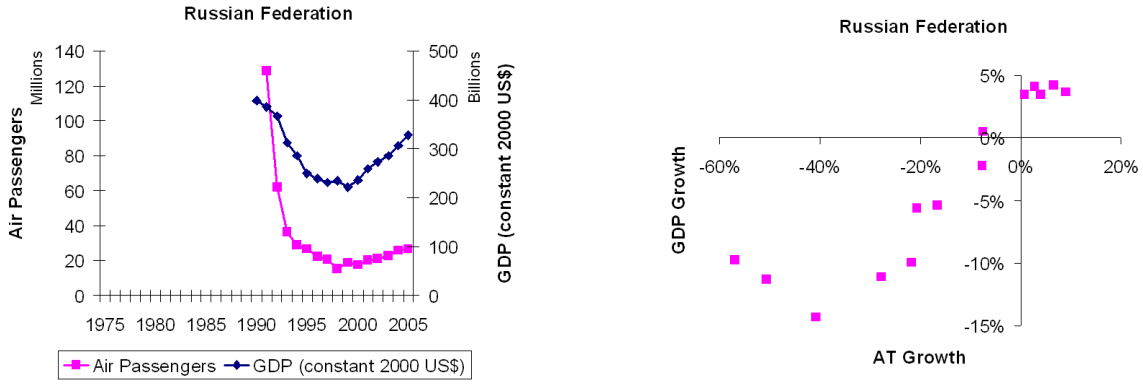


Figure D-23: Russian Federation

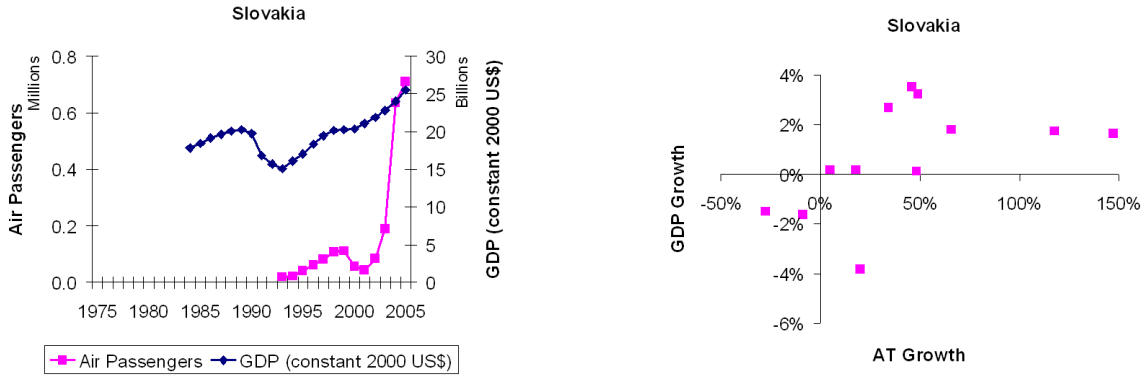


Figure D-24: Slovakia

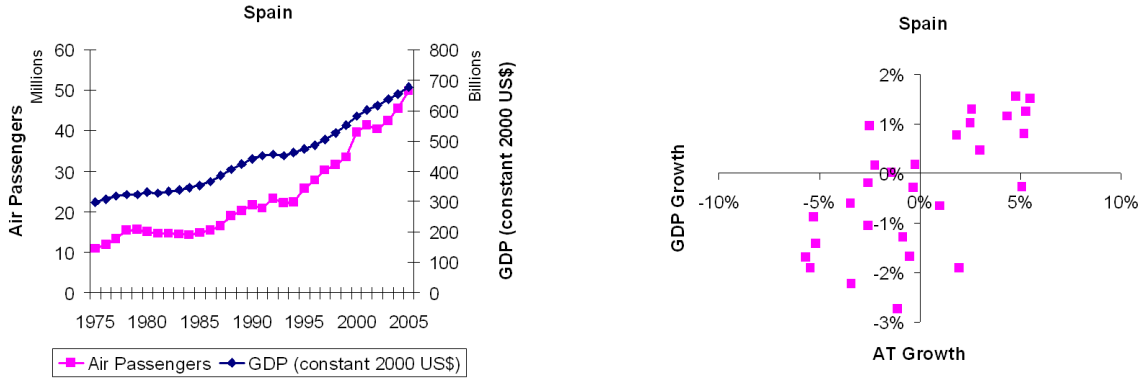


Figure D-25: Spain

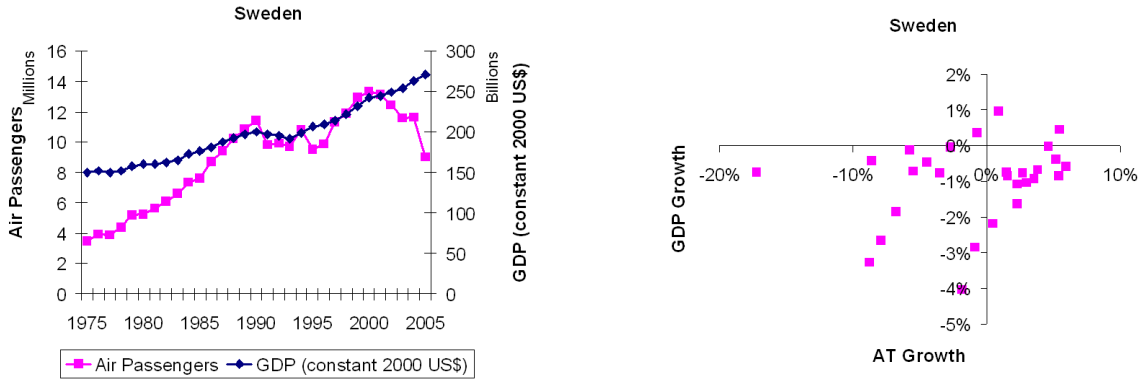


Figure D-26: Sweden

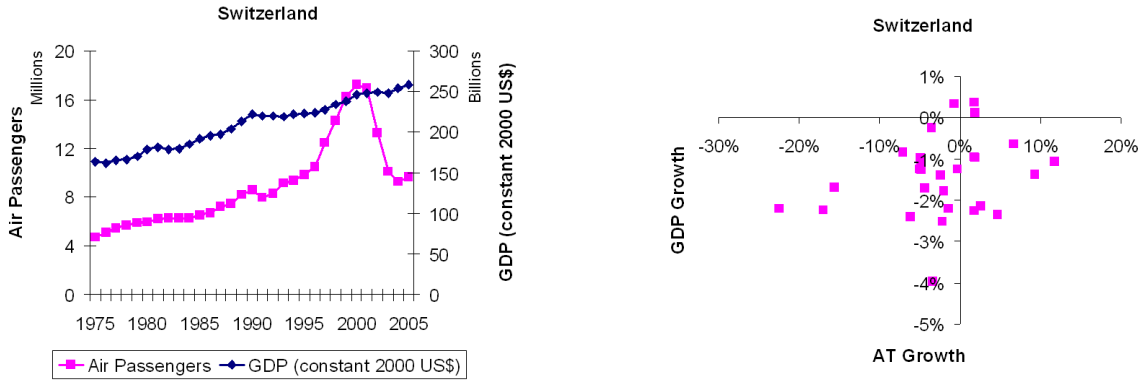


Figure D-27: Switzerland

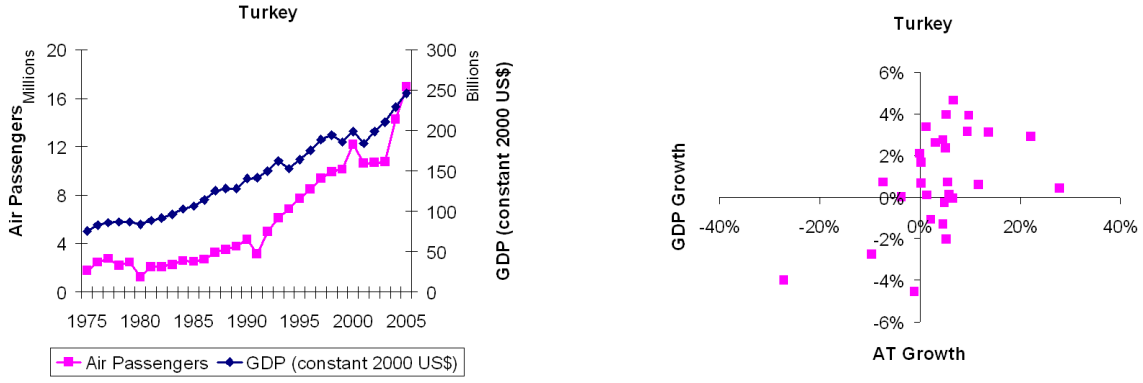


Figure D-28: Turkey

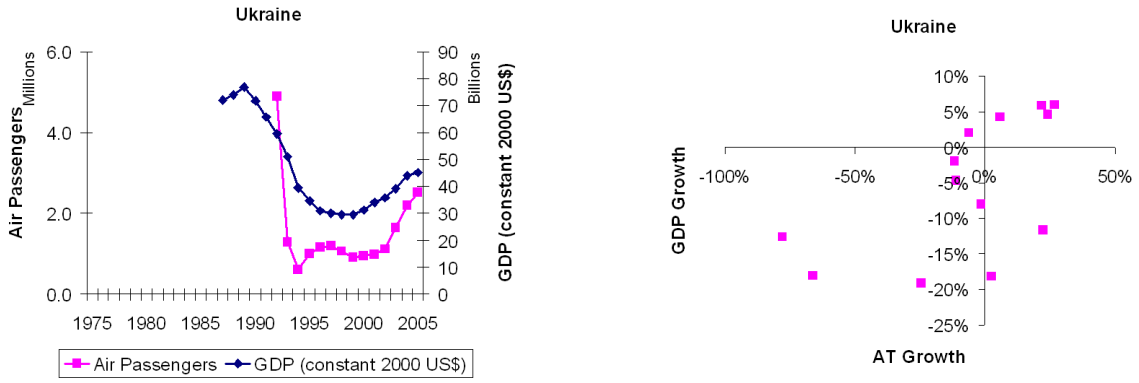


Figure D-29: Ukraine

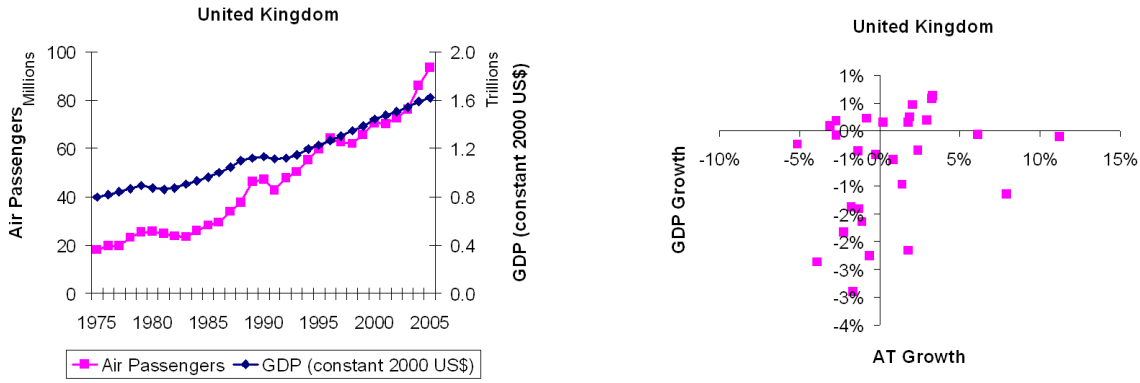


Figure D-30: United Kingdom

	Correlation	Total Years	AT Pax	AT per capita	GDP per capita	Population
Albania	0.96	12	1.96E+05	0.06	4,731	3.13E+06
Armenia	0.85	10	5.56E+05	0.18	4,406	3.02E+06
Austria	0.98	31	8.04E+06	0.98	29,836	8.23E+06
Azerbaijan	-0.01	14	1.13E+06	0.14	4,472	8.39E+06
Belarus	-0.54	14	2.82E+05	0.03	7,047	9.78E+06
Belgium	0.62	31	3.34E+06	0.32	29,093	1.05E+07
Bulgaria	0.31	26	6.54E+05	0.08	8,208	7.74E+06
Croatia	0.87	15	1.36E+06	0.31	11,614	4.44E+06
Cyprus	0.98	30	1.92E+06	2.53		7.58E+05
Czech Republic	0.96	16	4.71E+06	0.46	18,545	1.02E+07
Denmark	0.91	31	1.03E+07	1.91	30,519	5.42E+06
Estonia	0.96	14	5.78E+05	0.43	14,206	1.35E+06
Finland	0.96	31	7.08E+06	1.35	28,884	5.25E+06
France	0.99	31	5.25E+07	0.86	28,387	6.09E+07
Georgia	0.44	14	2.49E+05	0.06	2,994	4.47E+06
Germany	0.91	31	9.08E+07	1.10	26,672	8.25E+07
Greece	0.83	31	9.45E+06	0.85	20,798	1.11E+07
Hungary	0.89	31	2.74E+06	0.27	16,241	1.01E+07
Iceland	0.87	31	1.53E+06	5.15	33,003	2.97E+05
Ireland	0.92	31	4.29E+07	10.31	34,601	4.16E+06
Italy	0.97	31	3.61E+07	0.62	25,986	5.86E+07
Kazakhstan	0.22	14	1.16E+06	0.08	6,992	1.51E+07
Kyrgyz Republic	-0.72	13	2.26E+05	0.04	1,722	5.14E+06
Latvia	0.85	14	1.03E+06	0.45	12,188	2.30E+06
Lithuania	0.76	14	5.05E+05	0.15	12,975	3.41E+06
Luxembourg	0.97	31	8.51E+05	1.86	57,016	4.57E+05
Macedonia, FYR	0.05	14	1.92E+05	0.09	6,396	2.03E+06
Moldova	0.82	14	2.32E+05	0.06	2,045	3.88E+06
Montenegro	0.94	4	3.83E+05	0.63		6.08E+05
Netherlands	0.98	31	2.61E+07	1.60	30,520	1.63E+07
Norway	0.95	31	1.16E+07	2.50	36,767	4.62E+06
Poland	0.98	16	3.55E+06	0.09	12,604	3.82E+07
Portugal	0.94	31	1.01E+07	0.96	18,794	1.05E+07
Romania	0.60	26	1.71E+06	0.08	8,064	2.16E+07
Russian Federation	0.63	15	2.65E+07	0.19	9,650	1.43E+08
Serbia	-0.45	5	9.19E+05	0.12		7.44E+06
Slovak Republic	0.78	13	7.12E+05	0.13	14,226	5.39E+06
Slovenia	0.98	14	7.58E+05	0.38	19,823	2.00E+06
Spain	0.99	31	4.99E+07	1.15	23,836	4.34E+07
Sweden	0.85	31	9.02E+06	1.00	29,182	9.02E+06
Switzerland	0.81	31	9.66E+06	1.30	31,932	7.44E+06
Tajikistan	0.09	13	4.79E+05	0.07	1,191	6.55E+06
Turkey	0.96	31	1.69E+07	0.24	7,481	7.21E+07
Turkmenistan	-0.80	14	1.65E+06	0.34		4.83E+06
Ukraine	0.80	14	2.51E+06	0.05	6,101	4.71E+07
United Kingdom	0.99	31	9.36E+07	1.55	29,479	6.02E+07
Uzbekistan	-0.34	14	1.64E+06	0.06	1,836	2.62E+07

Table D.1: Europe & Central Asia: Correlation Coefficients between Air Transport Passengers and GDP (2000 US$); the total Number of Years for which country-level data are available; Mobility and GDP per capita statistics based on 2005 data.

00-05	AT Growth	GDP Growth	Market Share
Albania	7.45	5.39	0.01%
Armenia	13.26	12.23	0.03%
Austria	3.89	1.49	0.40%
Azerbaijan	15.75	13.49	0.06%
Belarus	5.97	7.47	0.01%
Belgium	-20.83	1.46	0.17%
Bulgaria	4.08	5.37	0.03%
Croatia	7.92	4.69	0.07%
Czech Republic	16.12	3.64	0.23%
Denmark	11.79	1.35	0.51%
Estonia	15.79	8.25	0.03%
Finland	0.71	2.27	0.35%
France	-0.04	1.49	2.60%
Georgia	16.22	7.27	0.01%
Germany	9.39	0.74	4.49%
Greece	3.55	4.40	0.47%
Hungary	4.47	4.33	0.14%
Iceland	1.32	3.86	0.08%
Ireland	25.12	5.34	2.12%
Italy	3.49	0.64	1.79%
Kazakhstan	20.26	10.37	0.06%
Kyrgyz Republic	-1.28	3.79	0.01%
Latvia	29.96	8.19	0.05%
Lithuania	12.23	7.74	0.02%
Luxembourg	-0.46	3.29	0.04%
Macedonia, FYR	-20.35	1.35	0.01%
Moldova	14.57	7.08	0.01%
Netherlands	4.57	0.84	1.29%
Norway	-5.29	2.06	0.57%
Poland	8.71	3.03	0.18%
Portugal	8.57	0.64	0.50%
Romania	6.99	5.69	0.08%
Russian Federation	8.44	6.13	1.31%
Slovak Republic	65.64	4.59	0.04%
Slovenia	3.83	3.44	0.04%
Spain	4.65	3.15	2.47%
Sweden	-7.55	2.24	0.45%
Switzerland	-10.96	1.00	0.48%
Tajikistan	23.32	9.35	0.02%
Turkey	6.81	4.32	0.84%
Ukraine	21.46	7.67	0.12%
United Kingdom	5.85	2.34	4.63%
Uzbekistan	-1.24	5.41	0.08%

Table D.2: Europe & Central Asia: Air Transport Passenger and GDP growth rates based on data between 2000 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

85-05	AT Growth	GDP Growth	Market Share
Austria	8.05	2.41	0.40%
Belgium	2.14	2.20	0.17%
Bulgaria	-5.65	0.82	0.03%
Denmark	5.57	1.95	0.51%
Finland	4.12	2.27	0.35%
France	3.88	2.18	2.60%
Germany	9.59	2.09	4.49%
Greece	1.19	2.57	0.47%
Hungary	4.58	1.59	0.14%
Iceland	3.44	3.00	0.08%
Ireland	17.08	6.07	2.12%
Italy	4.70	1.73	1.79%
Luxembourg	6.55	5.20	0.04%
Netherlands	7.61	2.50	1.29%
Norway	2.69	2.80	0.57%
Portugal	7.66	3.01	0.50%
Romania	1.71	0.07	0.08%
Spain	6.24	3.31	2.47%
Sweden	0.85	2.16	0.45%
Switzerland	2.00	1.50	0.48%
Turkey	10.02	4.26	0.84%
United Kingdom	6.18	2.63	4.63%

Table D.3: Europe & Central Asia: Air Transport Passenger and GDP growth rates based on data between 1985 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

Appendix E

Data Summary: Latin America & Caribbean

The figure on the left shows the number of scheduled air passengers carried by the airlines registered in a particular country and the country's GDP. The figure on the right is used to compare the country's air passenger and GDP growth rates to the world's: each point in the figure represents the difference between the country's and the world's three-year moving average growth rates for a particular year.

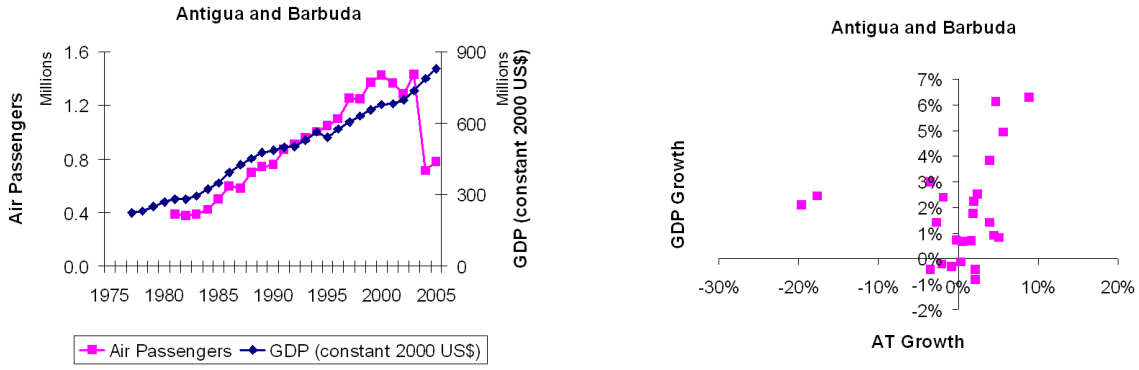
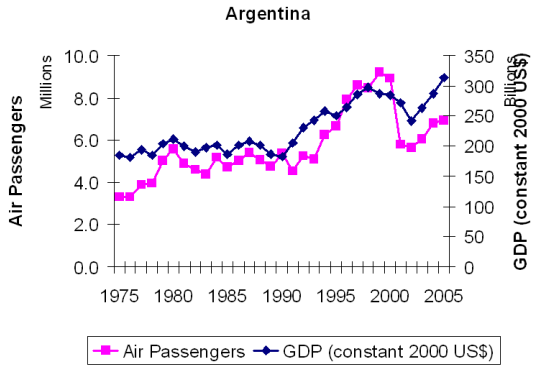


Figure E-1: Antigua and Barbuda



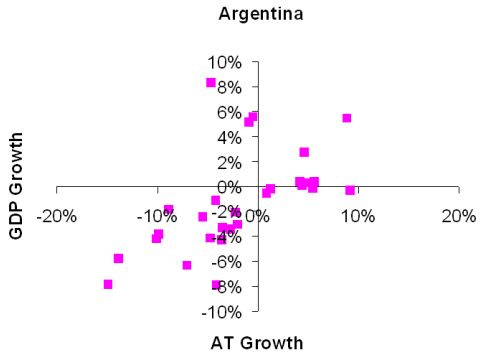
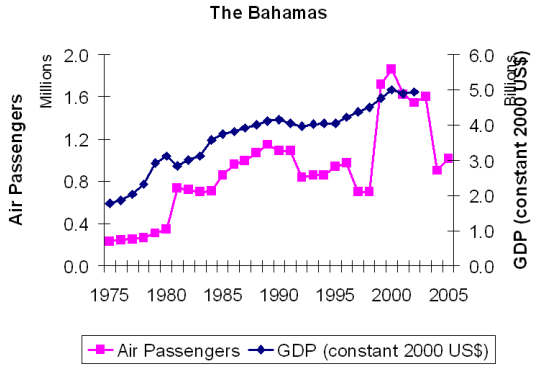


Figure E-2: Argentina



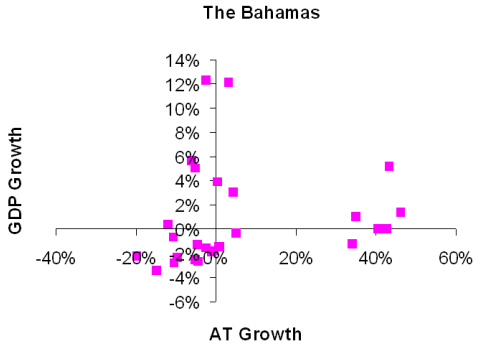
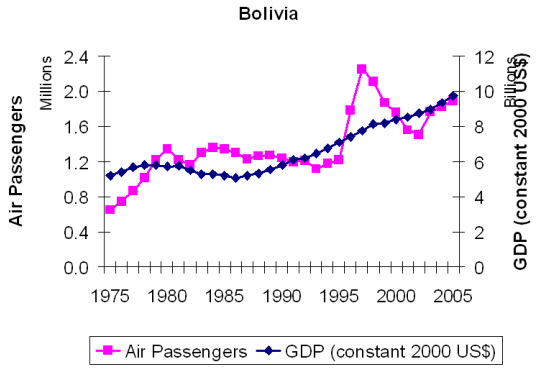


