

Analysis of Interaction between Air Transportation and Economic Activity.

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This paper uses both world-wide and country-level analysis to describe the relationship between air transportation and economic activity. In particular, we describe how economic, infrastructural, institutional and geographic factors affect the mapping of cargo and passenger flows to the enabled flows of labor, knowledge, investment, remittances, tourism and goods. We also identify the role of government and exogenous drivers in this relationship. We illustrate the relationship using several examples: Dubai in the United Arab Emirates, Jamaica, China and India.

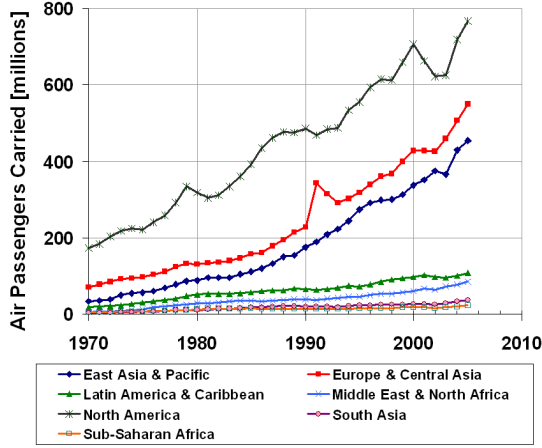
I. Introduction

Air transportation services and economic development interact with each other through a series of mutual-causality feedback relationships. Air transportation provides employment in the aviation sector and creates wider socioeconomic benefits through its potential to *enable* certain types of activities in a local economy. As a result, the availability of air transportation services effectively increases the scope and cycle time of economic activity. The region's economic activity in turn generates the need for passenger travel and freight and drives the demand for air transportation services. This feedback relationship results in general correlation between the amount of air travel and Gross Domestic Product (GDP) around the world that can be observed in Figure 1. However, even though air passengers and GDP have been increasing in all regions during the last thirty years, there is substantial variability in the growth rates. This reflects the variability in the nature of interaction between air transportation and economic activity. The goal of this paper is to identify and describe the mechanisms and the relevant factors influencing this interaction. In particular, we describe the government's role in influencing various economic and air transportation factors and the resulting air transportation impact. We use aggregate world-wide data and several case studies to illustrate the variability in the relationship between air transportation and economic activity around the world.

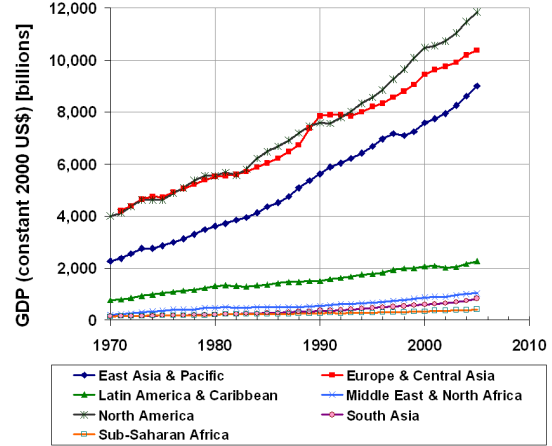
Presently, the literature is lacking a comprehensive way of describing the relationship of air transportation to economic activity because the analysis is usually performed on a case by case basis and ignores some interaction effects. There are two major types of studies evaluating the impact of air transportation. First, are studies evaluating the direct, indirect and induced employment impact of air transportation which ignore the enabling effects. Direct impact is 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 are typically done for the developed economies because they use data-intensive regional input-output matrices which are rarely available for the developing countries.^{1,14,16} Second, are studies which attempt to evaluate the enabling, or catalytic, impact of air transportation.

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(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: Changes in passenger traffic flows and GDP in the world's regions.³

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 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, 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 typically measure the impact of changes in air transportation usage on tourism, trade, local investment and productivity improvement.^{2, 4-6, 8, 10, 17, 18}

II. Describing the Interaction between Air Transportation and Economic Activity

The impact of air transportation on economic activity differs from other transportation modes because of its distinctive characteristics: speed, cost, flexibility, reliability, and safety. It 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, on the short-haul routes air transportation provides little advantage over surface transportation modes, especially the high-speed rail. Figure 2 is a high-level feedback model describing the interaction between air transportation system and an economy. The air transportation system is defined by its infrastructure capability, regulatory framework, vehicle and airline capability. 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 route. At the macroeconomic level, air transportation impacts economy by providing employment and by enabling effects including enabling access: to markets, to people, to capital, to ideas and knowledge, to labor supply, to skills, to opportunity, and to resources. The economy in turn provides capital and generates demand for passenger and freight travel.