Figure E-3: The Bahamas



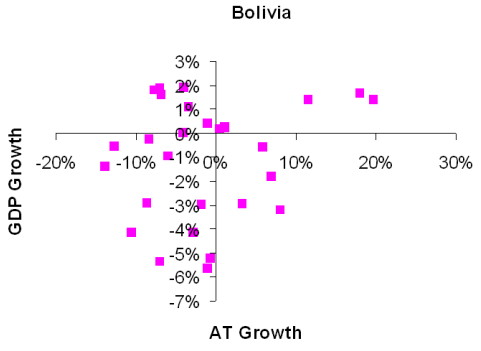


Figure E-4: Bolivia

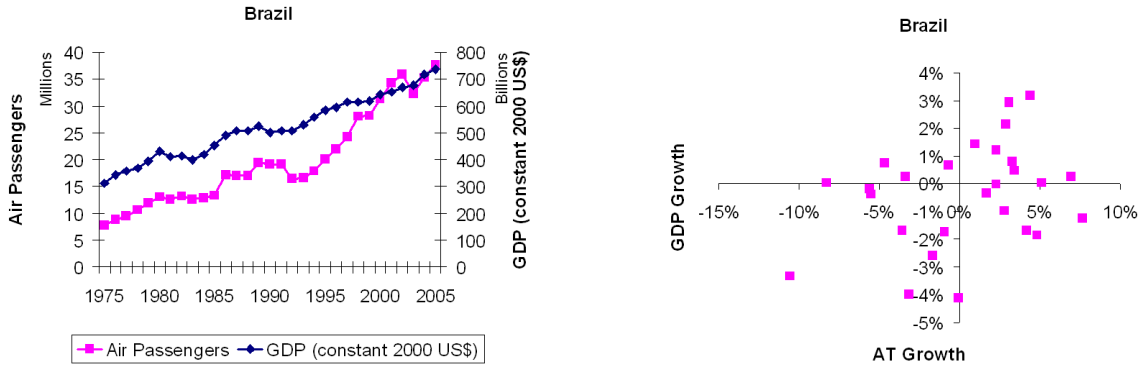


Figure E-5: Brazil

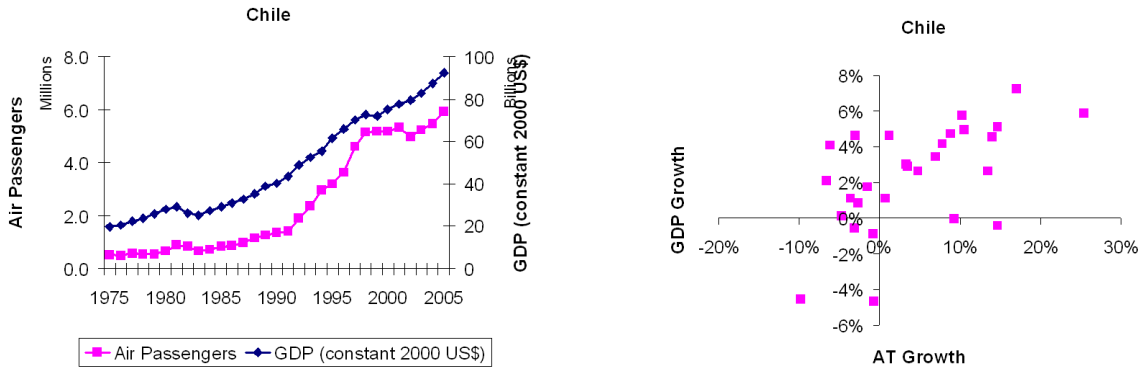


Figure E-6: Chile

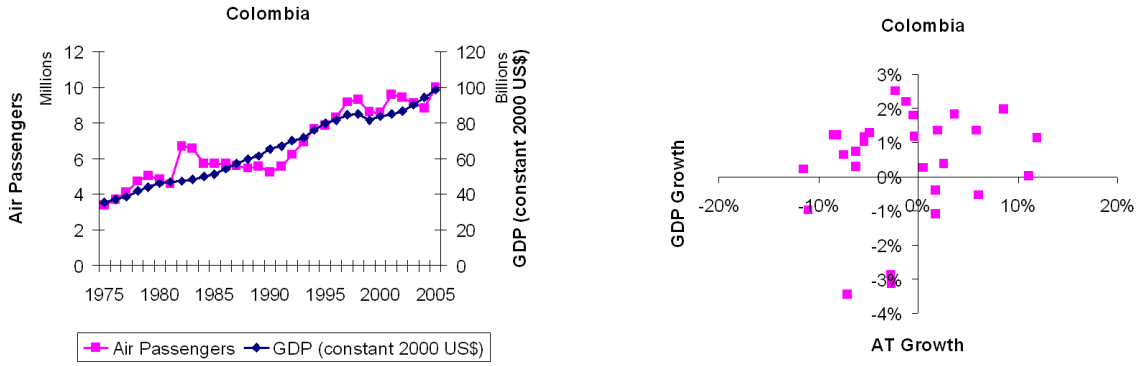
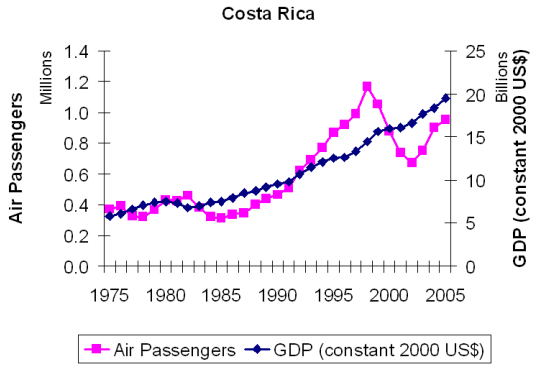


Figure E-7: Colombia



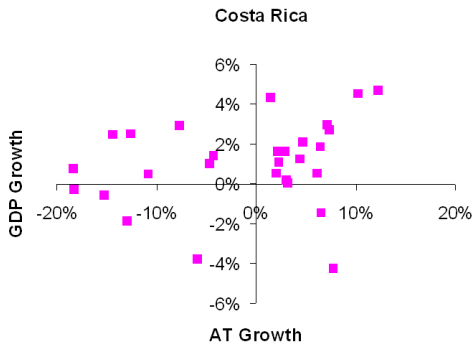
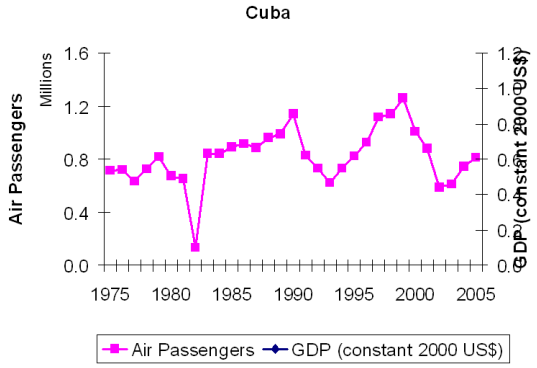


Figure E-8: Costa Rica



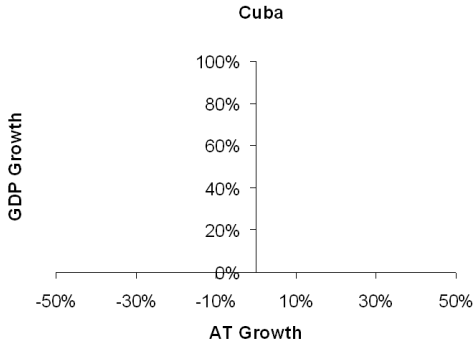
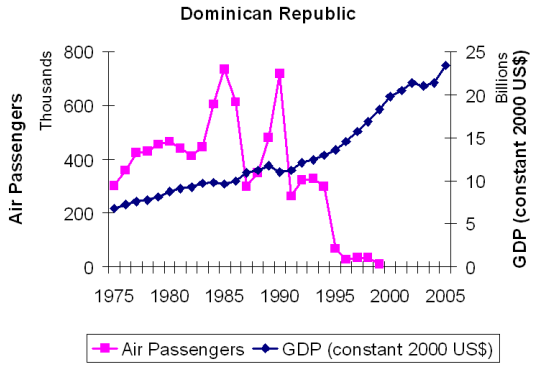


Figure E-9: Cuba



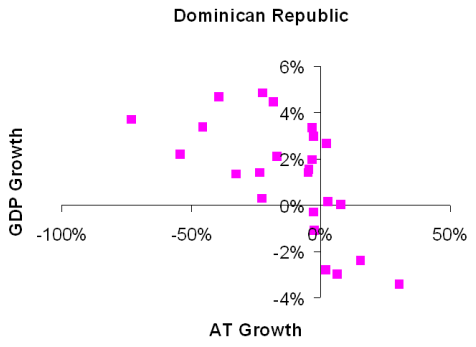


Figure E-10: Dominican Republic

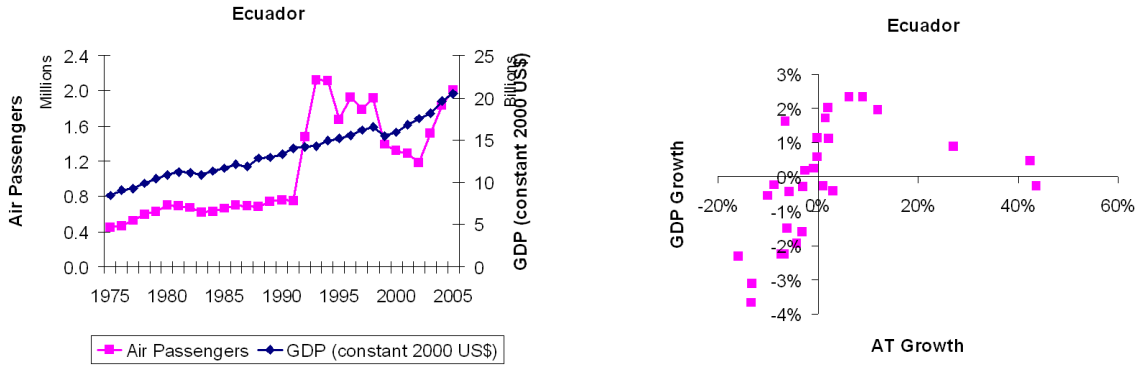


Figure E-11: Ecuador

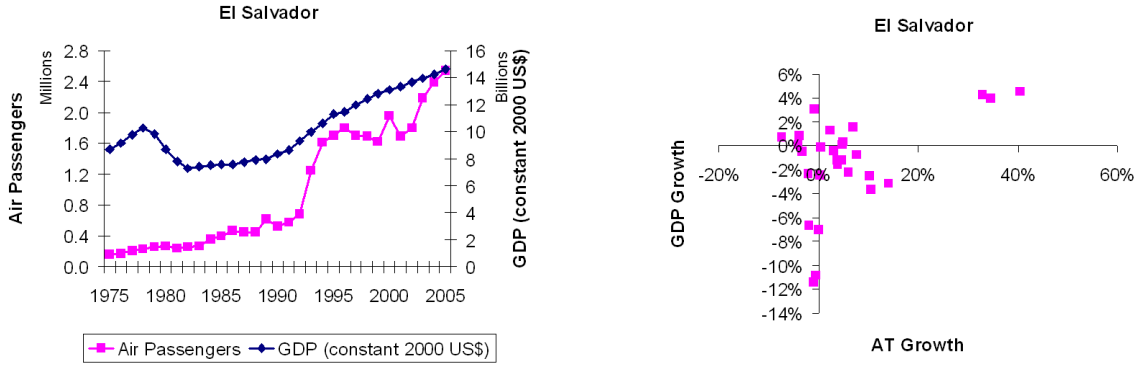


Figure E-12: El Salvador

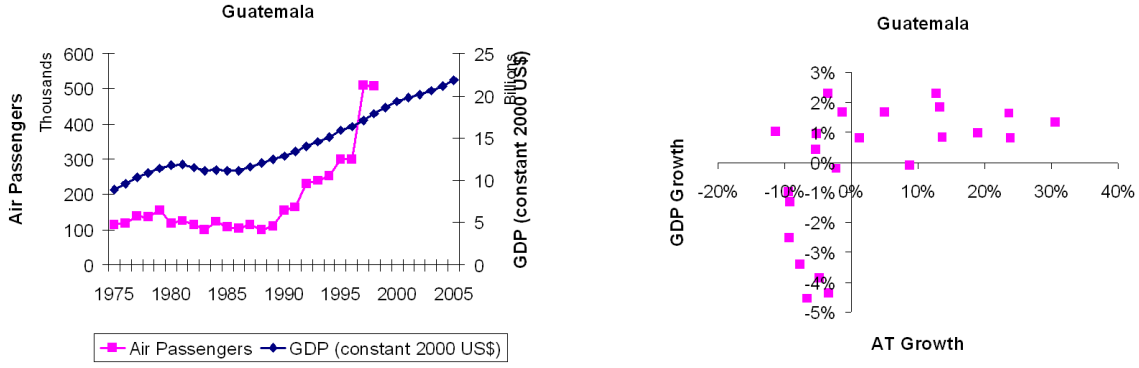
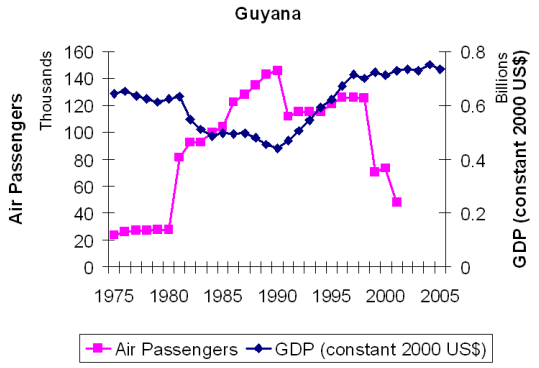


Figure E-13: Guatemala



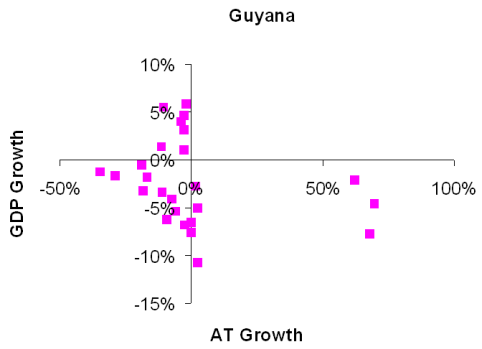
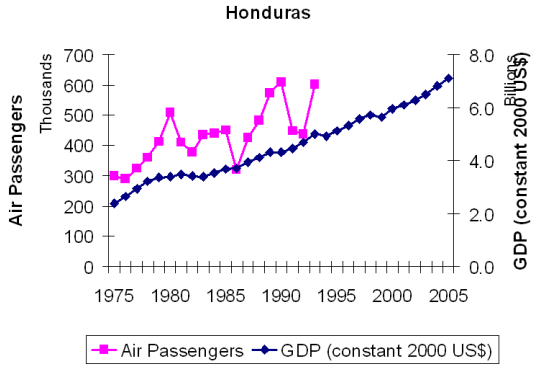


Figure E-14: Guyana



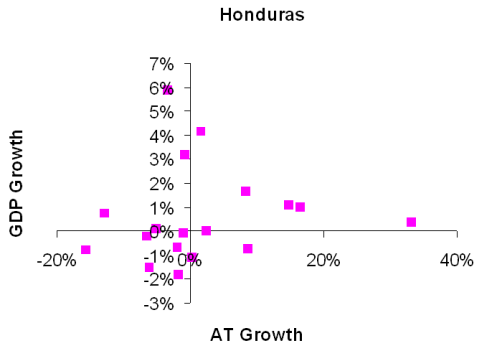


Figure E-15: Honduras

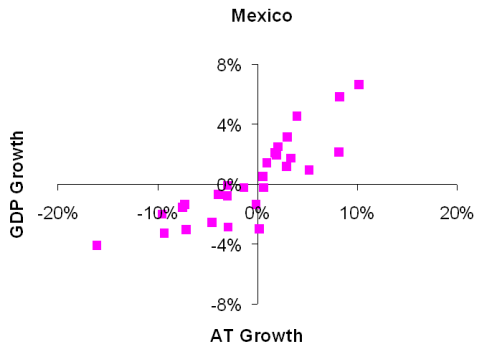


Figure E-16: Mexico

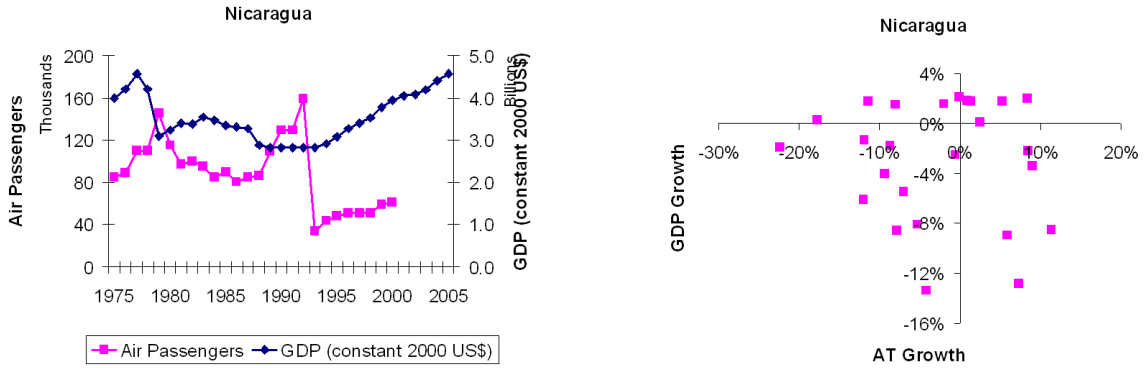


Figure E-17: Nicaragua

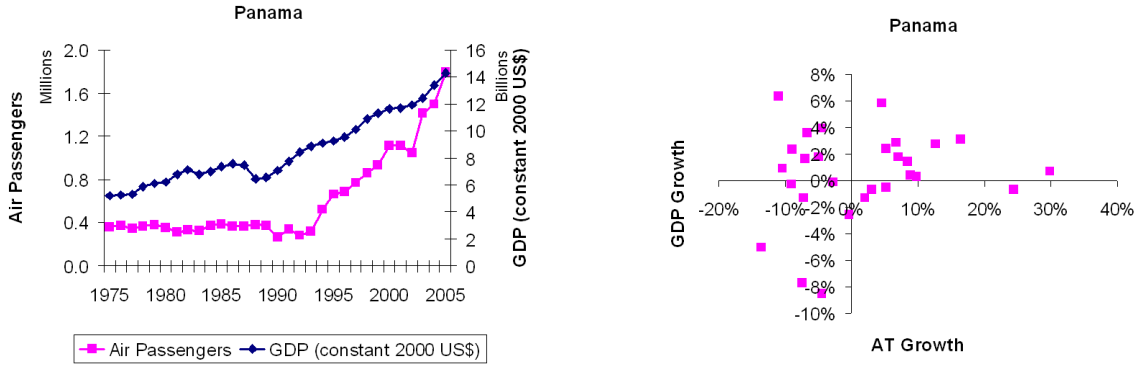


Figure E-18: Panama

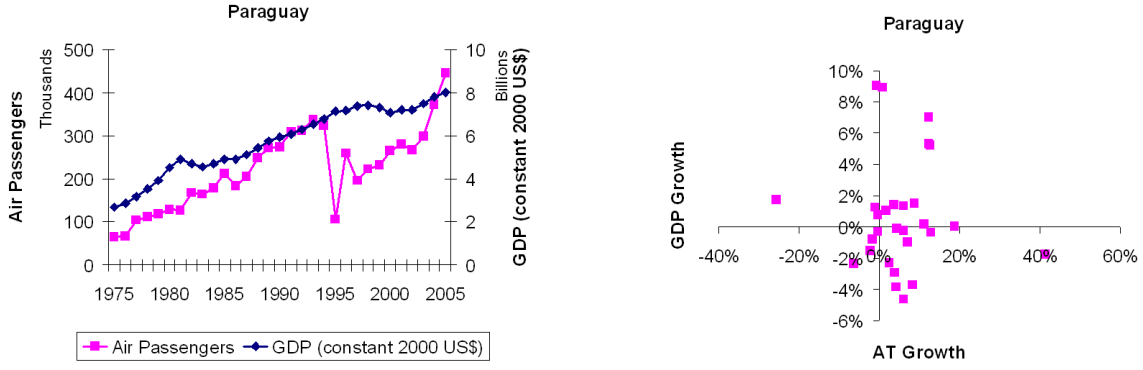


Figure E-19: Paraguay

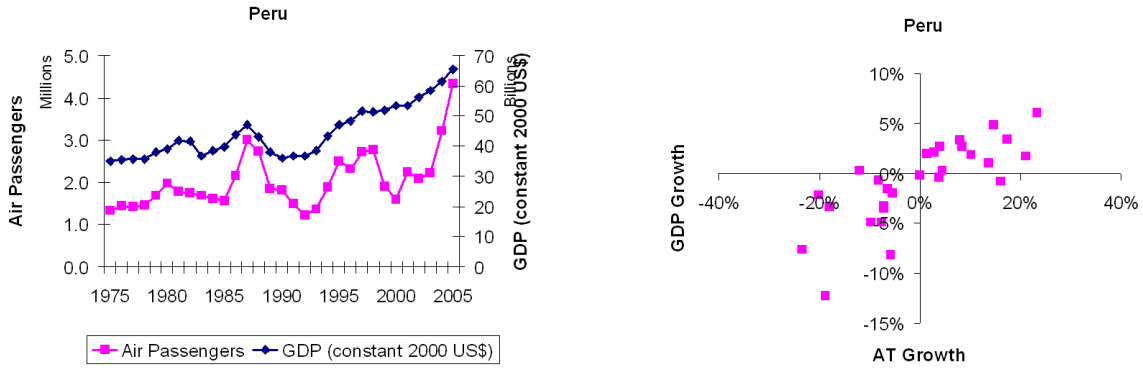


Figure E-20: Peru

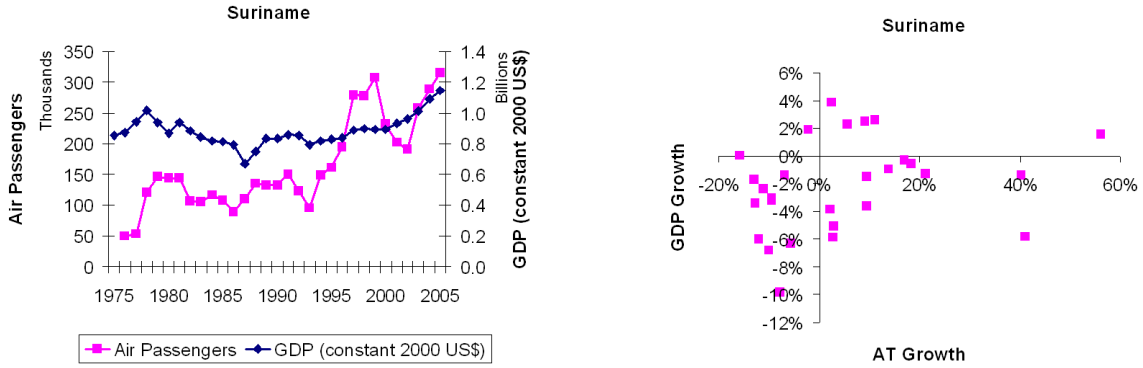


Figure E-21: Suriname

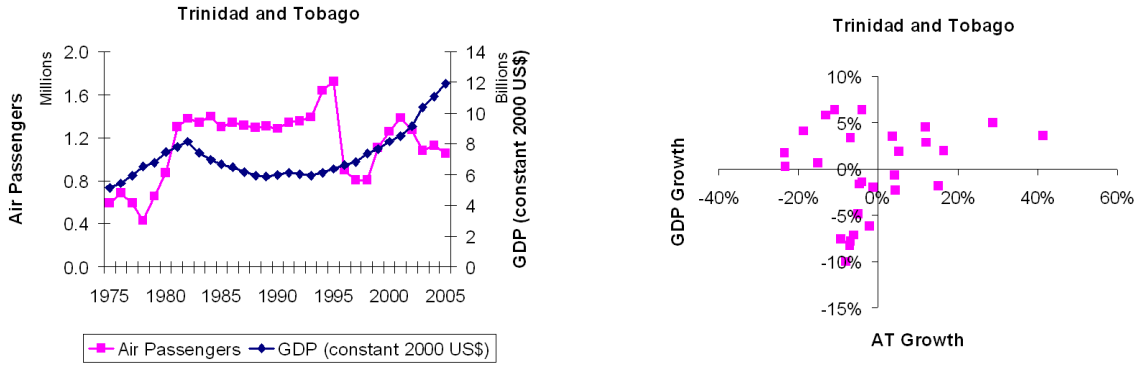
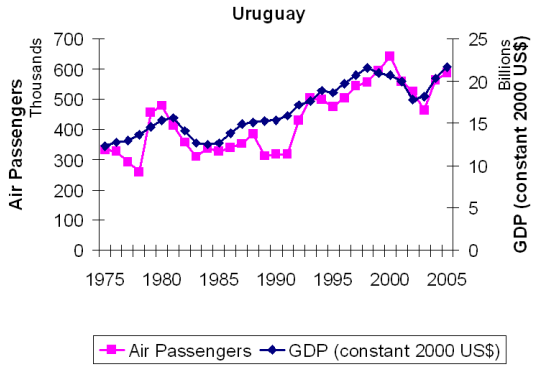


Figure E-22: Trinidad and Tobago



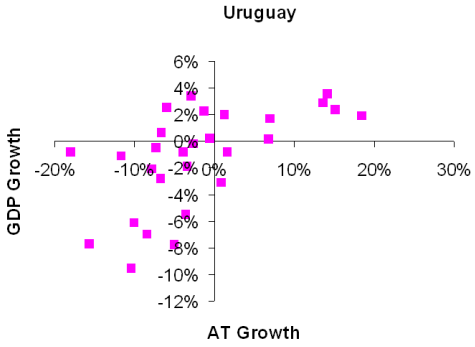
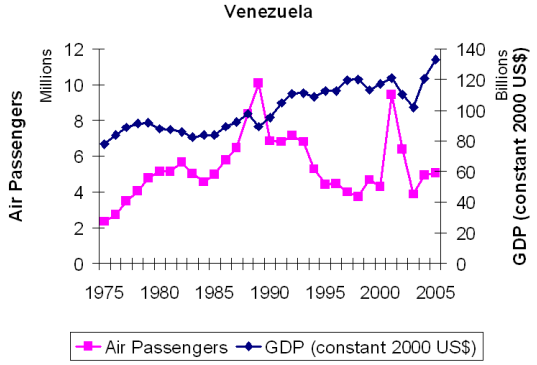


Figure E-23: Uruguay



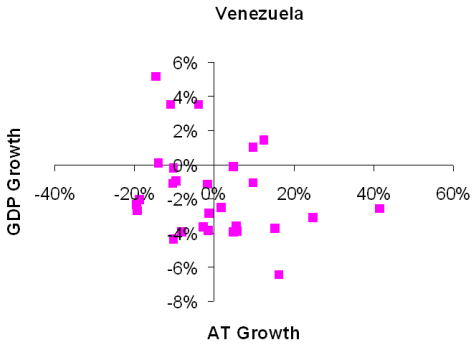


Figure E-24: Venezuela

	Correlation	Total Years	AT Pax	AT per capita	GDP per capita	Population
Antigua and Barbuda	0.77	25	7.78E+05	9.40	11,520	8.28E+04
Argentina	0.86	31	6.94E+06	0.18	12,709	3.87E+07
Bahamas, The	0.87	28	1.02E+06	3.16		3.23E+05
Bolivia	0.76	31	1.89E+06	0.21	2,509	9.18E+06
Brazil	0.96	31	3.77E+07	0.20	7,639	1.86E+08
Chile	0.98	31	5.94E+06	0.36	10,622	1.63E+07
Colombia	0.93	31	9.98E+06	0.22	6,536	4.49E+07
Costa Rica	0.85	31	9.53E+05	0.22	9,067	4.33E+06
Ecuador	0.82	31	2.01E+06	0.15	3,863	1.32E+07
El Salvador	0.91	31	2.54E+06	0.37	4,675	6.88E+06
Jamaica	0.82	31	1.57E+06	0.59	3,819	2.65E+06
Mexico	0.97	31	2.19E+07	0.21	9,618	1.03E+08
Panama	0.92	31	1.80E+06	0.56	6,800	3.23E+06
Paraguay	0.78	31	4.46E+05	0.08	4,287	5.90E+06
Peru	0.78	31	4.33E+06	0.15	5,375	2.80E+07
Suriname	0.55	30	3.15E+05	0.70	6,870	4.49E+05
Trinidad and Tobago	0.06	31	1.06E+06	0.81	13,109	1.31E+06
Uruguay	0.91	31	5.86E+05	0.18	9,269	3.31E+06
Venezuela, RB	0.13	31	5.04E+06	0.19	5,976	2.66E+07

Table E.1: Latin America & Caribbean: Correlation Coefficients between Air Transport Passengers and GDP (2000 US$); the total Number of Years for which country-level data are available; Mobility and GDP per capita statistics based on 2005 data.

00-05	AT Growth	GDP Growth	Market Share
Antigua and Barbuda	-11.41	4.11	0.04%
Argentina	-4.89	1.99	0.34%
Bolivia	1.50	3.01	0.09%
Brazil	3.78	2.74	1.86%
Chile	2.79	4.23	0.29%
Colombia	3.11	3.36	0.49%
Costa Rica	1.66	4.10	0.05%
Ecuador	8.81	5.15	0.10%
El Salvador	5.32	2.19	0.13%
Jamaica	-3.92	1.71	0.08%
Mexico	0.91	1.79	1.08%
Panama	9.96	4.25	0.09%
Paraguay	10.89	2.58	0.02%
Peru	22.12	4.17	0.21%
Suriname	6.28	5.16	0.02%
Trinidad and Tobago	-3.40	7.94	0.05%
Uruguay	-1.79	0.91	0.03%
Venezuela, RB	3.26	2.56	0.25%

Table E.2: Latin America & Caribbean: Air Transport Passenger and GDP growth rates based on data between 2000 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

85-05	AT Growth	GDP Growth	Market Share
Antigua and Barbuda	2.24	4.41	0.04%
Argentina	1.95	2.63	0.34%
Bolivia	1.73	3.19	0.09%
Brazil	5.30	2.46	1.86%
Chile	10.37	5.93	0.29%
Colombia	2.81	3.33	0.49%
Costa Rica	5.78	4.91	0.05%
Ecuador	5.70	2.87	0.10%
El Salvador	9.75	3.36	0.13%
Jamaica	2.90	2.64	0.08%
Mexico	1.78	2.60	1.08%
Panama	7.93	3.40	0.09%
Paraguay	3.79	2.50	0.02%
Peru	5.23	2.52	0.21%
Suriname	5.50	1.74	0.02%
Trinidad and Tobago	-1.04	2.94	0.05%
Uruguay	2.94	2.70	0.03%
Venezuela, RB	0.08	2.33	0.25%

Table E.3: Latin America & Caribbean: Air Transport Passenger and GDP growth rates based on data between 1985 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

Appendix F

Data Summary: Middle East & North Africa

The figure on the left shows the number of scheduled air passengers carried by the airlines registered in a particular country and the country's GDP. The figure on the right is used to compare the country's air passenger and GDP growth rates to the world's: each point in the figure represents the difference between the country's and the world's three-year moving average growth rates for a particular year.

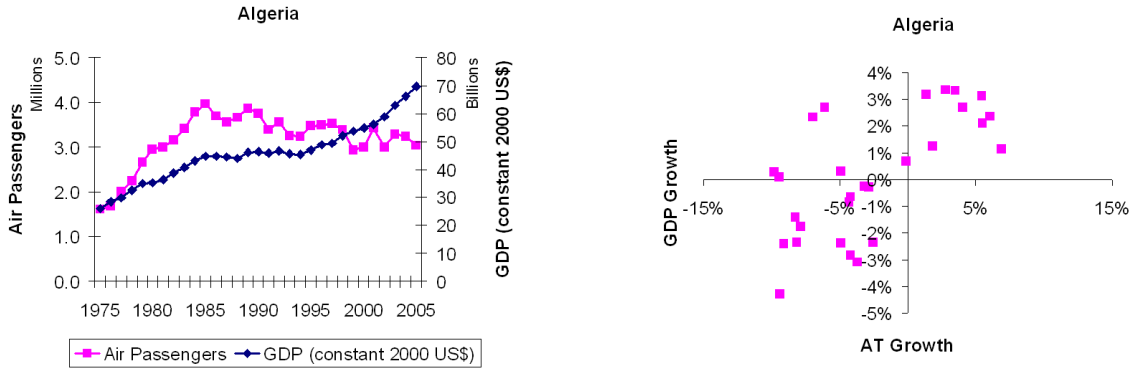


Figure F-1: Algeria

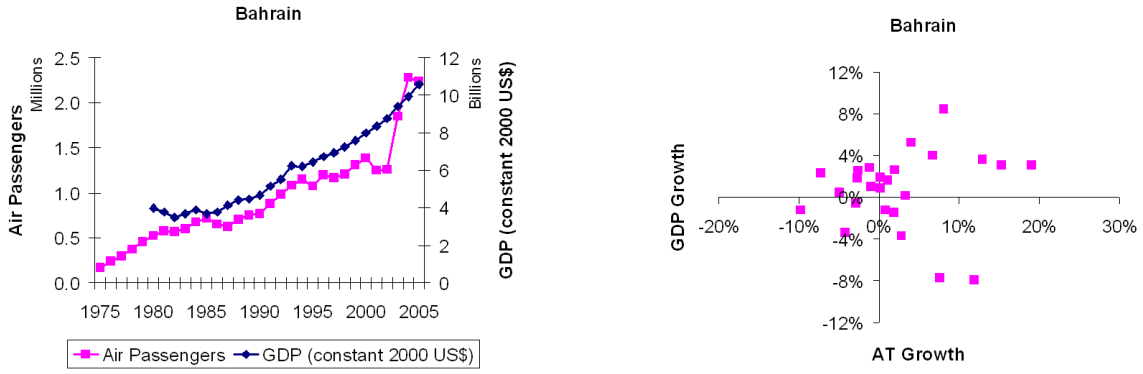


Figure F-2: Bahrain

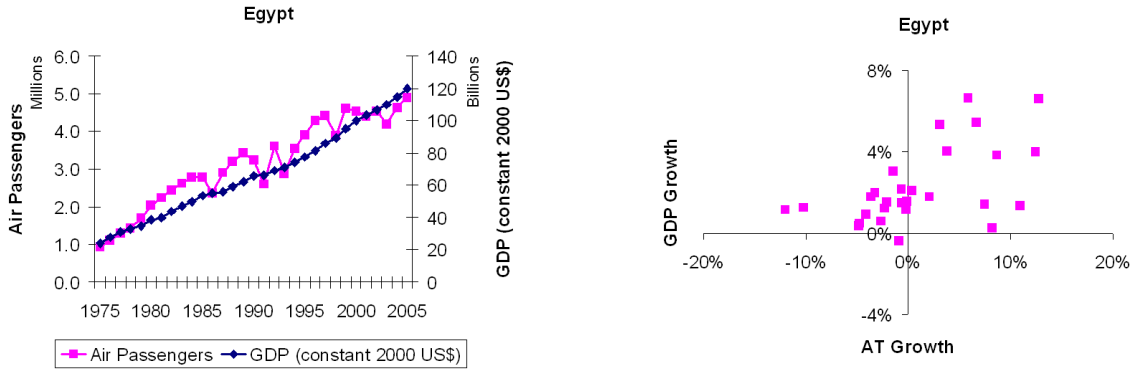


Figure F-3: Egypt

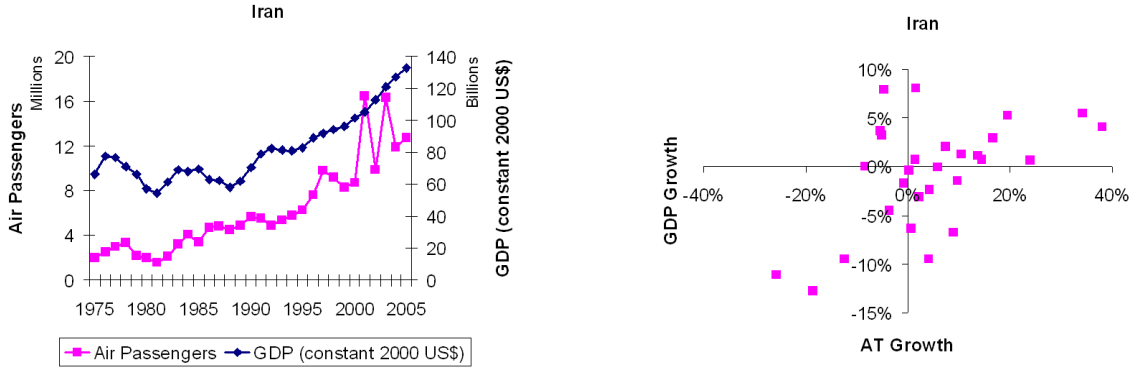
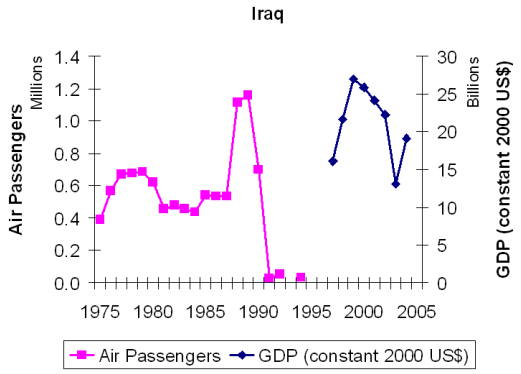


Figure F-4: Iran



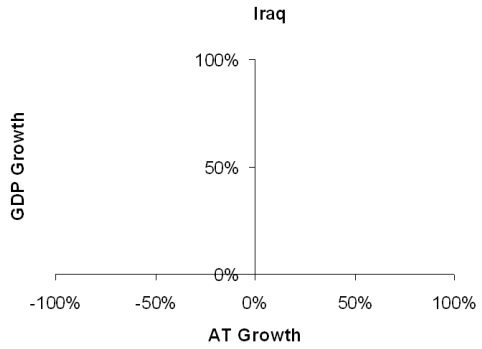
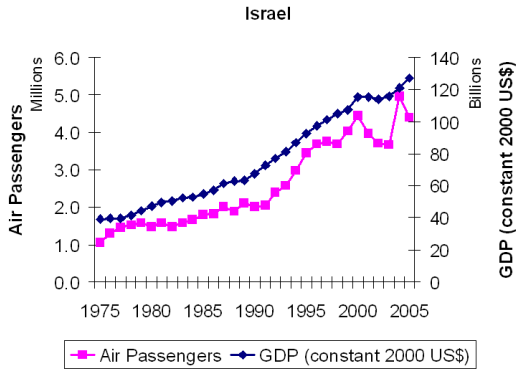


Figure F-5: Iraq



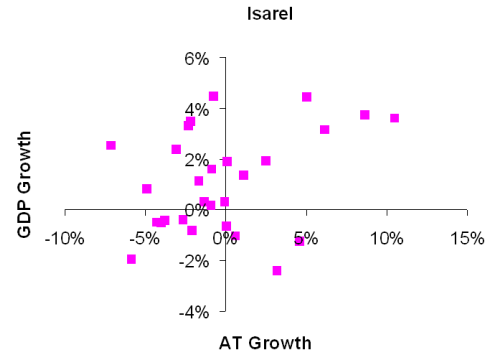
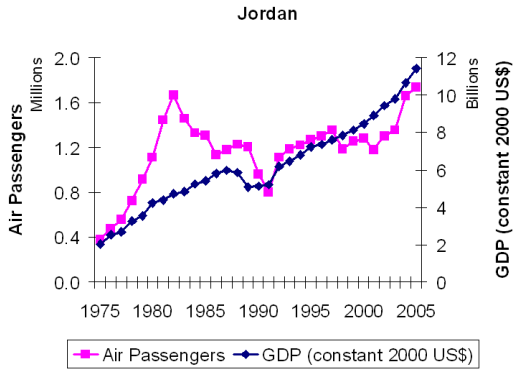


Figure F-6: Israel



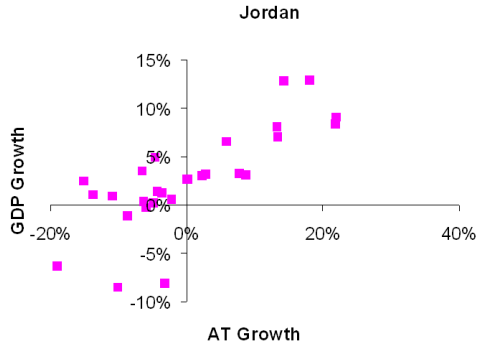
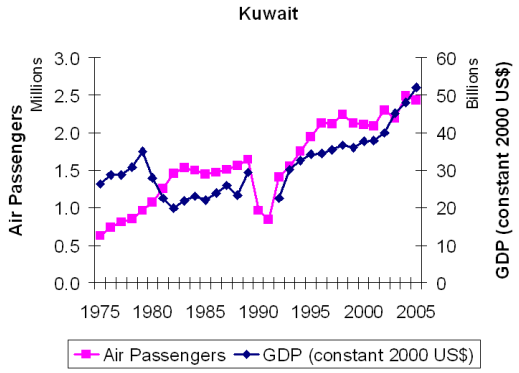


Figure F-7: Jordan



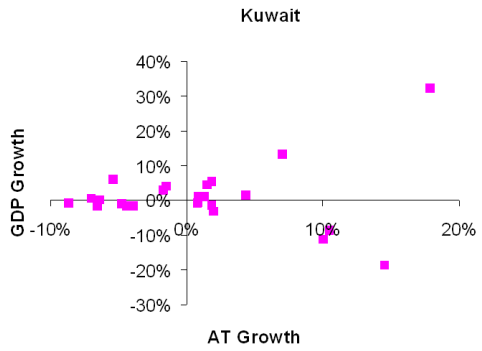
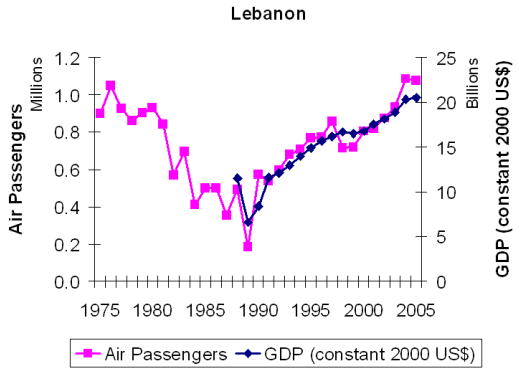


Figure F-8: Kuwait



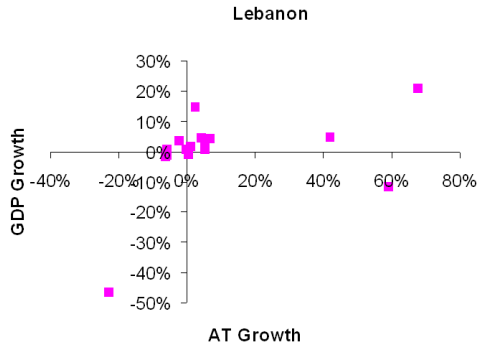
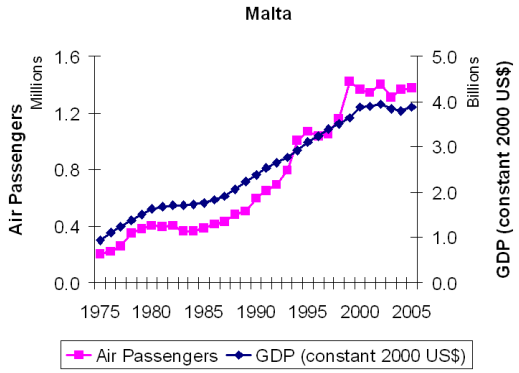


Figure F-9: Lebanon



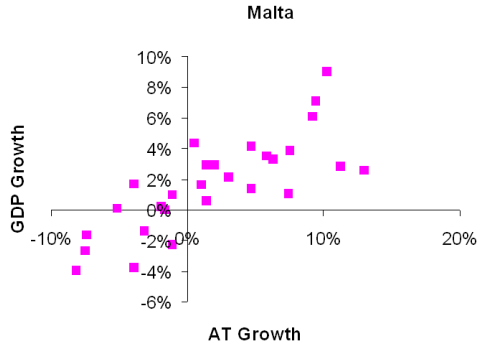
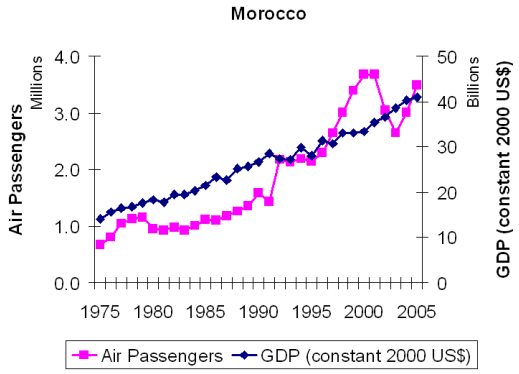


Figure F-10: Malta



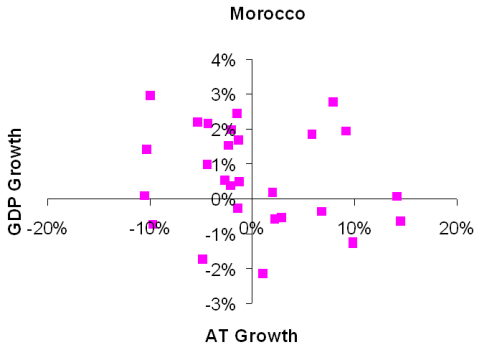
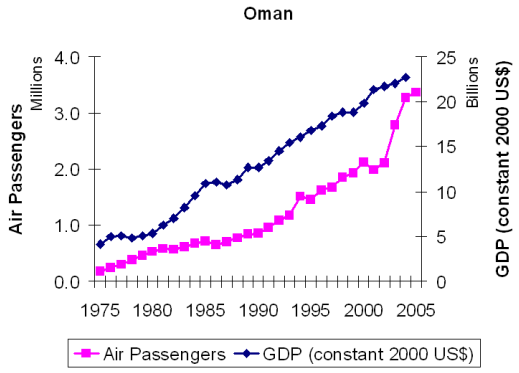