The economy's travel and freight needs are determined by the relative business and leisure attractiveness

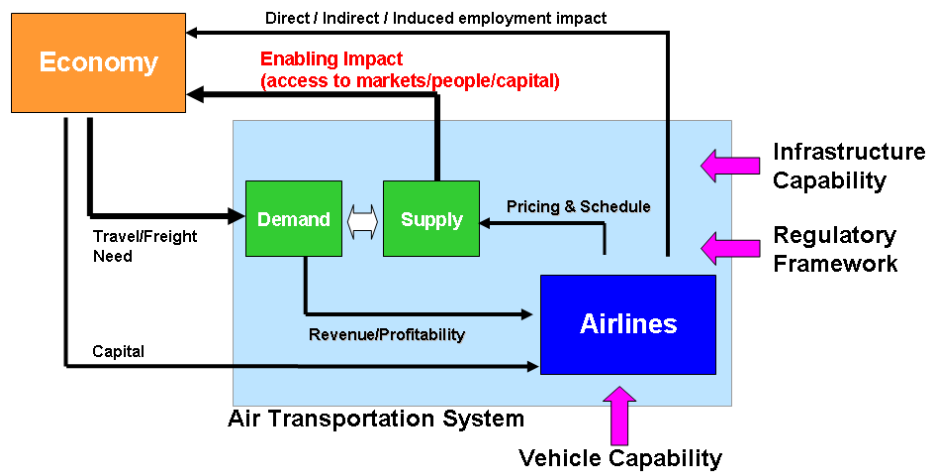


Figure 2: Feedback-based interaction between Air Transportation System and an Economy. (Adapted from Hansman.¹³)

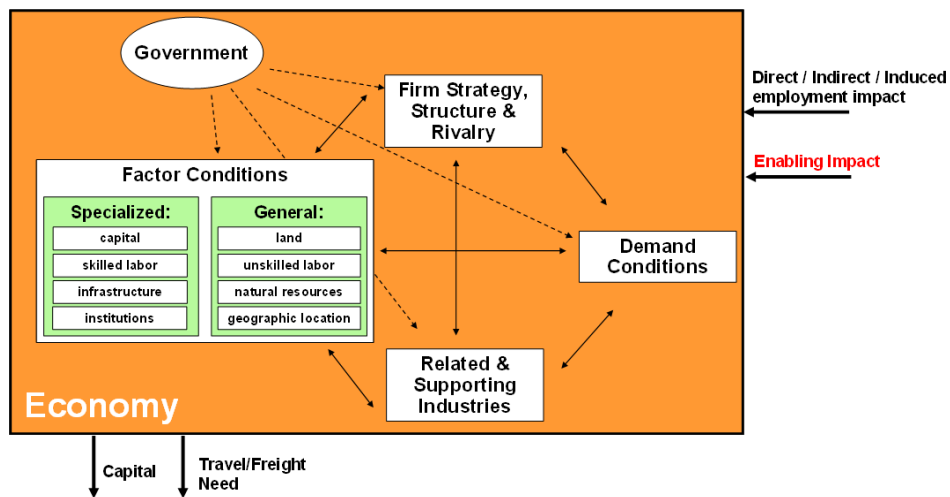


Figure 3: The Economy's competitiveness is defined by four necessary attributes with government and chance playing an important role. (Adapted from Porter.²⁵)

of that economy to the rest of the world. This measure of attractiveness and overall competitiveness in the global environment can be described using four attributes which are based on Porter’s theory of competitive advantage and are shown in Figure 3. The first set of attributes are the factor conditions which in standard economic theory are referred to as the factors of production. 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. We have amended Porter’s general model to include (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. The other attributes consist of demand conditions; presence of related and supporting industries; firm strategy, structure and rivalry. The original Porter’s definition of demand conditions refers only to home demand for goods and services. We expand this definition to include international demand for goods and services produced by the local economy. 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 determines the nation’s competitive advantage in the global economic environment and influences the economy’s travel and freight needs. Air transportation in turn affects these attributes through a set of enabling mechanisms.

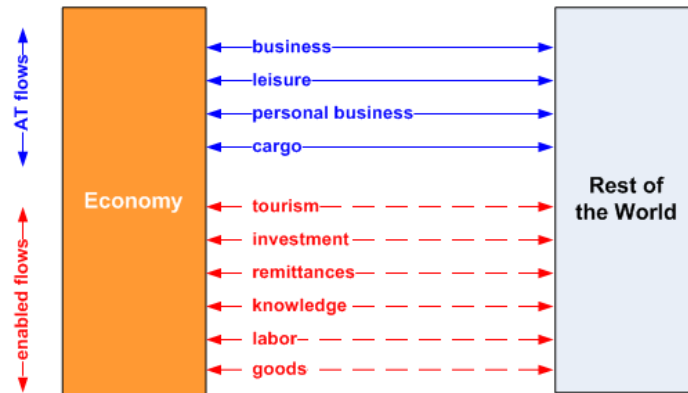


Figure 4: Air Transportation and the resulting Enabled flows between an Economy of interest and the Rest of the World.