Figure F-11: Morocco



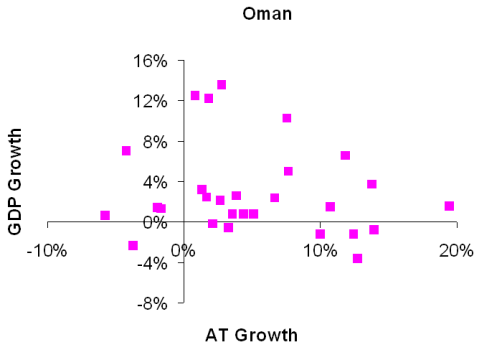
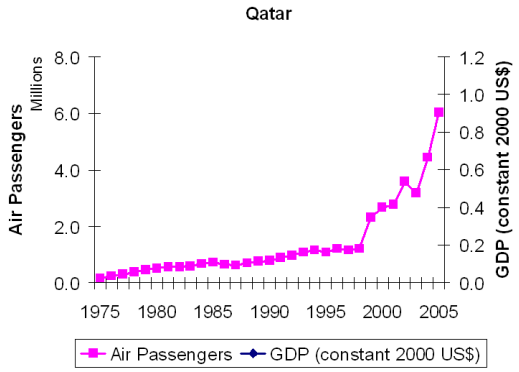


Figure F-12: Oman



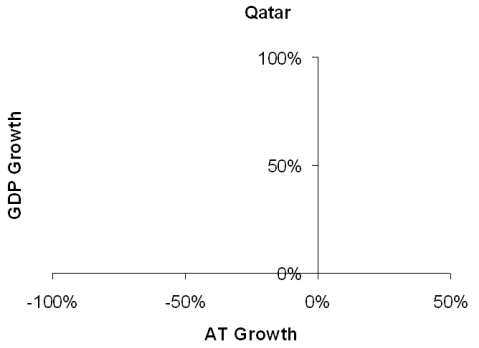


Figure F-13: Qatar

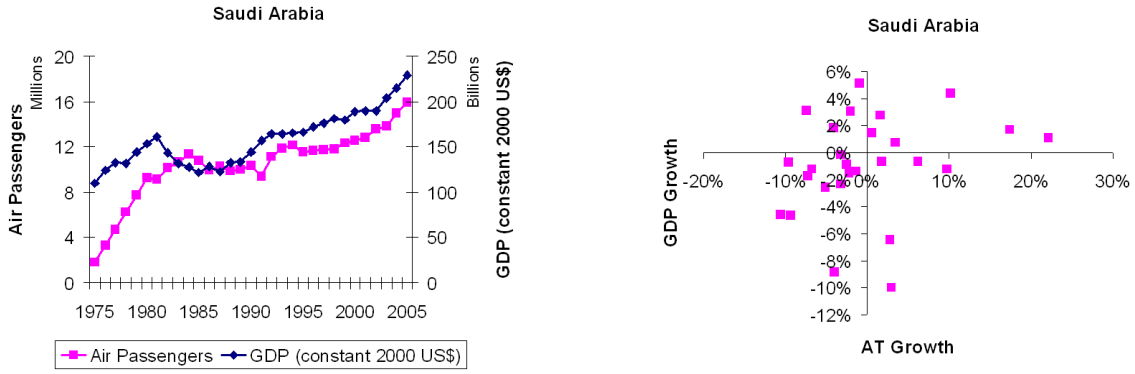


Figure F-14: Saudi Arabia

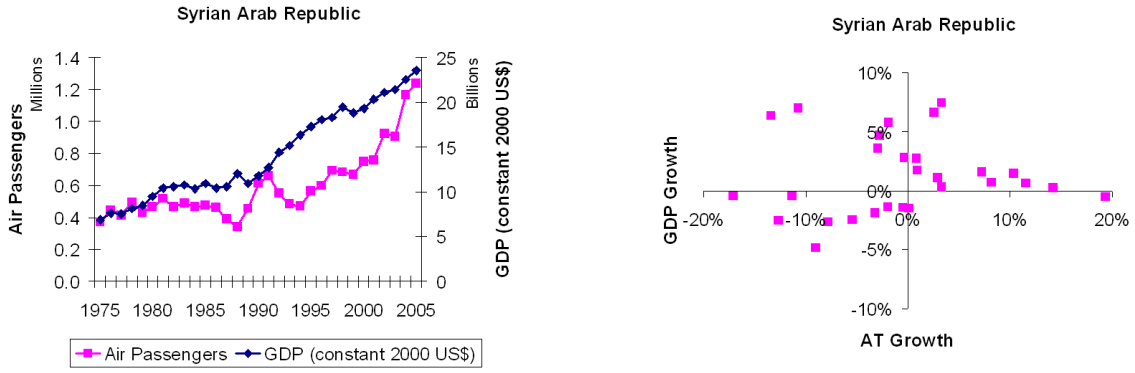


Figure F-15: Syrian Arab Republic

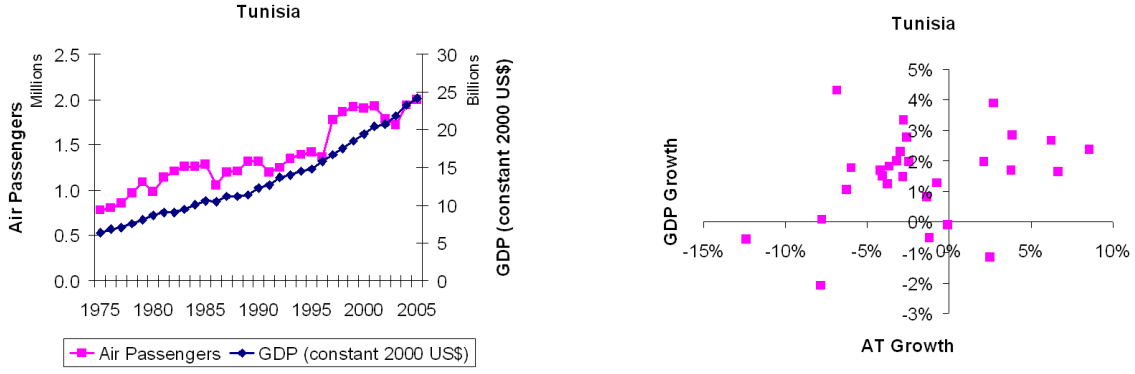


Figure F-16: Tunisia

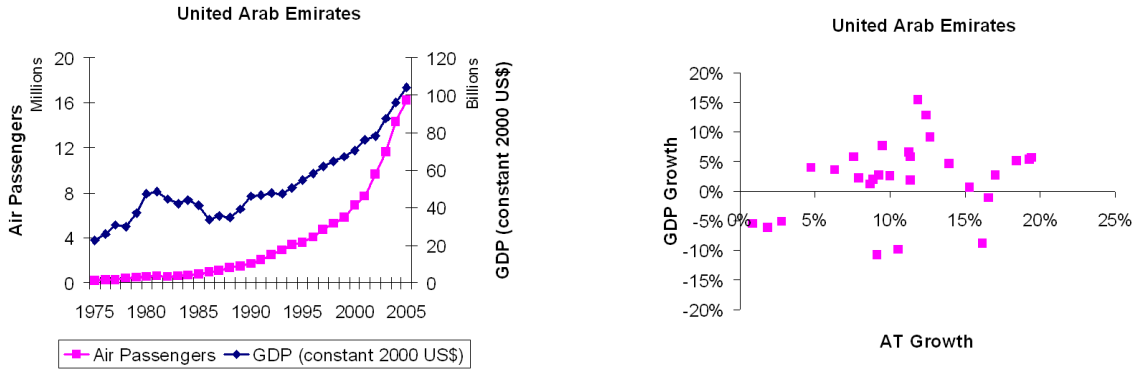


Figure F-17: United Arab Emirates

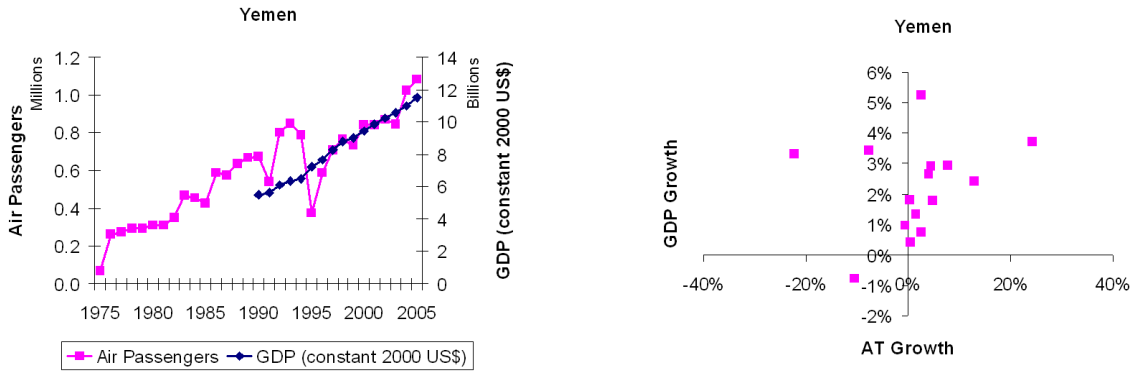


Figure F-18: Yemen

	Correlation	Total Years	AT Pax	AT per capita	GDP per capita	Population
Algeria	0.50	31	3.04E+06	0.09	6,283	3.29E+07
Bahrain	0.95	26	2.23E+06	3.07	19,120	7.27E+05
Egypt, Arab Rep.	0.95	31	4.89E+06	0.07	3,844	7.40E+07
Iran, Islamic Rep.	0.88	31	1.27E+07	0.19	7,092	6.83E+07
Israel	0.98	31	4.39E+06	0.63	23,020	6.92E+06
Jordan	0.70	31	1.74E+06	0.32	4,976	5.41E+06
Kuwait	0.68	29	2.43E+06	0.96	23,416	2.54E+06
Lebanon	0.94	18	1.08E+06	0.27	4,930	4.01E+06
Libya	-0.63	20	9.18E+05	0.16	6,700	5.85E+06
Malta	0.98	31	1.37E+06	3.40	17,079	4.04E+05
Morocco	0.91	31	3.49E+06	0.12	4,099	3.01E+07
Oman	0.94	30	3.37E+06	1.31		2.57E+06
Qatar		0	6.04E+06	7.43		8.13E+05
Saudi Arabia	0.77	31	1.59E+07	0.69	14,769	2.31E+07
Syrian Arab Republic	0.85	31	1.24E+06	0.07	3,410	1.90E+07
Tunisia	0.95	31	2.00E+06	0.20	7,451	1.00E+07
United Arab Emirates	0.96	31	1.62E+07	3.58	22,698	4.53E+06
Yemen, Rep.	0.65	16	1.08E+06	0.05	856	2.10E+07

Table F.1: Middle East & North Africa: Correlation Coefficients between Air Transport Passengers and GDP (2000 US$); the total Number of Years for which country-level data are available; Mobility and GDP per capita statistics based on 2005 data.

00-05	AT Growth	GDP Growth	Market Share
Algeria	0.26	4.93	0.15%
Bahrain	10.07	5.87	0.11%
Egypt, Arab Rep.	1.57	3.70	0.24%
Iran, Islamic Rep.	7.82	5.54	0.63%
Israel	-0.23	1.95	0.22%
Jordan	6.27	6.16	0.09%
Kuwait	2.87	6.70	0.12%
Lebanon	5.96	4.03	0.05%
Libya	8.86	3.22	0.05%
Malta	0.10	0.04	0.07%
Morocco	-0.99	4.18	0.17%
Saudi Arabia	4.86	3.98	0.79%
Syrian Arab Republic	10.57	4.08	0.06%
Tunisia	0.91	4.47	0.10%
United Arab Emirates	18.65	8.09	0.80%
Yemen, Rep.	5.18	4.02	0.05%

Table F.2: Middle East & North Africa: Air Transport Passenger and GDP growth rates based on data between 2000 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

85-05	AT Growth	GDP Growth	Market Share
Algeria	-1.32	2.25	0.15%
Bahrain	5.84	5.39	0.11%
Egypt, Arab Rep.	2.85	4.13	0.24%
Iran, Islamic Rep.	6.78	3.29	0.63%
Israel	4.55	4.31	0.22%
Jordan	1.42	3.78	0.09%
Kuwait	2.62	4.40	0.12%
Libya	-2.68	7.59	0.05%
Malta	6.57	4.02	0.07%
Morocco	5.88	3.26	0.17%
Saudi Arabia	1.97	3.21	0.79%
Syrian Arab Republic	4.91	3.92	0.06%
Tunisia	2.24	4.22	0.10%
United Arab Emirates	16.87	4.74	0.80%

Table F.3: Middle East & North Africa: Air Transport Passenger and GDP growth rates based on data between 1985 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

Appendix G

Data Summary: North America

The figure on the left shows the number of scheduled air passengers carried by the airlines registered in a particular country and the country's GDP. The figure on the right is used to compare the country's air passenger and GDP growth rates to the world's: each point in the figure represents the difference between the country's and the world's three-year moving average growth rates for a particular year.

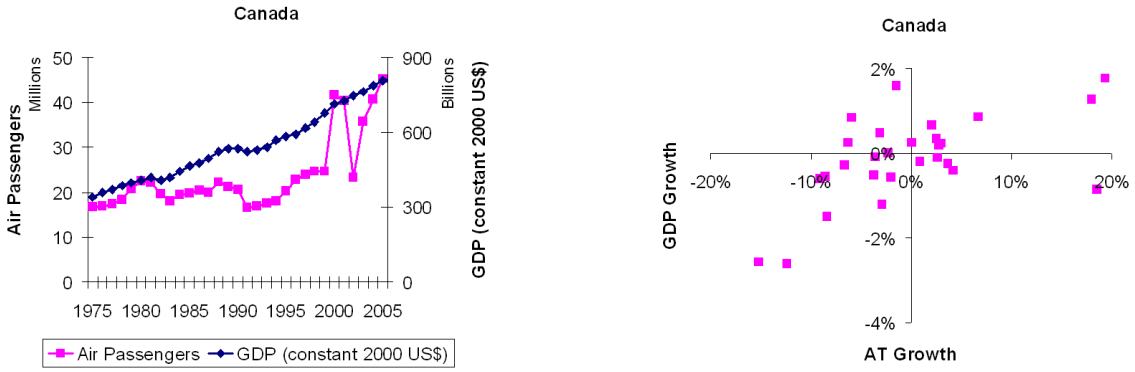
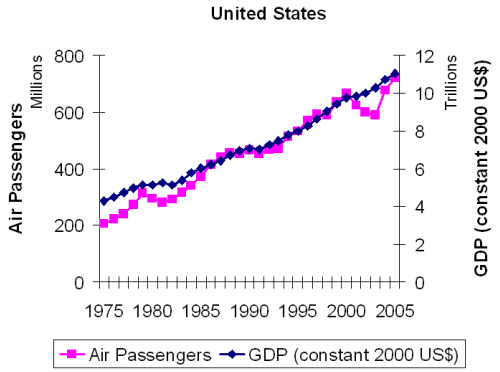


Figure G-1: Canada



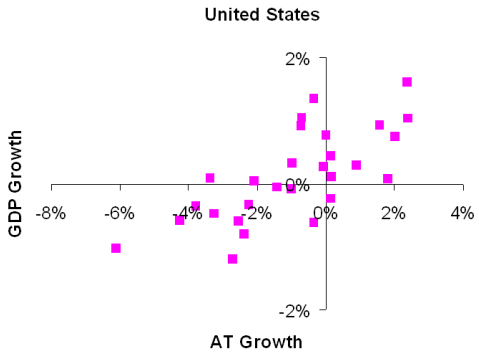


Figure G-2: United States of America

	Correlation	Total Years	AT Pax	AT per capita	GDP per capita	Population
Canada	0.80	31	4.52E+07	1.40	29,688	3.23E+07
United States	0.98	31	7.21E+08	2.43	37,267	2.96E+08

Table G.1: North America: Correlation Coefficients between Air Transport Passengers and GDP (2000 US$); the total Number of Years for which country-level data are available; Mobility and GDP per capita statistics based on 2005 data.

00-05	AT Growth	GDP Growth	Market Share
Canada	1.61	2.53	2.24%
United States	1.61	2.50	35.64%

Table G.2: North AmericA: Air Transport Passenger and GDP growth rates based on data between 2000 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

85-05	AT Growth	GDP Growth	Market Share
Canada	4.25	2.81	35.64%
United States	3.36	3.09	2.24%

Table G.3: North America: Air Transport Passenger and GDP growth rates based on data between 1985 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

Appendix H

Data Summary: South Asia

The figure on the left shows the number of scheduled air passengers carried by the airlines registered in a particular country and the country's GDP. The figure on the right is used to compare the country's air passenger and GDP growth rates to the world's: each point in the figure represents the difference between the country's and the world's three-year moving average growth rates for a particular year.

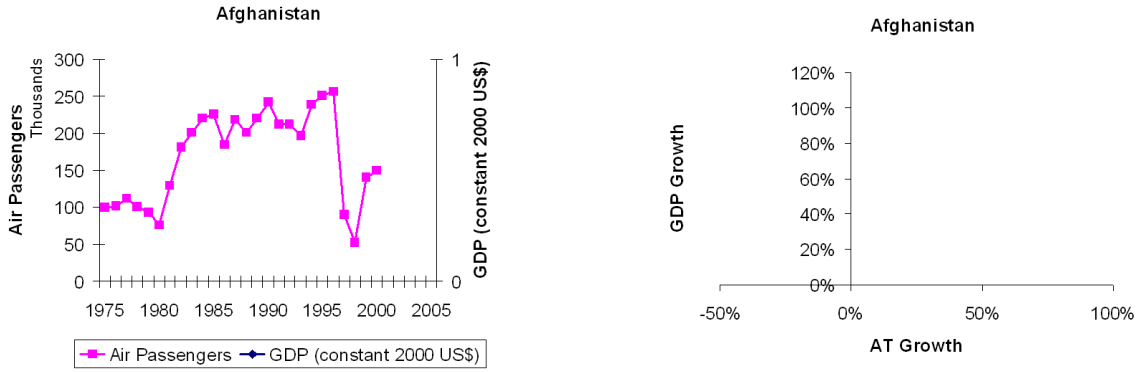


Figure H-1: Afghanistan

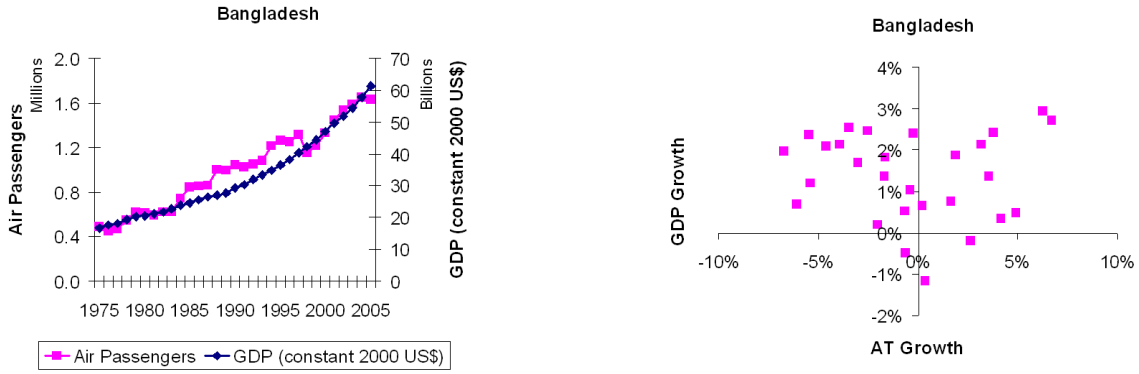


Figure H-2: Bangladesh

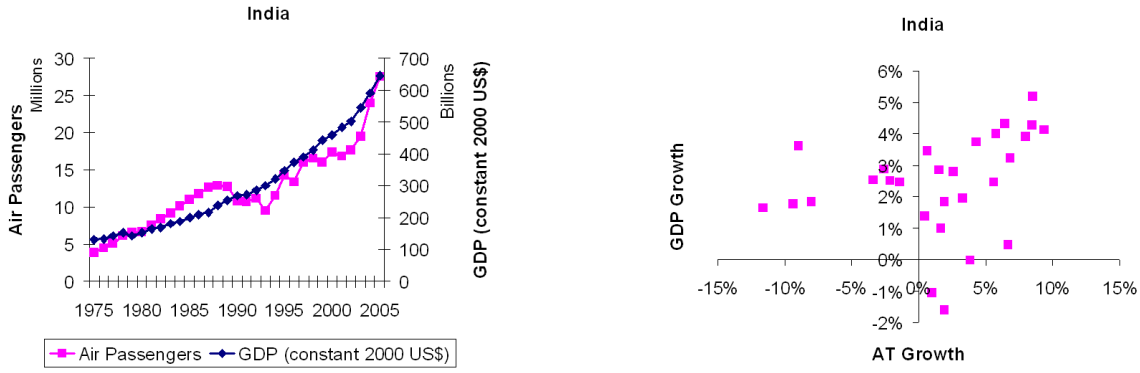


Figure H-3: India

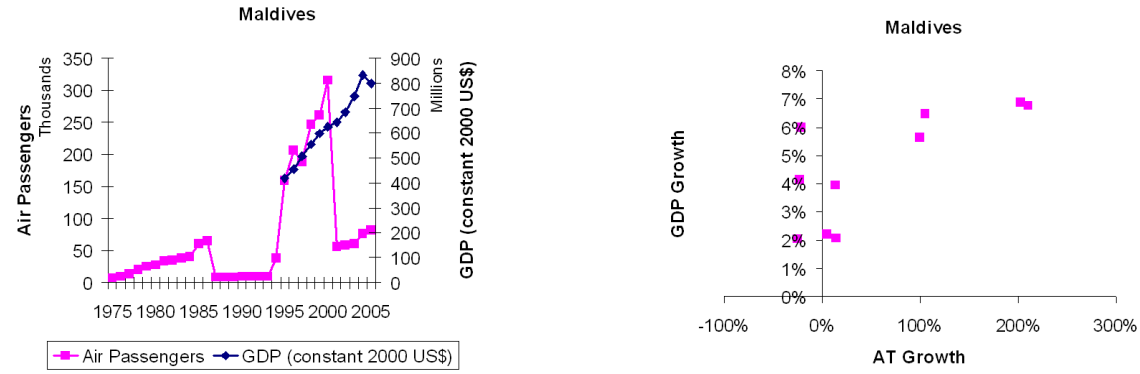


Figure H-4: Maldives

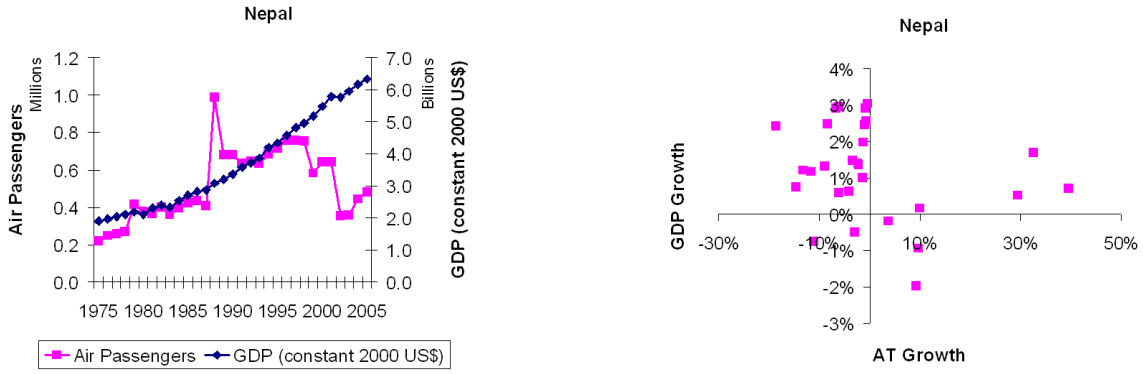


Figure H-5: Nepal

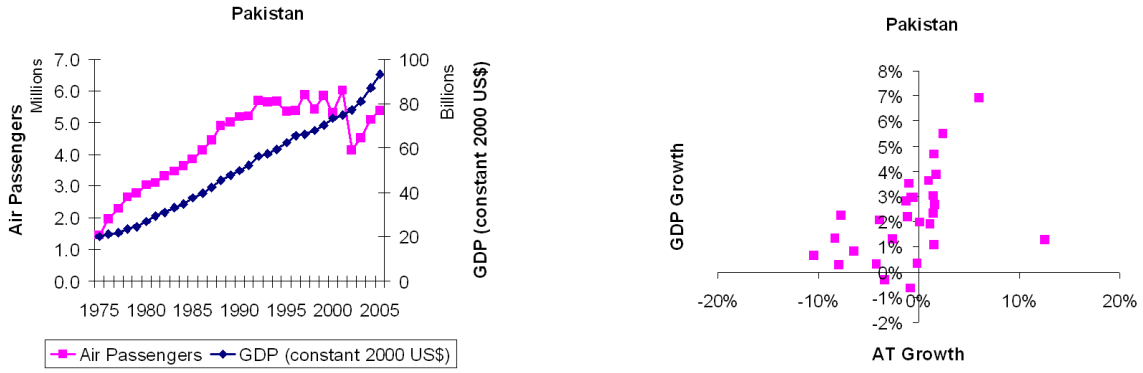


Figure H-6: Pakistan

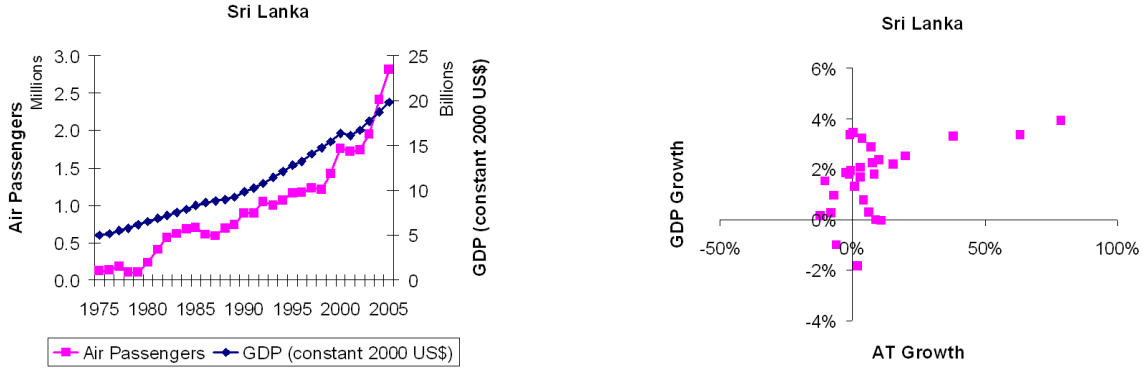


Figure H-7: Sri Lanka

	Correlation	Total Years	AT Pax	AT per capita	GDP per capita	Population
Bangladesh	0.96	31	1.63E+06	0.01	1,828	1.42E+08
Bhutan	0.88	18	4.91E+04	0.08	4,658	6.37E+05
India	0.95	31	2.75E+07	0.03	3,072	1.09E+09
Maldives	-0.56	11	8.19E+04	0.25	3,900	3.29E+05
Nepal	0.41	31	4.80E+05	0.02	1,380	2.71E+07
Pakistan	0.81	31	5.36E+06	0.03	2,120	1.56E+08
Sri Lanka	0.97	31	2.82E+06	0.14	4,121	1.96E+07

Table H.1: South Asia: Correlation Coefficients between Air Transport Passengers and GDP (2000 US$); the total Number of Years for which country-level data are available; Mobility and GDP per capita statistics based on 2005 data.

00-05	AT Growth	GDP Growth	Market Share
Bangladesh	4.19	5.43	0.08%
Bhutan	7.36	7.59	0.00%
India	9.74	6.96	1.36%
Maldives	-23.61	5.03	0.00%
Nepal	-5.68	2.95	0.02%
Pakistan	0.27	4.92	0.27%
Sri Lanka	9.93	3.94	0.14%

Table H.2: South Asia: Air Transport Passenger and GDP growth rates based on data between 2000 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

85-05	AT Growth	GDP Growth	Market Share
Bangladesh	3.35	4.69	0.08%
India	4.70	6.04	1.36%
Nepal	0.65	4.38	0.02%
Pakistan	1.69	4.65	0.27%
Sri Lanka	7.22	4.45	0.14%

Table H.3: South Asia: Air Transport Passenger and GDP growth rates based on data between 1985 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

Appendix I

Data Summary: Sub-Saharan Africa

The figure on the left shows the number of scheduled air passengers carried by the airlines registered in a particular country and the country's GDP. The figure on the right is used to compare the country's air passenger and GDP growth rates to the world's: each point in the figure represents the difference between the country's and the world's three-year moving average growth rates for a particular year.