The Mapping of Air Transportation Flows to Economic Attributes

Below we describe how air transportation flows map to the enabled flows which in turn affect the attributes defining the economy’s competitiveness. The enabling impact of air transportation is realized through passenger and cargo flows which take place between a given economy and the rest of the world and are shown in Figure 4. The passenger flows can be broken down into three major categories: business, leisure (recreation and holidays), and personal business (visiting friends and relatives, health, migrant, and education-related trips). All flows are bi-directional; for example, inbound leisure passengers spend money in the economy whereas outbound leisure passengers spend money abroad. In this paper we define inbound passengers as those whose main place of residence is not in the economy of interest and inbound cargo as the cargo produced outside of the economy. These air transportation flows give rise to the *enabled flows* of tourism, investment, remittances, knowledge, labor and goods. Cargo flights carry goods between economies; business passengers provide a source of labor, knowledge and investment; personal business passengers are a source of remittances, labor, knowledge and investment; leisure passengers result in tourism flows.

Business Passengers affect the Economy's Capital, Skilled Labor, and Firm Strategy.

Inbound Business Passengers provide a source of labor, knowledge and investment affecting the economy's *Capital, Skilled Labor*, and *Firm Strategy*. Air travel impacts *Firm Strategy* and the economy's *Skilled Labor* by enabling access to high-skill commuters, e.g., managerial staff in the headquarters and a regional location which allows companies to share skilled labor between facilities. Air travel also enables 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. Air travel enables access to labor from other economies increasing local economy's skill-level and human capital through transfer of skills, collaboration, and training. Air travel enables face-to-face contact in multi-national corporations which affects the level of collaboration and enables network effects which improve productivity. In addition, business passenger travel impacts the economy's *Capital* stock by enabling investors to personally oversee and monitor their investment.

Outbound Business Passengers provide a source of investment and knowledge affecting the economy's *Capital, Skilled Labor, Firm Strategy* and *Demand Conditions*. Air travel enables the flows of knowledge by enabling the local employees to get training at another location improving the economy's *Skilled Labor* stock. 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 affects investment and trade levels by enabling salesmen to travel to recruit customers in new markets increasing the *Demand*. Air travel enables access to opportunity by enabling local skilled employees to work as outsourced labor and not be constrained by the local markets, e.g., software developers in India. The ability to outsource affects *Firm Strategy* and international *Demand Conditions* for locally produced goods and services.

Personal Business Passengers affect the Economy's Capital, Skilled and Unskilled Labor, and Demand Conditions.

Personal Business Passengers provide a source of investment, knowledge, labor, and remittances affecting the economy's *Capital, Labor*, and *Demand Conditions*. Outbound air travel for education purposes allows local population to gain access to higher education institutions abroad while maintaining family ties in the local economy. Maintaining contacts and families at home incentivizes expatriates to invest into the local economy to get 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.

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*. Inbound migrant workers are a source of *Unskilled Labor* for the host economy. Health-related air travel has become more common: it allows customers both in developing and developed economies to use health outsourcing options 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. These inbound retirement flows result in the development of the supporting infrastructure and employment which increase the local income levels and change the economy's *Demand Conditions*.

Leisure Passengers affect the Economy's Demand Conditions.

Leisure Passengers result in tourism flows. Air transportation provides a faster mode of transportation increasing the number of possible holiday 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*.

Cargo Flows affect the Economy's Demand Conditions, Capital, and Firm Strategy.

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. Access to air cargo services affects the *Demand* for goods by providing a different distribution mechanism, such as the next-day delivery; by providing a different purchasing mechanism, such as e-commerce with next-day delivery instead of going to the physical store; by providing a viable transportation mode for perishable luxury and exotic agricultural goods for affluent consumers, such as flowers and produce from Colombia to the U.S. and from Kenya to Europe. Access to air cargo introduces robustness to demand variability and allows firms to quickly take advantage of new market opportunities since changes in the freight links require minimal infrastructure investment. 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. Access to air cargo 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.

The Role of Government

Government supports the economy's competitiveness by influencing both the economic attributes and air transportation system development. For example, the government may affect the factor conditions through economic regulation and openness to trade, investment into telecommunications and supporting infrastructure, and educational incentives to increase the economy's skilled labor stock. The government affects air transportation system development through changes in the regulatory framework, infrastructure investment, airline ownership, and operational incentives.