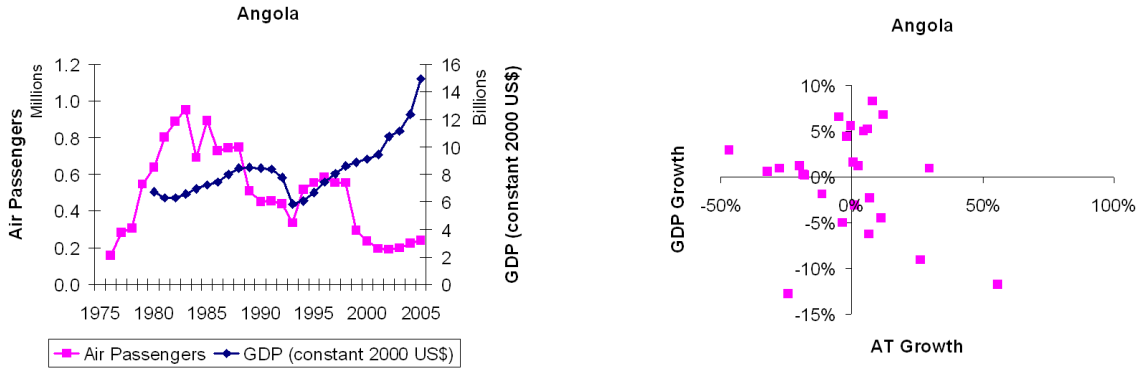


Figure I-1: Angola

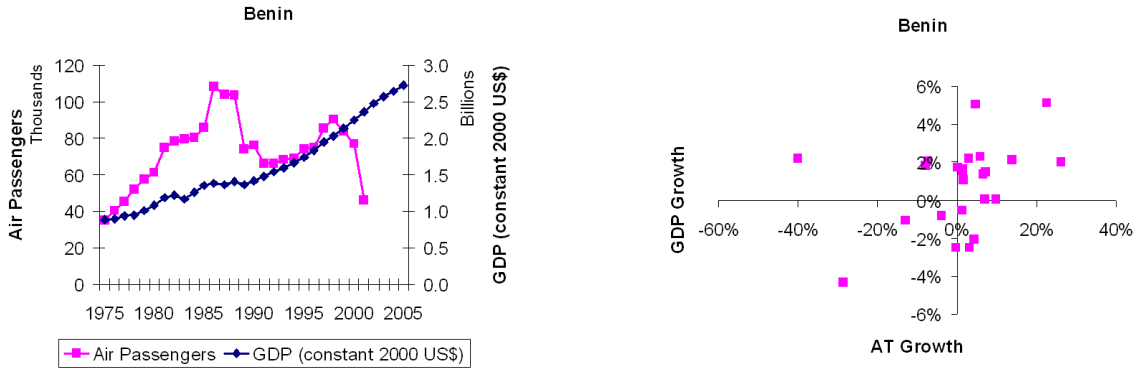


Figure I-2: Benin

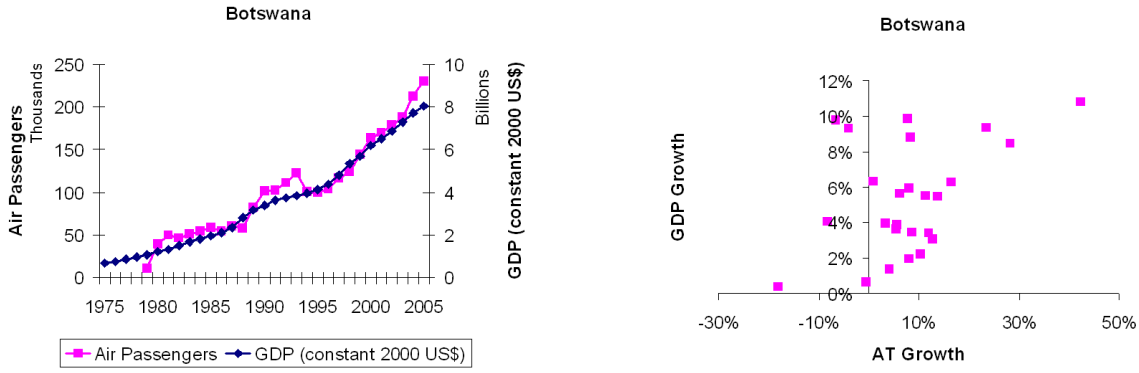


Figure I-3: Botswana

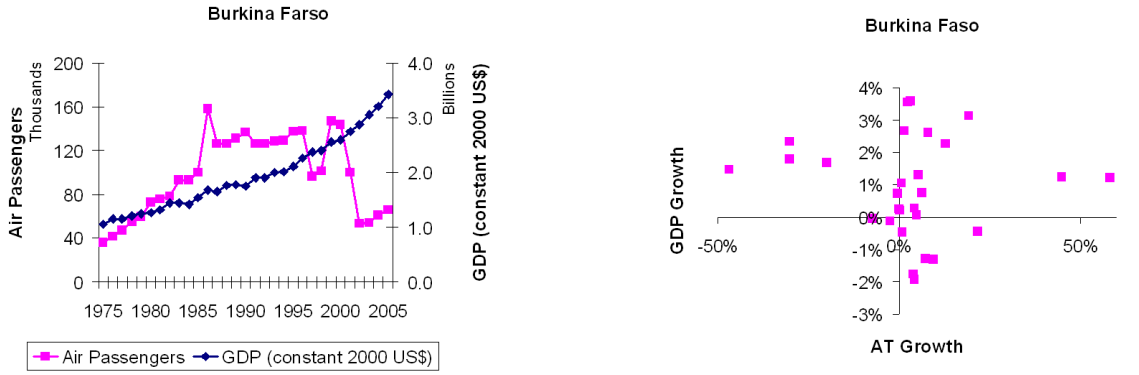


Figure I-4: Burkina Faso

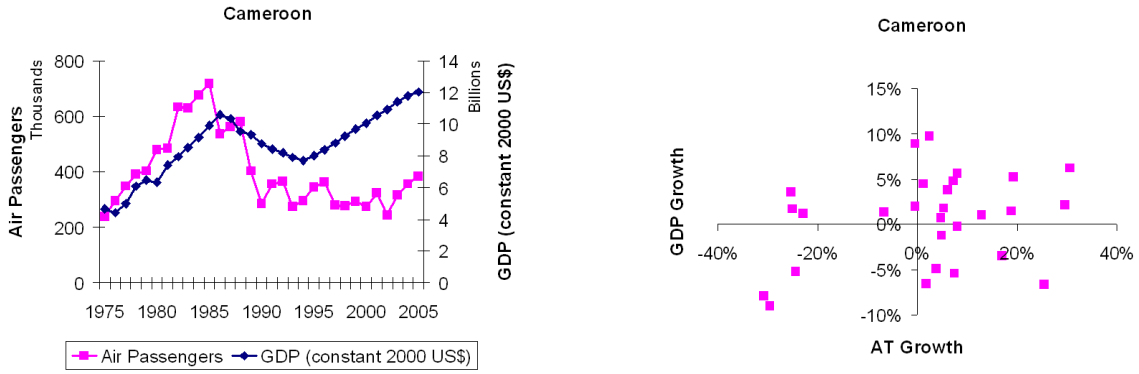


Figure I-5: Cameroon

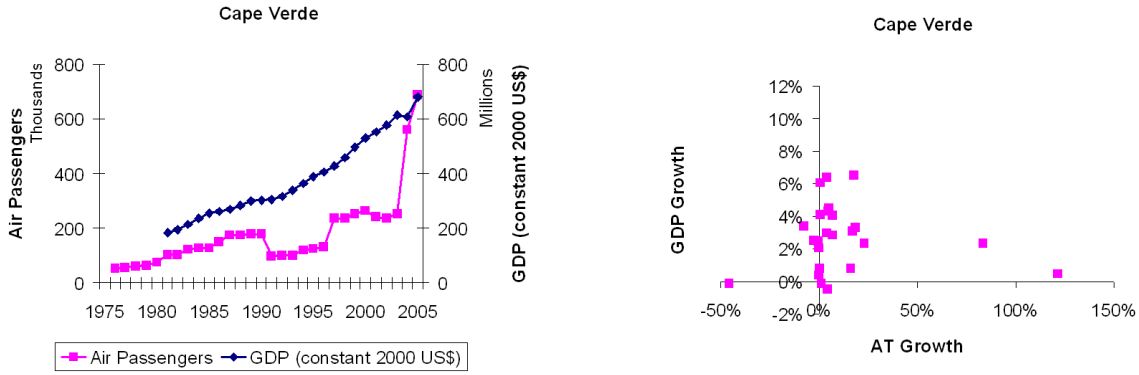


Figure I-6: Cape Verde

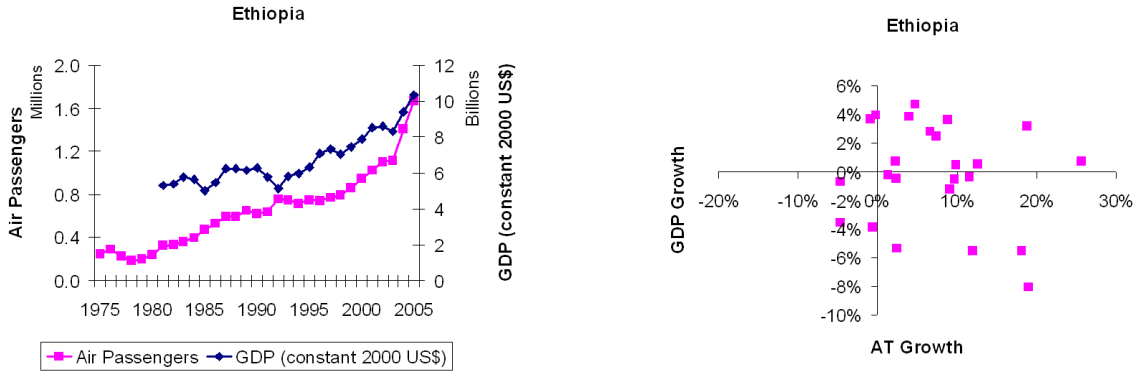


Figure I-7: Ethiopia

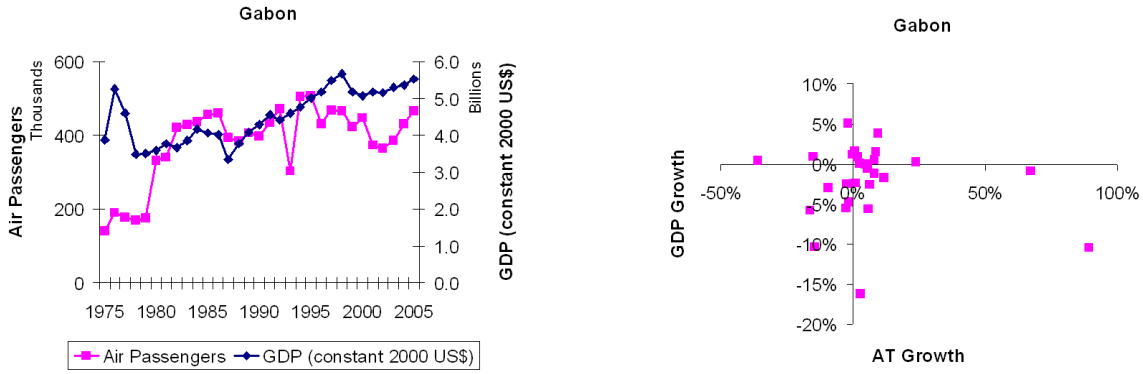


Figure I-8: Gabon

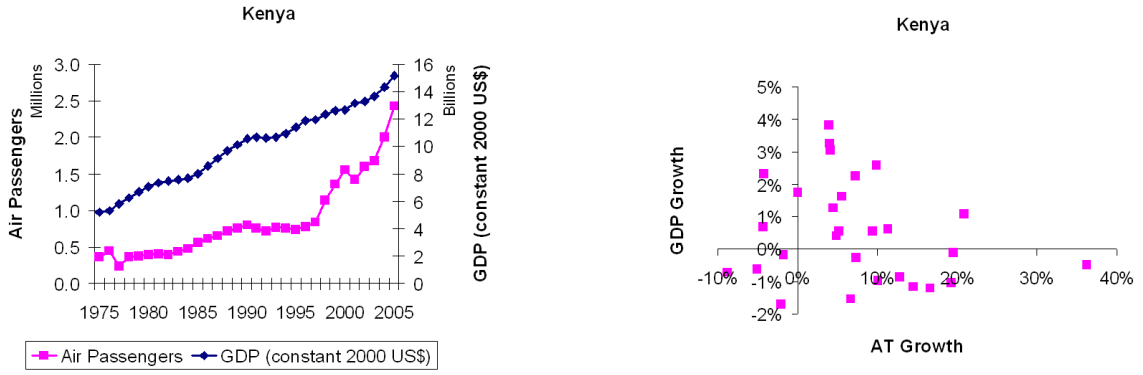


Figure I-9: Kenya

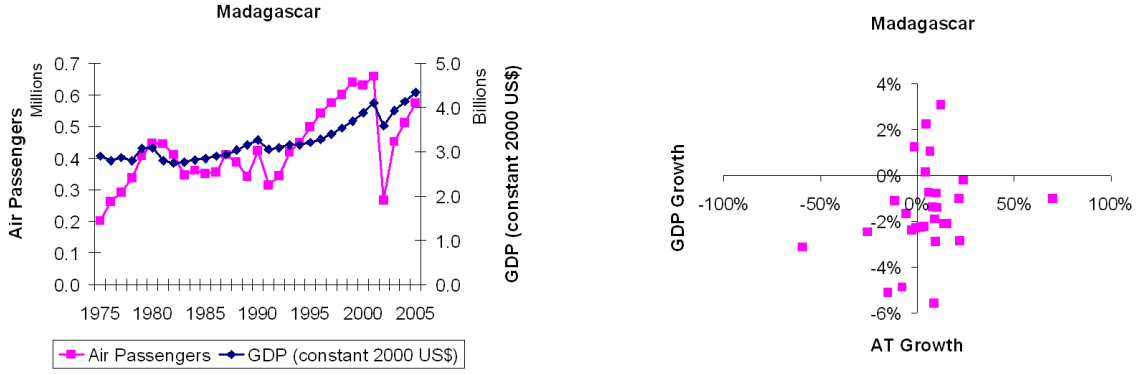


Figure I-10: Madagascar

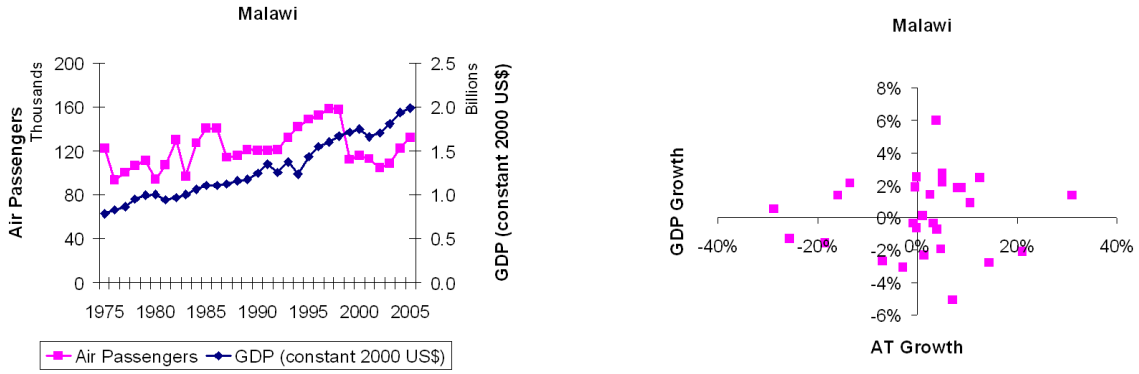


Figure I-11: Malawi

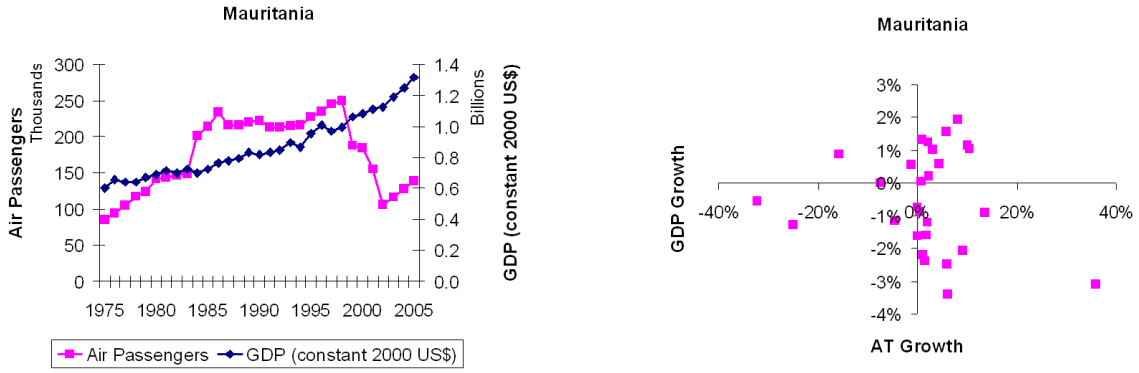


Figure I-12: Mauritania

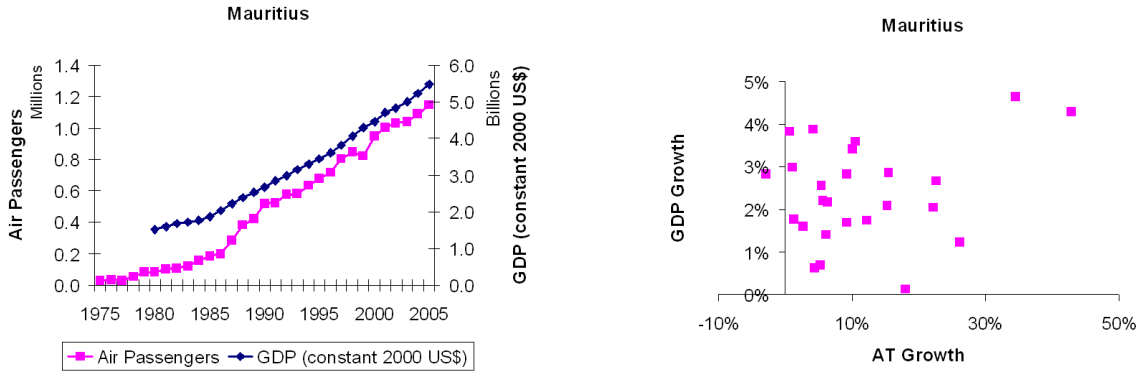


Figure I-13: Mauritius

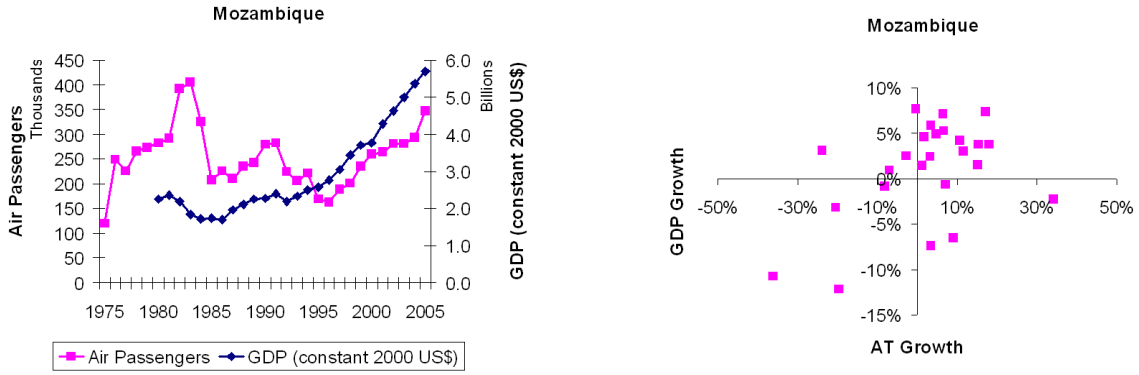


Figure I-14: Mozambique

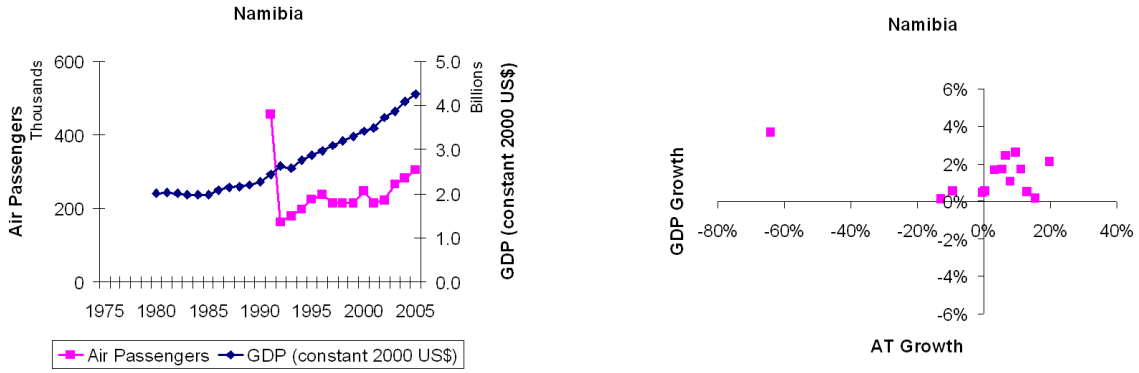


Figure I-15: Namibia

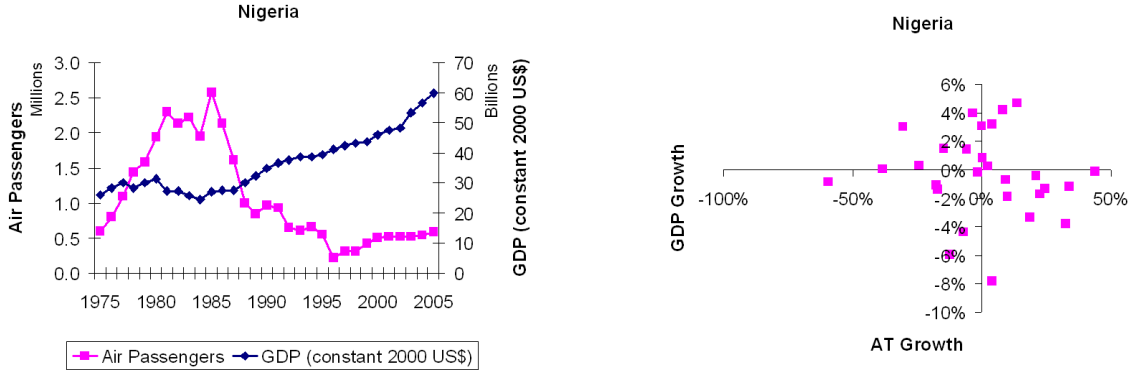


Figure I-16: Nigeria

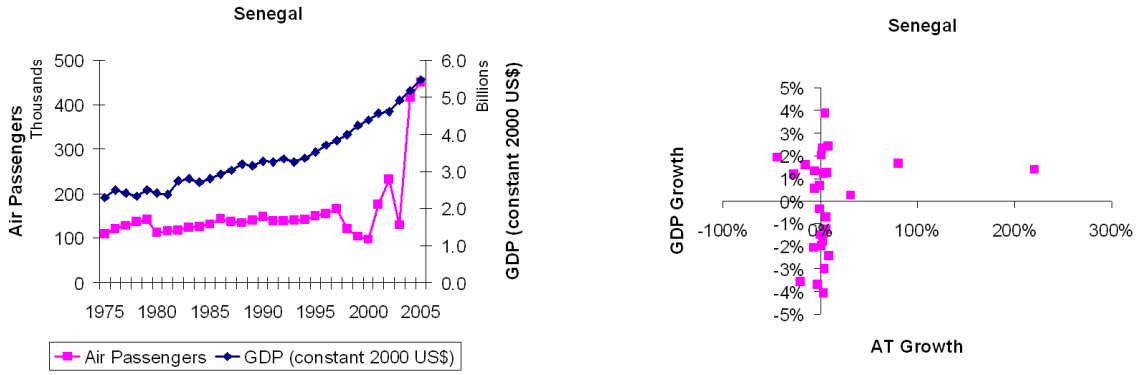


Figure I-17: Senegal

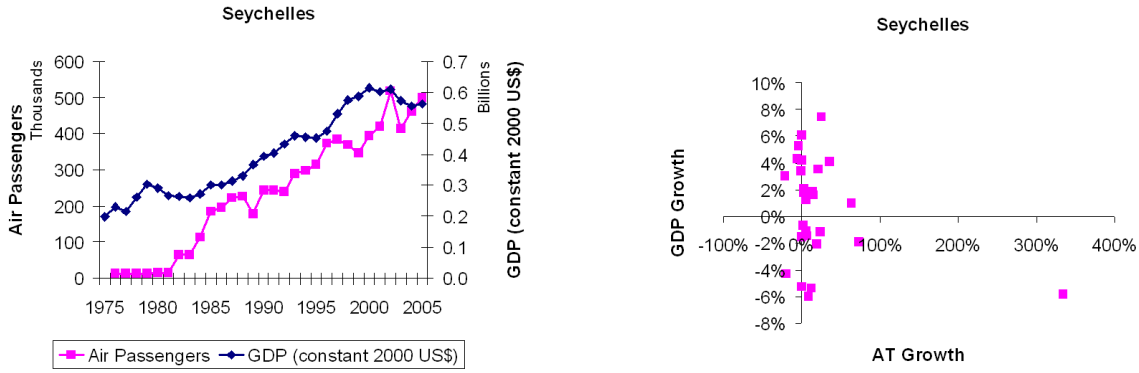


Figure I-18: Seychelles

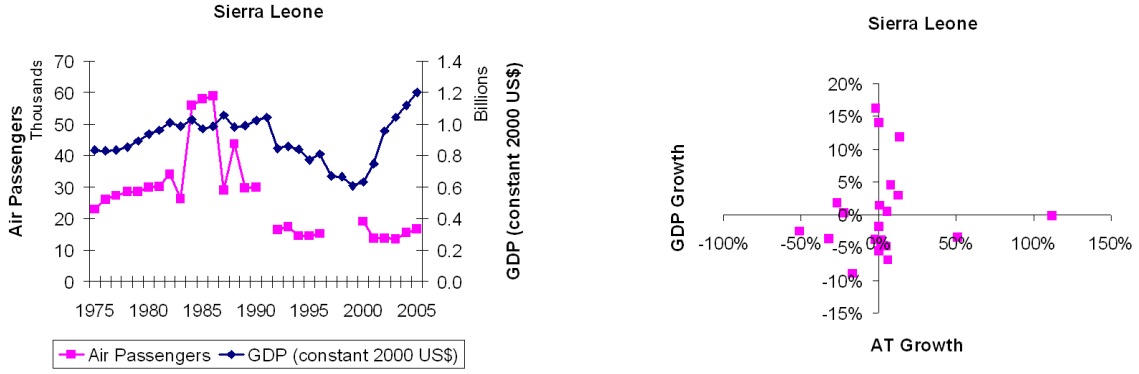


Figure I-19: Sierra Leone

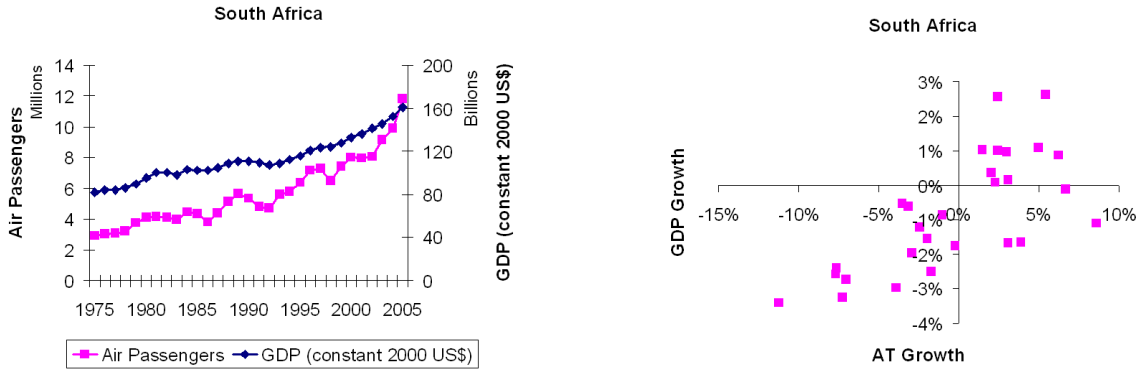


Figure I-20: South Africa

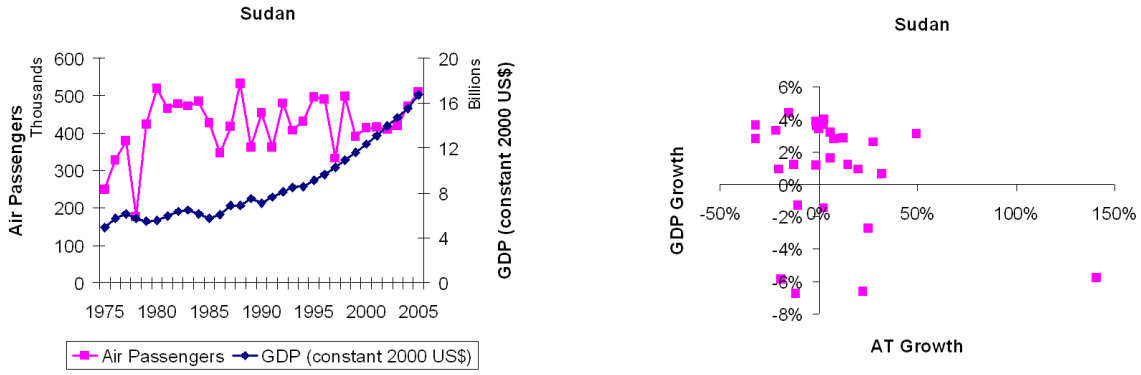


Figure I-21: Sudan

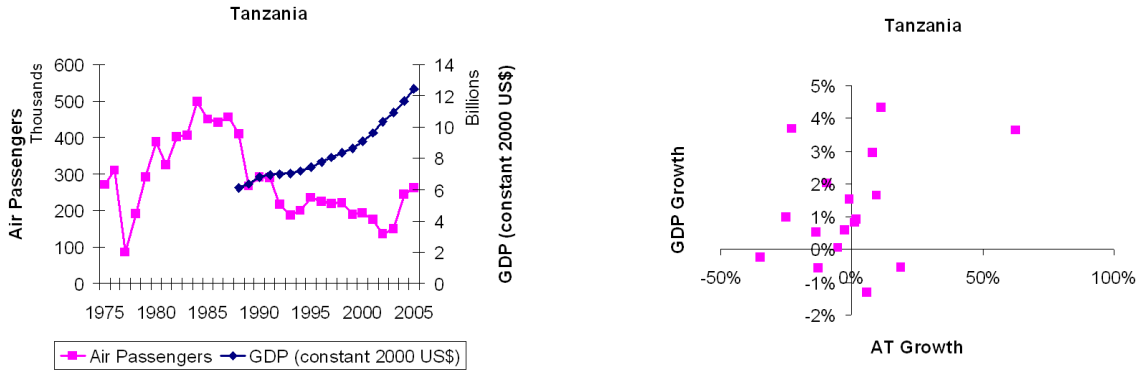


Figure I-22: Tanzania

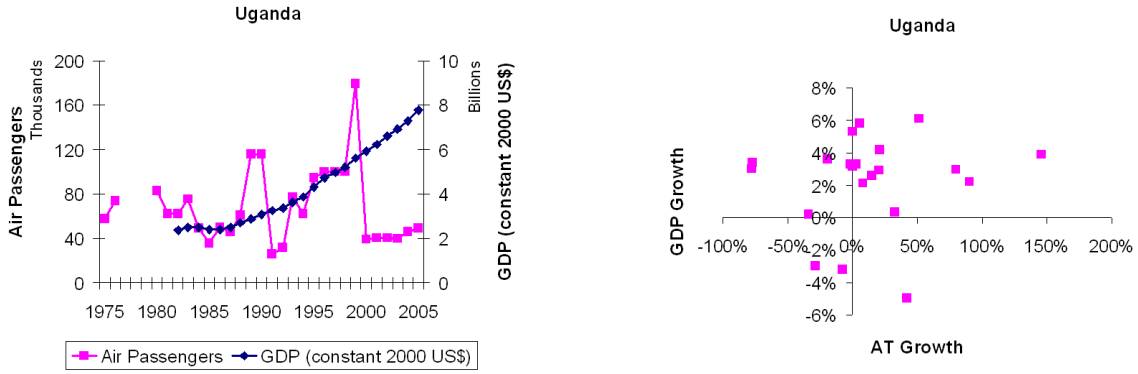


Figure I-23: Uganda

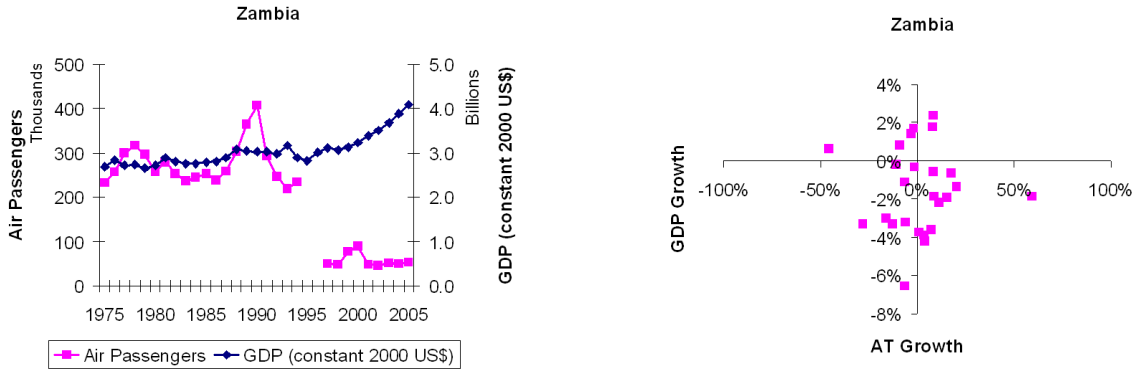


Figure I-24: Zambia

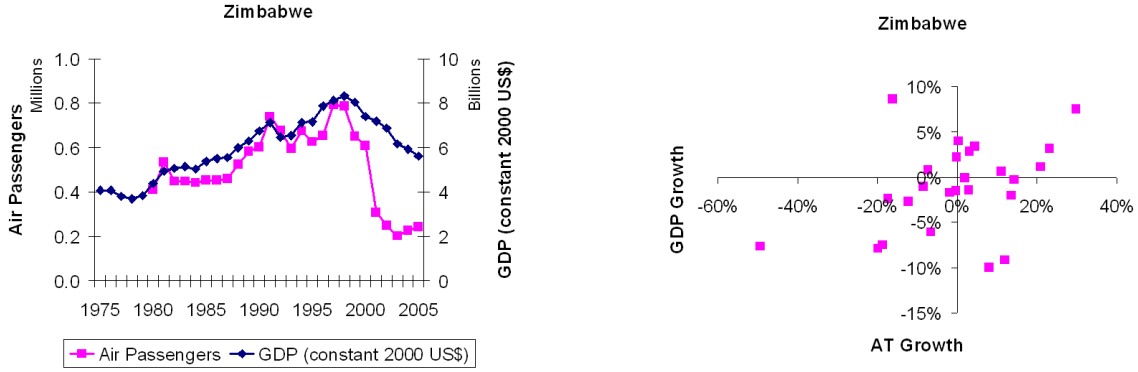


Figure I-25: Zimbabwe

	Correlation	Total Years	AT Pax	AT per capita	GDP per capita	Population
Angola	-0.66	26	2.40E+05	0.02	2,077	1.59E+07
Botswana	0.98	27	2.30E+05	0.13	10,812	1.76E+06
Burkina Faso	0.14	31	6.63E+04	0.01	1,111	1.32E+07
Cameroon	0.12	31	3.84E+05	0.02	2,046	1.63E+07
Cape Verde	0.77	25	6.90E+05	1.36	5,187	5.07E+05
Ethiopia	0.93	25	1.67E+06	0.02	965	7.13E+07
Gabon	0.35	31	4.65E+05	0.34	5,858	1.38E+06
Kenya	0.89	31	2.42E+06	0.07	1,104	3.43E+07
Madagascar	0.69	31	5.75E+05	0.03	822	1.86E+07
Malawi	0.33	31	1.32E+05	0.01	595	1.29E+07
Mauritania	0.10	31	1.39E+05	0.05	1,988	3.07E+06
Mauritius	0.99	26	1.15E+06	0.92	11,317	1.24E+06
Mozambique	0.15	26	3.47E+05	0.02	1,090	1.98E+07
Namibia	0.10	15	3.06E+05	0.15	6,792	2.03E+06
Nigeria	-0.71	31	5.84E+05	0.00	975	1.41E+08
Senegal	0.65	31	4.50E+05	0.04	1,584	1.17E+07
Seychelles	0.94	30	4.99E+05	5.90	14,671	8.45E+04
Sierra Leone	0.29	27	1.67E+04	0.00	717	5.53E+06
South Africa	0.98	31	1.18E+07	0.25	9,952	4.69E+07
Sudan	0.24	31	5.11E+05	0.01	1,853	3.62E+07
Tanzania	-0.43	18	2.63E+05	0.01	629	3.85E+07
Uganda	-0.02	24	4.94E+04	0.00	1,293	2.88E+07
Zambia	-0.70	29	5.39E+04	0.00	910	1.17E+07
Zimbabwe	0.56	26	2.43E+05	0.02	1,837	1.30E+07

Table I.1: Sub-Saharan Africa: Correlation Coefficients between Air Transport Passengers and GDP (2000 US$); the total Number of Years for which country-level data are available; Mobility and GDP per capita statistics based on 2005 data.

00-05	AT Growth	GDP Growth	Market Share
Angola	0.37	10.35	0.01%
Botswana	7.01	5.43	0.01%
Burkina Faso	-14.32	5.71	0.00%
Cameroon	7.06	3.66	0.02%
Cape Verde	21.23	5.08	0.03%
Ethiopia	12.04	5.58	0.08%
Gabon	0.82	1.74	0.02%
Kenya	9.29	3.58	0.12%
Madagascar	-1.80	2.27	0.03%
Malawi	2.69	2.68	0.01%
Mauritania	-5.62	4.03	0.01%
Mauritius	3.84	4.14	0.06%
Mozambique	5.97	8.56	0.02%
Namibia	4.33	4.52	0.02%
Nigeria	2.84	5.46	0.03%
Senegal	35.76	4.57	0.02%
Seychelles	4.84	-1.74	0.02%
Sierra Leone	-2.51	13.68	0.00%
South Africa	8.16	3.89	0.59%
Sudan	4.29	6.26	0.03%
Tanzania	6.34	6.54	0.01%
Uganda	4.63	5.61	0.00%
Zambia	-9.68	4.78	0.00%
Zimbabwe	-16.76	-5.36	0.01%

Table I.2: Sub-Saharan Africa: Air Transport Passenger and GDP growth rates based on data between 2000 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

85-05	AT Growth	GDP Growth	Market Share
Angola	-6.37	3.70	0.01%
Botswana	7.05	7.36	0.01%
Burkina Faso	-2.05	4.08	0.00%
Cameroon	-3.08	0.99	0.02%
Cape Verde	8.78	5.03	0.03%
Ethiopia	6.52	3.69	0.08%
Gabon	0.10	1.55	0.02%
Kenya	7.61	3.23	0.12%
Madagascar	2.50	2.12	0.03%
Malawi	-0.30	2.96	0.01%
Mauritania	-2.14	3.04	0.01%
Mauritius	9.61	5.50	0.06%
Mozambique	2.60	6.09	0.02%
Nigeria	-7.15	4.08	0.03%
Senegal	6.32	3.41	0.02%
Seychelles	5.08	3.19	0.02%
Sierra Leone	-6.02	1.07	0.00%
South Africa	5.15	2.29	0.59%
Sudan	0.89	5.50	0.03%
Uganda	1.69	6.05	0.00%
Zambia	-7.46	1.92	0.00%
Zimbabwe	-3.07	0.21	0.01%

Table I.3: Sub-Saharan Africa: Air Transport Passenger and GDP growth rates based on data between 1985 and 2005. The Market Share represents the 2005 country's Air Passenger market share compared to the World's.

Appendix J

Data Summary: Other Tables

	Domestic	International Outbound	Share of International Passengers
USA	19,694,178	1,989,339	9%
Brazil	1,166,708	130,708	10%
China	1,759,184	279,404	14%
Japan	2,427,504	631,507	21%
Australia	849,397	225,169	21%
Norway	412,040	120,803	23%
India	484,393	155,693	24%
Mexico	659,011	226,220	26%
Argentina	297,193	105,696	26%
Venezuela	145,855	53,936	27%
Taiwan	525,119	199,216	28%
Peru	99,470	40,461	29%
Chile	129,155	53,349	29%
South Africa	215,971	91,037	30%
New Zealand	186,267	82,347	31%
Canada	890,340	481,182	35%
Malaysia	248,005	163,340	40%
Sweden	265,034	212,870	45%
Italy	742,074	602,903	45%
Turkey	210,169	175,869	46%
Spain	776,435	656,596	46%
France	733,479	887,427	55%
Thailand	230,483	305,957	57%
Morocco	31,853	46,816	60%
Portugal	97,121	143,063	60%
Egypt	52,522	100,020	66%
Kenya	20,257	41,977	67%
Germany	652,241	1,367,185	68%
UK	564,961	1,493,371	73%
Ireland	30,171	200,998	87%
Singapore		385,138	100%

Table J.1: Weekly outbound international and domestic seats supplied in 2000. *Source:* Several tables in Chapter 1 of William's book on deregulation [208].

% share of number of arrivals	Leisure	Business	Visiting Friends/Relatives	Others
Argentina	58.3	14.0	20.0	7.8
Australia	52.6	12.0	17.4	18.0
Austria	62.4	22.3	11.1	4.2
Belgium	61.6	15.3	22.7	0.4
Brazil	69.1	26.3	1.6	3.0
Canada	59.2	14.8	23.9	2.1
Chile	63.5	10.5	15.0	11.0
China	67.1	27.8	5.1	0.0
Colombia	69.1	26.3	1.6	3.0
Croatia	71.5	17.0	9.1	2.4
Czech Republic	53.9	14.3	18.0	13.8
Denmark	60.5	30.4	9.1	0.0
Egypt	71.8	13.9	12.7	1.6
Finland	42.7	25.8	10.4	21.2
France	69.8	12.1	7.6	10.4
Germany	50.4	35.5	11.2	2.9
Greece	88.5	10.1	1.3	0.0
Hong Kong, China	47.6	31.4	21.0	0.0
Hungary	48.8	10.1	14.6	26.5
India	40.7	36.8	19.2	3.3
Indonesia	50.0	40.0	0.0	10.0
Ireland	53.1	12.6	28.5	5.8
Israel	30.4	16.6	33.6	19.4
Italy	57.5	22.6	7.8	12.1
Japan	62.1	24.0	5.6	8.2
Malaysia	73.7	9.7	11.5	5.1
Mexico	9.3	39.7	51.0	0.0
Morocco	52.0	6.0	38.0	4.0
Netherlands	60.3	29.0	10.8	0.0
New Zealand	50.5	10.9	28.5	10.0
Norway	55.7	16.6	24.3	3.4
Philippines	45.0	14.0	30.0	11.0
Poland	24.0	28.0	21.0	27.0
Portugal	71.5	17.2	11.3	0.0
Romania	7.7	32.8	54.9	4.6
Russia	11.7	9.9	73.4	4.9
Singapore	45.3	18.0	6.7	30.0
Slovakia	44.9	31.3	19.2	4.6
Slovenia	45.3	20.7	0.3	33.7
South Africa	31.3	36.3	24.4	8.0
South Korea	73.7	5.9	11.4	9.1
Spain	79.0	8.2	8.0	4.7
Sweden	41.5	36.7	15.7	6.1
Switzerland	60.0	33.3	4.2	2.5
Taiwan	36.5	30.0	12.7	20.8
Thailand	84.1	11.2	0.0	4.7
Turkey	45.5	18.9	13.3	22.3
United Arab Emirates	45.8	26.1	27.1	1.0
United Kingdom	40.2	28.7	22.5	8.6
USA	48.3	15.0	26.6	10.2
Venezuela	35.0	39.0	20.8	5.2
Vietnam	50.0	19.5	15.5	15.0

Table J.2: Arrivals by Purpose of Visit by Country: % Breakdown in 2005. *Notes:* Includes only the 52 markets researched in depth by Euromonitor International. *Source:* Euromonitor International. Date Exported (GMT): 13/03/2008.

Appendix K

Jamaica: Supplemental Materials

K.1 Data Trends

Figure K-1 shows the historic trends in air ticket prices for the U.S. airlines. Yield information is based on aggregate statistics for all airlines registered in the U.S. with the Air Transport Association (*www.airlines.org*). These data are in constant 1978 cents per passenger mile and are used as an aggregate metric to capture the decrease in airline prices until year 2002 and gradual increase in prices since then. For the purpose of the simulation, it is assumed that the yield will be increasing at constant rate in the future. This is motivated by the fact that fuel prices have been steadily increasing in recent years.

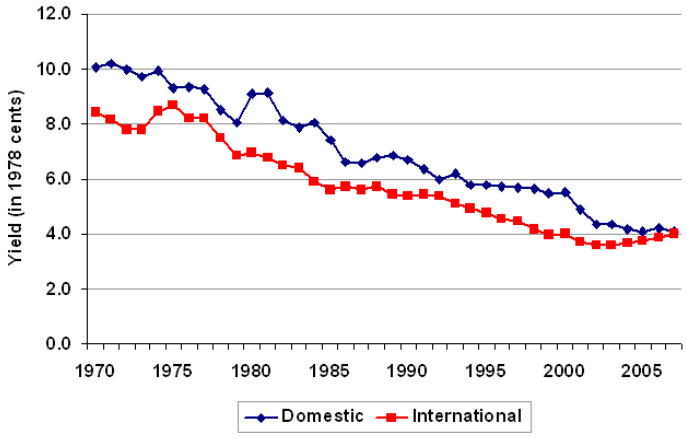


Figure K-1: The real yields of U.S. airlines (in 1978 cents per passenger-mile) have been declining over the last several decades. Data source: Air Transport Association website *http://airlines.org*.

The *Number of Destinations Competing on Airline Ticket* parameter (shown in Figure K-2) is based on this historic yield information. Since at 8 cents/mile, an $800 ticket would get you to a certain number of destinations at a given radius, at 4 cents/mile, a ticket of $400 would provide the same destination choice. Therefore, as the price decreases by a half, one should get the square increase in the number of destinations available. A conservative estimate is made for the purposes of this simulation and it is assumed that there

is a linear relationship between yield and the number of destinations available.

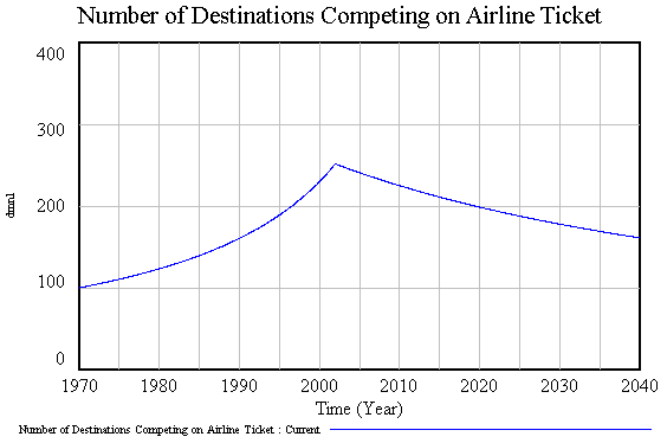


Figure K-2: Number of destinations competing on airline ticket.

Figure K-3 shows two trends. The first one represents the airport data, or the total number of passengers embarked and disembarked in Jamaica's two largest airports in Montego Bay and Kingston. The second one effectively include only the total number of scheduled domestic and international passengers carried by Air Jamaica. As was described in Chapter 3, the airline data exhibit greater volatility compared to the airport passenger data. The airport data represent the traffic transported by both Air Jamaica and foreign carriers serving the island. Comparing the two trends, it is reasonable to assume that Air Jamaica on average transports about half of all air passengers visiting the island.

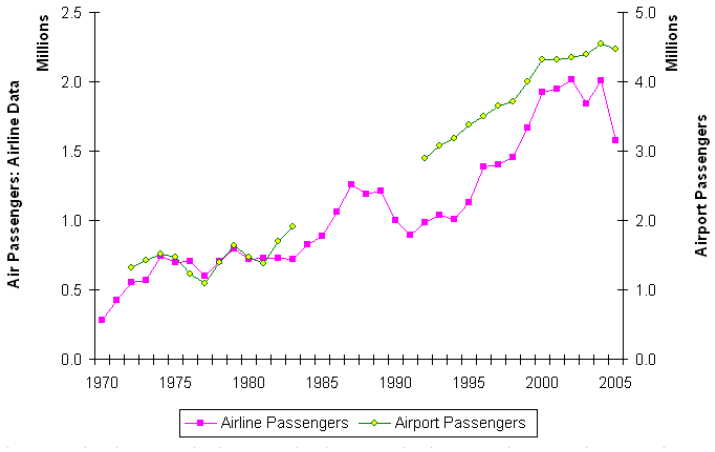


Figure K-3: Jamaica air passengers. Airline data effectively represent the total number of passengers carried by Air Jamaica. Airport data represent the total number of embarked and disembarked passengers in Montego Bay and Kingston airports. Data source: ICAO airport and airline databases.

Figure K-4 shows the historic trend in the number of tourists from different regions. The data source is the World Tourism Organization. Jamaica's tourism industry is highly dependent on the North American market with the U.S. nationals accounting for 73% of all tourist arrivals in 2002 [37].

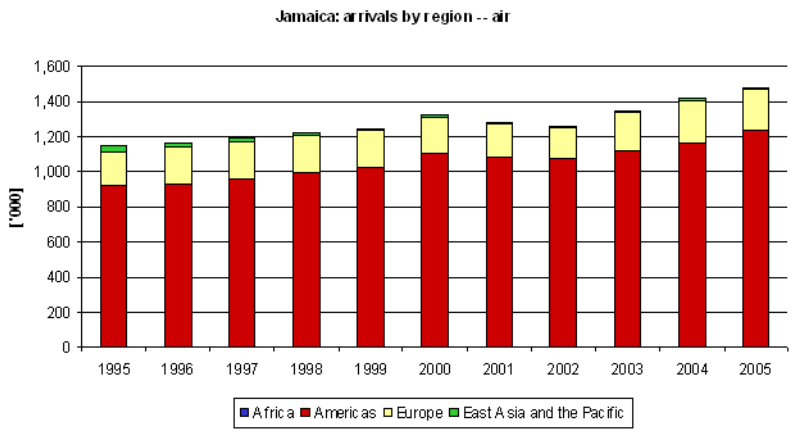


Figure K-4: Jamaica air tourist arrivals by region [213].

Figure K-5 shows the growth in the number of accommodations in Jamaica. World Tourism Organization does not disaggregate by the accommodation type, but other sources, including [37] and [122], have some data on shares of all-inclusive and other types of accommodation.

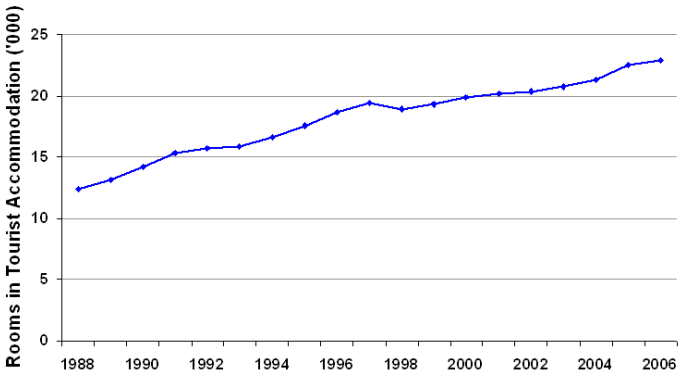


Figure K-5: Jamaica accommodations [213].

Jamaica tourist receipts present an interesting story in Figures K-6 and K-7. Figure K-6 shows that while the total international tourism expenditure has been growing, its share of total exports has been falling in recent years. Figure K-7 shows that the individual tourism expenditure per person, adjusted for inflation, has also been falling in recent years. Unfortunately, the World Tourism Organization does not have the expenditure data prior to 1992, so other data sources, such as government tourism offices, should be probed to obtain longer historic trends.

If the individual expenditure data were available for a longer time period, these trends would have been used in the model to estimate the *Cost per Day* parameter. Since these data were not available, a surrogate metric based on the GDP per capita data was also investigated. However, the trends in Figure K-8 show

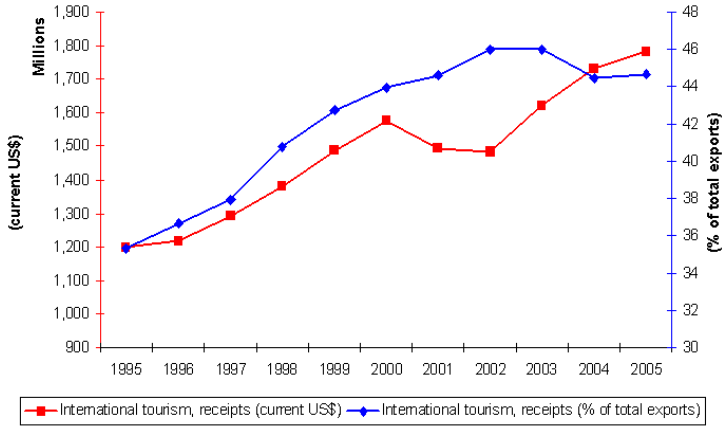


Figure K-6: Jamaica tourist receipts [213].

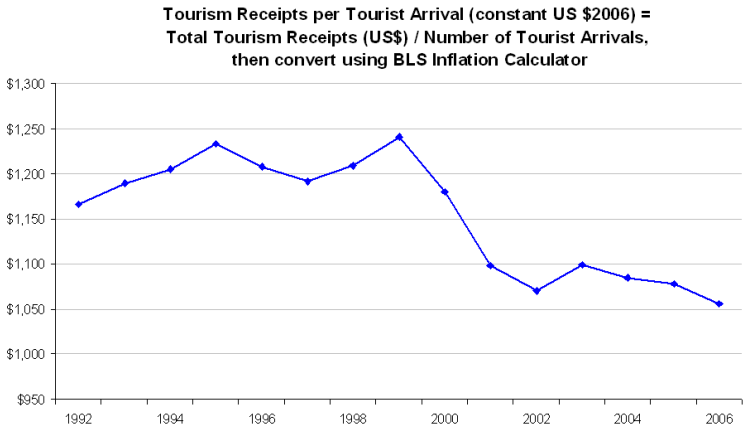


Figure K-7: Jamaica tourist receipts per person [213].

that using GDP per capita data to estimate the *Cost per Day* parameter in the model is not appropriate for Jamaica. Specifically, the individual tourism expenditure data show that the accommodation costs have been decreasing in recent years while the GDP per capita has been increasing since 1998.

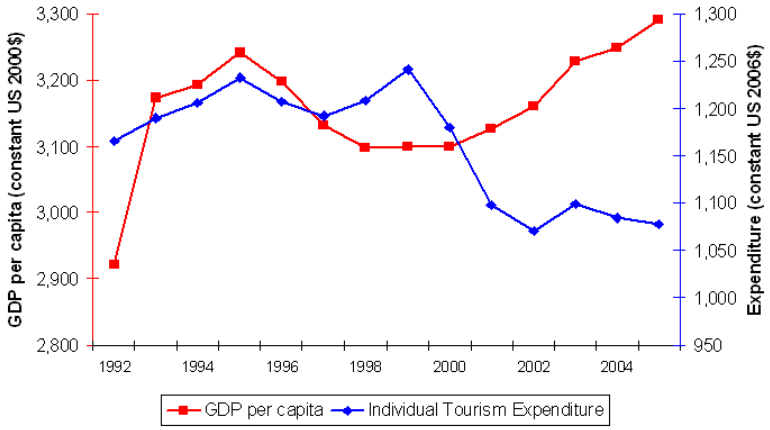


Figure K-8: Data trends comparison: Jamaica tourist receipts per person vs. GDP per capita [213, 212].

Calculating the Number of Visitors per Hotel Room per Year

World Tourism Organization (WTO) data on number of accommodations, overnight visitors, length of stay, and occupancy rates was used to calculate the *Number of Visitors per Hotel Room per Year* in the model.

The following calculation was performed based on 1997 data. That year Jamaica had 1,248,000 tourists, staying on average 6.9 nights in 19,300 rooms. Since each tourist stays on average 6.9 nights and there are 365 nights in a year, this gives us 1,248,000*6.9/365 = 23,592 people-nights/night. Next, it is assumed that two people on average share a room, so one gets 11,796 people-nights/night/(people/room). To obtain the occupancy rate, this number is divided by the total number of rooms available on the island, that is 11,796/19,300 = 61% while the actual occupancy rate given by the WTO is 57%.

However, this version of the simulation does not use the length of stay as one of the parameters, so it is sufficient to use only the number of tourists to calculate the *Number of Visitors per Hotel Room per Year*, or 1,248,000 tourists/19,300 rooms = 62.4 people/room/year in year 1997.

K.2 Model Source Code

The model and analysis can be replicated from the information provided in Chapter 7 and the data provided above. In model source code and analysis documentation can be obtained from the author by writing to *ishut@alum.mit.edu*.

Bibliography

[1] Advisory Council for Aeronautics Research in Europe. *The Economic Impact of Air Transport on the European Economy*, September 2003.

[2] Air Jamaica grounds flights: FAA concerned about island's civil aviation oversight. *The Jamaica Observer: Internet Edition*, February 7, 2005.

[3] Air Transport Action Group, Geneva, Switzerland. *The Economic and Social Benefits of Air Transport*, October 2005.

[4] Airfleets.net 2002-2008. *Airfleets: Airliner Photos, Aircraft Production Lists.* Available at http://airfleets.net.

[5] Airports Council International. *The Global Airport Community*, February 2007.

[6] Airports Council International – European Region, Brussels, Belgium. *Creating Employment and Prosperity in Europe: A study by ACI EUROPE of the social and economic impact of airports*, September 1998.

[7] Alitalia gets government bridge loan. *Aviation Week & Space Technology*, 168(18):22, May 5, 2008.

[8] D. Alleyne and I. Boxill. The impact of crime on tourist arrivals in Jamaica. *International Journal of Tourism Research*, 5(5):381–391, 2003.

[9] T. Altenburg, H. Schmitz, and A. Stamm. Breakthrough China's and India's transition from production to innovation. *World Development*, 36(2):325–344, February 2008.

[10] W. Aspray, F. Mayadas, and M. Y. Vardi. *Globalization and Offshoring of Software: Report of the ACM Job Migration Task Force.* Association for Computing Machinery, 2006.

[11] At-a-glance: Heathrow's rivals. *news.bbc.co.uk*, November 22, 2007.

[12] *AirDisaster.com Accident Database.* Accessed on October 9, 2008.

[13] *Aviation Safety Network Aviation Safety Database.* http://aviation-safety.net. Accessed on October 9, 2008.

[14] BA launching services to Algiers. *news.bbc.co.uk*, November 30, 2003.

[15] Bain & Company. *When Global Strategies Go Wrong.* The Asian Wall Street Journal, April 4, 2002.

[16] C. Barbot. Low-cost airlines, secondary airports, and state aid: An economic assessment of the Ryanair-Charleroi airport agreement. *Journal of Air Transport Management*, 12(4):197–203, July 2006.

[17] S. D. Barrett. How do the demands for airport services differ between full-service carriers and low-cost carriers? *Journal of Air Transport Management*, 10(1):33–39, January 2004.

[18] J. Baumann. South Africa: Tourism reaps benefit of Open Skies. *Business Day*, June 23, 2008. Available at http://allafrica.com/stories/200806230336.html.

[19] G. Beckett. Foreign trade by air. *Journal of Marketing*, 12(4):505–506, April 1948.

[20] G. Bel and X. Fageda. Getting there fast: Globalization, intercontinental flights and location of headquarters. Available at http://ssrn.com/abstract=849165, September 2005.

[21] A. R. Bender and F. J. Stephenson. Contemporary issues affecting the demand for business air travel in the United States. *Journal of Air Transport Management*, 4(2):99–109, April 1998.

[22] W. B. Beyers and S. J. Hyde. *King County International Airport: 2003 Economic Impact Study*. King County Department of Transportation, December 2003.

[23] E. Blewett. Pathfinder: Flying with a broken wing. *The Sofia Echo*, May 8, 2002.

[24] P. Bonnefoy. *Scalability of the Air Transportation System and Development of Multi-Airport Systems: A Worldwide Perspective*. PhD thesis, Massachusetts Institute of Technology, 2008.

[25] I. Boxill. Toward an alternative tourism for Jamaica. *International Journal of Contemporary Hospitality Management*, 16(4):269–272, 2004.

[26] J. K. Brueckner. Airline traffic and urban economic development. *Urban Studies*, 40(8):1455–1469, July 2003.

[27] L. Bunce, K. Gustavson, J. Williams, and M. Miller. The human side of reef management: a case study analysis of the socioeconomic framework of Montego Bay Marine Park. *Coral Reefs*, 18:369–380, 1999.

[28] Business Monitor International, London, UK. *The Turkey Freight Transport Report 2008*, 2008.

[29] K. Button, editor. *Airline Deregulation: International Experiences*. University Press, New York, NY, 1991.

[30] K. Button. Air transportation infrastructure in developing countries: privatization and deregulation. In *Comparative Political Economy and Infrastructure Performance: the Case of Airports*, Madrid, Spain, September 2006.

[31] K. Button, A. Clarke, G. Palubinskas, R. Stough, and M. Thibault. Confirming with ICAO safety oversight standards. *Journal of Air Transport Management*, 10(4):249–255, July 2004.

[32] K. Button, S. Lall, R. Stough, and M. Trice. High-technology employment and hub airports. *Journal of Air Transport Management*, 5:53–59, 1999.

[33] K. Button and S. Taylor. International air transportation and economic development. *Journal of Air Transport Management*, 6:209–222, 2000.

[34] C. Buyck. Brussels surprise: SN Brussels Airlines stays aloft, odd name and all, although many wonder how. *Air Transport World*, 40(6), June 1, 2003.

[35] J. Calderwood. Dubai serves as diversification model. *The Associated Press*, February 4, 2007.

[36] Cambridge Systematics, Inc. and Economic Development Research Group, Chevy Chase, Maryland. *Baltimore/Washington International Airport Air Cargo Assessment*, November 2003.

[37] Caribbean Tourism Organization. *2002 Caribbean Report*, 2002. Available at http://www.onecaribbean.org/.

[38] P. R. Carlile and C. M. Christensen. The cycles of theory building in management research. Harvard Business School Working Paper No. 05-057. Available at: http://hbswk.hbs.edu/item/5422.html, February 2005.

[39] P. M. Carrera and J. Bridges. Globalization and healthcare: Understanding health and medical tourism. *Expert Review of Pharmacoeconomics and Outcomes Research*, 6(4):447–454, August 2006.

[40] P. Cech. The catalytic effect of the accessibility of air cargo services. *The International Air Cargo Association Graduate Research Paper Competition*, 2004.

[41] Central Intelligence Agency, United States. *The World Factbook*. Available at https://www.cia.gov/library/publications/the-world-factbook/index.html.

[42] B.-H. Cho. Destination. In J. Jafari, editor, *Encyclopedia of Tourism*, pages 144–145. Routledge, London and New York, 2000.

[43] J. Connell. Medical tourism: Sea, sun, sand and ... surgery. *Tourism Management*, 27(6):1093–1100, December 2006.

[44] Convention Industry Council, Alexandria, VA. *The Economic Impact of Meetings, Conventions, Exhibitions, and Incentive Travel*, 2004.

[45] P. Conway. Cargo caution. *Airline Business*, 260, September 22, 2008.

[46] A. Cooper and P. Smith. *The Economic Catalytic Effects of Air Transport in Europe*. EUROCONTROL Experimental Centre, 2005.

[47] R. de Neufville. *Thesis Definition and Preparation: Some General Guidelines*. Technology and Policy Program, MIT, Cambridge, MA, September 1998.

[48] R. de Neufville. The future of secondary airports: Nodes of a parallel air transport network? In *Transportation Research Board*, 2006. Available at http://ardent.mit.edu/airports.

[49] R. de Neufville and A. R. Odoni. *Airport Systems Planning Design and Management*. McGraw-Hill, New York, NY, 2003.

[50] P. S. Dempsey. *Airport Planning and Development Handbook: a Global Survey*. McGraw-Hill, New York, NY, 2000.

[51] N. Dennis. Industry consolidation and future airline network structures in Europe. *Journal of Air Transport Management*, 11:175–183, May 2005.

[52] W. Dennis. Indonesia faces scrutiny over transport disasters. *IEEE Engineering & Technology Magazine*, pages 24–25, April 2007.

[53] J. M. Denstadli. Impacts of videoconferencing on business travel: the Norwegian experience. *Journal of Air Transport Management*, 10(6):371–376, November 2004.

[54] Department for Transport, London, UK. *Aviation, Core Cities and Regional Economic Development*, December 2003.

[55] B. Derudder, L. Devriendt, and F. Witlox. Flying where you don't want to go: an empirical analysis of hubs in the global airline network. *Tijdschrift voor Economische en Sociale Geografie*, 98(3):307–324, July 2007.

[56] F. Docquier and H. Rapoport. Skilled migration: The perspective of developing countries. In *Alfred P. Sloan Foundation Industry Studies Annual Conference*, Boston, MA, May 2008.

[57] R. Doganis. *The Airline Business*. Routledge, London; New York, 2^{nd} edition, 2006.

[58] Economic Development Research Group, Boston, MA. *Logan International Airport's Evolving Role in the New England Economy*, December 2001.

[59] The Economist Intelligence Unit, London, UK. *United Arab Emirates: Country Report*, August 2007.

[60] The Economist Intelligence Unit, London, UK. *Chile: Country Profile*, February 2008.

[61] The Economist Intelligence Unit, London, UK. *China: Country Profile*, October 2008.

[62] The Economist Intelligence Unit, London, UK. *India: Country Profile*, September 2008.

[63] The Economist Intelligence Unit, London, UK. *Jamaica: Country Report*, May 2008.

[64] The Economist Intelligence Unit, London, UK. *Libya: Country Profile*, August 2008.

[65] The Economist Intelligence Unit, London, UK. *South Africa: Country Report*, August 2008.

[66] The Economist Intelligence Unit, London, UK. *Turkey: Country Report*, August 2008.

[67] Encyclopædia Britannica Online. *Jamaica*, December 2008.

[68] Encyclopædia Britannica Online. *Kuwait*, December 2008.

[69] Encyclopædia Britannica Online. *Libya*, September 2008.

[70] Encyclopædia Britannica Online. *Turkey*, August 2008.

[71] G. Endres. In from the cold. *Airline Business*, May 19, 2008.

[72] Ethical Trading Initiative. *Workers' conditions in the cut flower industry*, February 2008.

[73] EU rules Alitalia loan illegal, okays privatisation plan. *The European Weekly: neurope.eu*, November 17, 2008.

[74] EU to resolve aircraft noise dispute. *Associated Press Online*, March 25, 2002.

[75] Euromonitor International. *US Market for Travel & Tourism: Market Overview*, January 26, 2006.

[76] Euromonitor International. *Global Market Information Database*, 2007. Available at www.euromonitor.com.

[77] Euromonitor International. *Travel and Tourism in Maldives*, May 2007.

[78] Euromonitor International. *Travel and Tourism in Qatar*, January 2007.

[79] Euromonitor International, *http://www.euromonitor.com/. The World Market for Travel and Tourism*, January 2007.

[80] Euromonitor International. *Transportation — Bulgaria: Country Sector Briefing*, May 2008.

[81] European Commission. *Communication from the Commission — Strengthening Aviation Relationship with Chile*, September 2005. Available at http://eur-lex.europa.eu.

[82] Federal Aviation Administration: Air Traffic Organization. *The Economic Impact of Civil Aviation on the U.S. Economy*, October 2008.

[83] F. Fiorino. Counter measures. *Aviation Week & Space Technology*, 146(22):19, May 26, 1997.

[84] F. Fiorino. Latin growth prospects dimmed but not quenched. *Aviation Week & Space Technology*, 155(21):72, November 19, 2001.

[85] F. Fiorino. Survival of the fittest. *Aviation Week & Space Technology*, 169(8), September 1, 2008.

[86] J. Flottau. Jaded outlook: Jade Cargo remains mired in financial difficulties while shareholders debate how to proceed. *Aviation Week & Space Technology*, 169(6):46, August 11, 2008.

[87] J. Flottau. Sweet spot: Location, airline alliance and MRO at core of Turkish's exponential growth strategy. *Aviation Week & Space Technology*, 168(23):44, June 9, 2008.

[88] N. Ford. Low-cost airlines increase market share. *African Business*, December 2005.

[89] P. Forsyth, J. King, and C. L. Rodolfo. Open Skies in ASEAN. *Journal of Air Transport Management*, 12(3):143–152, May 2006.

[90] W. Garner, D. Erkkila, and J. Hyunkuk. *Development of a Web-Based Economic Impact Calculator for Small and Medium Size Airports*. Minnesota Department of Transportation, May 2005.

[91] M. Goel. Chinese aviation reaches new heights. *Asia Times Online*, March 18, 2006.

[92] A. Goldstein. Infrastructure development and regulatory reform in Sub-Saharan Africa: The case of air transport. *The World Economy*, 24(2):221–248, 2001.

[93] K. N. Gourdin. *Global Logistics Management: a competitive advantage for the 21st century*. Blackwell Publishing, Malden, MA, 2^{nd} edition, 2006.

[94] Greenheart Economics, LLC, Longwood, Florida. *Florida's Air Cargo Trade with Chile*, 2007.

[95] R. Guimera, S. Morossa, A. Turtschi, and L. A. N. Amaral. The worldwide air transportation network: Anomalous centrality, community structure, and cities' global roles. *Proceedings of the National Academy of Sciences of the United States of America*, 102(22):7794–7799, 2005.

[96] P. Gustafson. Transnationalism in retirement migration: the case of North European retirees in Spain. *Ethnic and Racial Studies*, 31(3), 2008.

[97] R. J. Hansman. The impact of information technologies on air transportation. In *AIAA Aerospace Sciences Conference*, AIAA 2005-0001, Reno, Nevada, January 2005.

[98] S. K. Happel and T. D. Hogan. Counting snowbirds: The importance of and the problems with estimating seasonal populations. *Population Research and Policy Review*, 21:227–240, 2002.

[99] E. Hawkes and Jr. R.J. Kwortnik. Connecting with the culture: A case study in sustainable tourism. *Cornell Hotel and Restaurant Administration Quarterly*, November 2006.

[100] K. Heinicke. *An Air Cargo Perspective and Forecast*. Boeing. Presentation delivered on October 18, 2006.

[101] High-speed rail give short-haul air a run for the money in europe, with more flexible travel, greater comfort, lower environmental impact. *Hotel News Resource*, April 23, 2007.

[102] C. Hofer, R. J. Windle, and M. R. Dresner. Price premiums and low cost carrier competition. *Transportation Research Part E: Logistics and Transportation Review*, 44(5):864–882, September 2008.

[103] S. Husain. Emirates airline plans 450-plane fleet by 2020. *gulfnews.com*, April 22, 2008.

[104] A. Içduygu. International migrants remittances in Turkey. In *Euro-Mediterranean Consortium for Applied Research on International Migration: Analytical and Synthetic Notes — Demographic & Economic Module*, CARIM-AS 2006/7. European University Institute, 2006.

[105] Indonesia's Merpati bailed out yet again. *Airline Business*, September 22, 2008.

[106] Institute of International Education, New York, NY. *Open Doors 2007 Fast Facts*, November 2007.

[107] International Air Transport Association, Montreal, Canada. *World Air Transport Statistics: Volume 1 — World Air Transport Digest*, 50th edition, 2006.

[108] International Air Transport Association. *Economic Benefits from Air Transport in Chile*, October 2007.

[109] International Air Transport Association, Montreal, Canada. *World Air Transport Statistics: Volume 1 — World Air Transport Digest*, 51st edition, 2007.

[110] International Civil Aviatin Organization, Montreal, Canada. *Airport Traffic: Digest of Statistics*, 1971-2007.

[111] International Civil Aviation Organization, Montreal, Canada. *Background to Experiences of Liberalization in Africa*, March 2003.

[112] International Civil Aviation Organization. *The impact of low cost carriers in Europe*, February 2003.

[113] International Civil Aviation Organization, Montreal, Canada. *Economic Contribution of Civil Aviation, Volume 1*, 2004.

[114] International Civil Aviation Organization, Port-of-Spain. *ICAO Seminar on Air Transport Regulatory Policy: Liberalization Policy and Implementation*, April 2004.

[115] International Civil Aviation Organization, Montreal, Canada. *Report by the Council on Evaluation of the Economic Contribution of Civil Aviation*, 2004.

[116] International Civil Aviation Organization. *ICAO Information Paper: Regulatory and Industry Overview*, August 2006.

[117] Inter *VISTAS*-ga^2 Consulting, Inc., Washington, DC. *The Economic Impact of Air Service Liberalization*, June 2006.

[118] N. Ionides. Air Maldives' future uncertain. *Airline Business*, July 31, 2000.

[119] N. Ionides. Foreign low-cost operators restricted. *Airline Business*, May 1, 2005.

[120] M. D. Irwin and J. D. Kasarda. Air passenger linkages and employment growth in U. S. metropolitan areas. *American Sociological Review*, 56:524–537, August 1991.

[121] J. J. Issa and C. Jayawardena. The "all-inclusive" concept in the Caribbean. *International Journal of Contemporary Hospitality Management*, 15(3):167–171, 2003.

[122] Jamaica Tourist Board. *Annual Travel Statistics*, 2000.

[123] Jamaica's tourism trade. Technical Report 139, American Institute Trade & Environment Database, 2007.

[124] J. D. Kasarda. Air cargo: Engine for economic development. In *The International Air Cargo Association: Air Cargo Forum*, September 2004.

[125] J. D. Kasarda and J. D. Green. Air cargo as an economic development engine: a note on opportunities and constraints. *Journal of Air Transport Management*, 11:459–462, 2005.

[126] R. J. Kauffman and A. Kumar. Scale and scope externalities in growth of it industries in india: An agglomeration perspective. In *HICSS '07: Proceedings of the 40th Annual Hawaii International Conference on System Sciences*, Washington, DC, USA, 2007. IEEE Computer Society.

[127] T. Khanna. China + India: The power of two. *Harvard Business Review*, 85(12):60–69, 2007.

[128] N. Kim. The impact of remittances on labor supply: The case of Jamaica. World Bank Policy Research Working Paper No. 4120. Available at SSRN: http://ssrn.com/abstract=960183, February 2007.

[129] A. Knorr and A. Eisenkopf. How sustainable is Emirates' business model? *Aerlines Magazine*, 38, October 2007.

[130] M. Lagace. The rise of medical tourism: Q & A with Tarun Khanna. *Harvard Business School: Working Knowledge*, December 2007.

[131] Latin America & Caribbean report: Air Jamaica. *Air Transport World*, 42(7):88–91, July 2005.

[132] T.R. Leinbach and J.T. Bowen Jr. Air cargo services and the electronics industry in southeast asia. *Journal of Economic Geography*, 4(3):299–321, June 2004.

[133] E. Levy-Yeyati and F. Sturzenegger. To float or to fix: Evidence on the impact of exchange rate regimes on growth. *American Economic Association*, 93(4):1173–1193, 2003.

[134] Low-cost airlines face big barriers in China. *USA Today*, May 14, 2004.

[135] L. Machipisa. Sun sets on Zimbabwe tourism. *news.bbc.co.uk*, March 14, 2001.

[136] M. A. Madas and K. G. Zogafos. Airport capacity vs. demand: Mismatch or mismanagement? *Transportation Research Part A: Policy and Practice*, 42(1):203–226, January 2008.

[137] M. Maier. Rise of the Emirates empire. *CNNMoney.com: Business 2.0*, October 1, 2005.

[138] A. Mattoo, D. Mishra, and A. Narain. *From Competition at Home to Competing Abroad: A Case Study of India's Horticulture*. The World Bank, April 17, 2007.

[139] E. Mcdowell. Business travel: An industry executive questions the FAA's assessment of aviation safety around the world. *New York Times*, July 31, 1996.

[140] C. McGreal. Last BA flight from a grounded economy. *The Guardian*, October 29, 2007.

[141] B. Miller and J.-P. Clarke. Investments in rural air transportation networks in developing countries. In *AIAA Aviation Technology, Integration and Operations Conference*, AIAA 2004-6342, Chicago, Illinois, September 2004.

[142] B. Moestafa. Air crashes prompt Indonesia to act. *International Herald Tribune*, June 19, 2007.

[143] P. S. Morrell. *Airline Finance*. Ashgate, Great Britain, 3^{rd} edition, 2007.

[144] Moving forward: Bulgaria's air transport. *The Sofia Echo*, June 5, 2006.

[145] A. Mozdzanowska. *System Transition: Dynamics of Change in the US Air Transportation System*. PhD thesis, Massachusetts Institute of Technology, 2008.

[146] V. Nacheva. Balkan: Phoenix or flightless bird? *The Sofia Echo*, March 14, 2002.

[147] V. Nacheva. Balkan struggles to take off. *The Sofia Echo*, June 20, 2002.

[148] R. Nanda and T. Khanna. Diasporas and domestic entrepreneurs: Evidence from the Indian software industry. Harvard Business School Working Paper No. 08-003. Available at SSRN: http://ssrn.com/abstract=1001709, June 2007.

[149] The National Association of Software and Service Companies (NASSCOM). *Indian IT/ITES Industry: Impacting Economy and Society 2007-08*, April 2008.

[150] W. J. Nordlund. *Silent Skies: The Air Traffic Controllers' Strike*. Praeger, Westport, CT, 1998.

[151] J. F. O'Connell. The changing dynamics of the Arab Gulf based airlines and an investigation into the strategies that are making Emirates into a global challenger. *World Review of Intermodal Transportation Research*, 1(1):94–114, 2006.

[152] J. F. O'Connell and G. Williams. Transformation of India's domestic airlines: A case study of Indian Airlines, Jet Airways, Air Sahara and Air Deccan. *Journal of Air Transport Management*, 12(6):358–374, 2006.

[153] K. O'Connor. Airport development in Southeast Asia. *Journal of Transport Geography*, 3(4):269–279, 1995.

[154] Ownership and control liberalization: A discussion paper. Technical Report CAP 769, The United Kingdom Civil Aviation Authority, October 2006.

[155] Passengers shun troubled Zimbabwe airline. *Mail & Guardian online*, April 7, 2006.

[156] D.H. Perkins, S. Radelet, D. R. Snodgrass, M. Gillis, and M. Roemer. *Economics of Development*. W. W. Norton & Company, Inc., New York, NY, 5^{th} edition, 2001.

[157] B. Perrett. Beijing gives a boost to regional ops. *Aviation Week & Space Technology*, 168(20):54–55, May 19, 2008.

[158] B. Perrett. Cross-strait hope: Airlines in Taiwan look to mainland tourism to help reinvigorate services and profits. *Aviation Week & Space Technology*, 168(20):54–55, May 19, 2008.

[159] M. Piling. Aftergold rush. *Airline Business*, 86, April 23, 2007.

[160] G. H. Pirie. Southern African air transport after apartheid. *The Journal of Modern African Studies*, 30(2):341–348, 1992.

[161] S. Plog. Why destinations areas rise and fall in popularity. *Cornell Hotel and Restaurant Administration Quarterly*, 2001.

[162] M. Plowright. Ready for take-off. *China Business International*, October 11, 2007.

[163] K. R. Polenske and S. F. Fournier. Introduction to Input-Output accounting and modeling. In R. E. Klosterman and R. K. Brail, editors, *Spreadsheet Models for Urban and Regional Analysis*, pages 205–227. Center for Urban Policy Research, New Brunswick, NJ, 1993.

[164] M. E. Porter. *The Competitive Advantage of Nations*. The Free Press, New York, NY, 1990.

[165] M. E. Porter, K. Schwab, and X. Sala–i–Martin. *The Global Competitiveness Report: 2007-2008*. World Economic Forum, New York, NY, November 2007.

[166] R. Prud'homme. Infrastructure and development. In F. Bourguignon and B. Pleskovic, editors, *Annual World Bank Conference on Development Economics 2005: Lessons of Experience*, pages 153–189. World Bank and Oxford University Press, New York, NY, 2005.

[167] Record growth in Indonesia air traffic. *AsiaNews.it*, January 10, 2007.

[168] A. Saxenian. From brain drain to brain circulation: Transnational communities and regional upgrading in India and China. *Studies in Comparative International Development*, 40(2):35–61, June 2005.

[169] A. Saxenian. The new argonauts. *Words Into Action: IMF/World Bank publication*, 2006.

[170] A. Schafer and D. G. Victor. The future mobility of the world population. *Transportation Research Part A*, 34:171–205, 2000.

[171] C. E. Schumer and C. B. Maloney. *Your Flight Has Been Delayed Again: Flight Delays Cost Passengers, Airlines, and the U.S. Economy Billions*. The U. S. Senate Joint Economic Committee, May 2008.

[172] J. Sharkey. Open Skies, better deals (for now). *The New York Times*, April 6, 2008.

[173] D. Sinha. *Deregulation and liberalisation of the airline industry : Asia, Europe, North America and Oceania*. Ashgate, Aldershot, England, 2001.

[174] S. K. Smith and M. House. Snowbirds, sunbirds, and stayers: Seasonal migration of elderly adults in Florida. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 61, 2006.

[175] B. Sobie. Mountain climbing. *Airline Business*, 255, April 21, 2008.

[176] B. Sobie. Temel Kotil: Turkish Airlines unphased by credit crunch. *Airline Business*, June 4, 2008.

[177] B. Sobie. Turkey's other carriers eye international expansion. *Airline Business*, June 16, 2008.

[178] P. Sparaco. Belgium seeks redress for Sabena demise. *Aviation Week & Space Technology*, 158(7):44, February 17, 2003.

[179] P. Sparaco. Switzerland's "grounding". *Aviation Week & Space Technology*, 166(5):50, January 29, 2007.

[180] J. D. Sterman. *Business Dynamics: Systems Thinking and Modeling for a Complex World*. Irwin McGraw-Hill, 2000.

[181] D. Subramanian. How far has Indian industry traveled down the deregulatory road. Technical report, Centre asie ifri, June 2008.

[182] Swissair group sells SAA stake back to South African government. *Airline Industry Information*, February 18, 2002.

[183] Swissair imposing new financial rigor. *Aviation Week & Space Technology*, 144(24):31, June 10, 1996.

[184] Syria breaks ties with Balkan Airlines. *Airline Industry Information*, July 13, 1999.

[185] R. Tam and R.J.Hansman. An analysis of the dynamics of the US commercial air transportation system. Technical Report ICAT-2003-2, MIT International Center for Air Transportation, May 2003.

[186] R. H. Tanger. The air cargo market between China and the United States: Demand, developments and competition. Technical report, Northwestern University Kellogg School of Management, May 2007.

[187] S. Tenreyro. On the trade impact of nominal exchange rate volatility. *Journal of Development Economics*, 82(2):485–508, 2007.

[188] G. Thomas. Will China go low-cost? *Air Transport World*, May 2005.

[189] Trade body suspends Air Zimbabwe. *news.bbc.co.uk*, February 4, 2004.

[190] M. Tretheway and D. Mak. Emerging tourism markets: Ageing and developing economies. *Journal of Air Transport Management*, 12(1):21–27, January 2006.

[191] Turkey expands flight scope. *Turkish Daily News*, August 20, 2008.

[192] U. S. Department of State, http://www.state.gov/r/pa/ei/bgn/. *Bureau of Public Affairs: Electronic Information and Publications Office: Background Notes*, 2008.

[193] UAE airports: as a result of the UAE becoming an increasingly successful player in the tourism and commercial markets, its airports are working on some of the world's greatest development plans. *Airports International*, 37(2), March 2004.

[194] United Kingdom Department for Environment, Food and Rural Affairs, London, UK. *Overview of the benefits and carbon costs of the African horticultural trade with the UK*, April 2007.

[195] United Nations, New York and Geneva. *World Investment Report 2007: Transnational Corporations, Extractive Industries and Development*, October 2007.

[196] United Nations Environment Program. *Economic Impacts of Tourism*, 2002.

[197] United World. *Libya: Country Report*, 2006.

[198] U.S. Department of Agriculture Economic Research Service Report: Agricultural Outlook Archives. *Fresh fruit leads Chile's export mix ...*, April 1992.

[199] U.S. Department of Commerce: Bureau of Economic Analysis. *Bureau of Economic Analysis: National Economic Accounts*, 2008. Available at http://web.bea.gov.

[200] U.S. Department of Transportation: Bureau of Transportation Statistics. *Bureau of Transportation Statistics: TranStats Database*, 2008. Available at http://www.transtats.bts.gov/.

[201] A. Vandyk. To evade an embargo; Libyan Arab Airlines wants to update its fleet to meet a rise of tourism but a U.S. high-tech ban is in the way. *Air Transport World*, September 1, 1991.

[202] H. Vega. Air cargo, trade and transportation costs of perishables and exotics from south america. *Journal of Air Transport Management*, September 2008.

[203] M. J. Villena, R. Harrison, and M. G. Villena. Impacto economico de la politica de acuerdos de cielos abiertos en Chile. *Revista de Análisis Económico*, 23(1):107–149, 2008.

[204] R. Wall and J. C. Anselmo. Greening frenzy: Airlines fear costly cap-and-trade regulations are only a matter of time. *Aviation Week & Space Technology*, 168(23):24–25, June 9, 2008.

[205] R. Wall and J. Flottau. Drastic measures; low-fare carriers reel under economic pressures, but some investors remain bullish. *Aviation Week & Space Technology*, 169(1), July 7, 2008.

[206] D. Warnock-Smith and P. Morrell. Air transport liberalisation and traffic growth in tourism-dependent economies: A case-history of some US-Caribbean markets. *Journal of Air Transport Management*, 14(2):82–91, March 2008.

[207] M. Westlake. China air cargo holds vast opportunities. *Aerospace America*, pages 6–8, May 2005.

[208] G. Williams. *Airline Competition: Deregulation's Mixed Legacy*. Ashgate, Aldershot, England, 2002.

[209] The World Bank, Washington, DC. *The Road to Sustained Growth in Jamaica — A World Bank country study*, 2004.

[210] The World Bank, New York, NY. *World Development Report 2005: A Better Investment Climate for Everyone*, 2005.

[211] The World Bank, Washington, DC. *Migration and Remittances Factbook 2008*, September 2008.

[212] The World Bank. *The World Bank World Development Indicators Online*, 2008. Available at www.worldbank.org/data/wdi/home.html.

[213] World Tourism Organization. *Compendium of Tourism Statistics*, 2007.

[214] World Tourism Organization, Madrid, Spain. *Tourism Highlights: 2007 Edition*, 2007.

[215] X. Yang, S. K. Tok, and F. Su. The privatization and commercialization of China's airports. *Journal of Air Transport Management*, 14(4), 2008.

[216] Llewelyn Davies Yeang, D. Banister, and P. Hall. *Transport and City Competitiveness – a Literature Review*. UK Department for Transport, 2004.

[217] Y. Zhang and D. K. Round. China's airline deregulation since 1997 and the driving forces behind the 2002 airline consolidations. *Journal of Air Transport Management*, 14(3):130–142, 2008.

[218] D. Zweig and S. Rosen. How China trained a new generation abroad. *Science and Development Network*, May 22, 2003.