Air transportation supply is set by the airlines whose decision to operate a particular route is influenced by its 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. 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, and operational incentives, such as tax incentives to promote operations in under-used secondary airports. 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 entry requirements, perceived health risks, natural disasters, significant shifts in world financial markets or exchange rates, and oil shocks.

Since each economy has a unique set of attributes, different governments pursue different types of incentives for economic development. These incentives influence the potential enabling impact of air transportation. For example, many tropical developing countries, such as Jamaica, consider the enabling impact of tourism to be an integral part of their developmental framework. As a result, they incentivize investment into air transportation and supporting tourism infrastructure to increase the relative attractiveness of their economies to leisure travelers. Other developing countries, such as Chile and the UAE, consider air transportation development to be part of their economic diversification strategies. These countries take advantage of the enabled flows by promoting investment into the supporting infrastructure and changes in the regulatory framework. 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. Alternatively, the government of Dubai invested into the supporting infrastructure and built the Dubai International Financial Center. This Center is a financial free zone which provides the necessary legal, business

and physical infrastructure to encourage foreign direct investment and business development enabled by the business passenger flows going through the nearby Dubai International Airport.

Limits to Growth

Air passenger growth rates have been exhibiting exponential growth behavior in many regions as illustrated in Figure 1. However, no real system can grow forever and it is likely that air transportation will exhibit 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 fixed carrying capacity.²⁹ Similarly, the evolution of the air transportation system has three distinct stages: the start-up development phase, the growth phase, and the saturation phase. As the air transportation system evolves, so does its interaction with an economy. The start-up development phase is characterized by the relatively expensive air transportation services which serve an enabling role for certain types of economic activities. The second stage is the growth phase characterized by continued reliance of economy on air transportation as the demand is stimulated and air travel becomes mainstream. This increase in the growth rate is a typical consequence of changes in the regulatory framework such as airline deregulation or liberalization. However, the growth rates eventually decrease as the system becomes constrained by the available resources. As the system reaches maturity, the effective cost of air travel increases thereby decreasing the attractiveness of air travel as a transportation mode.

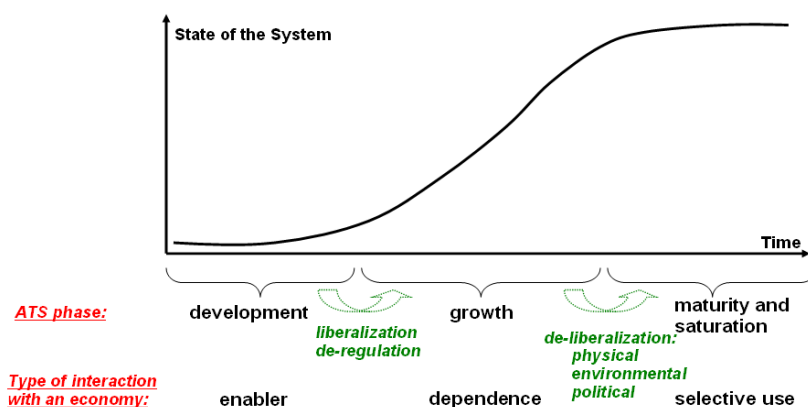


Figure 5: Evolution of the air transportation system and its interaction with economic activity: *S-shaped growth*.

The major resource constraint to further expansion in air transportation is airport infrastructure. Airports traditionally have been built near major metropolitan areas and as the urban areas grew, they often enclosed airport infrastructure within their boundaries. 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. 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.

Physical infrastructure constraints are not the only factors limiting further growth. Other factors which may change the behavior include political and environmental constraints as well as the limited supply of fuel. In addition to the factors limiting air transportation supply, air travel demand may become saturated as well.

III. Country-level Trend Analysis

In this section we describe the results of cross-sectional country-level analysis to gain insight into the general relationship between air passenger travel and GDP and relate the observed trends to stages of economic and air transportation development. The data presented in this section were obtained from the on-line database *World Development Indicators* maintained by the World Bank Group. The original source for economic data is the World Bank national accounts.

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. These data have several limitations. First, the data cover the air traffic carried on scheduled services, but changes in air transport regulations make it difficult to classify traffic as scheduled or nonscheduled. Therefore, some discrete changes in the data could be due to differences in classification. Second, the reported national statistics contain only the data for carriers registered in that country. This implies that these data are not necessarily representative of all the passengers traveling to and from a particular country. So, for countries with a few air carriers or only one, the addition or discontinuation of a home-based air carrier may cause significant changes in the data while the actual traffic might not have changed significantly. Also, in widely 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. In addition, in small countries with few airlines the volatility in the data may be due to the dynamics of a particular airline and is not representative of the actual traffic.

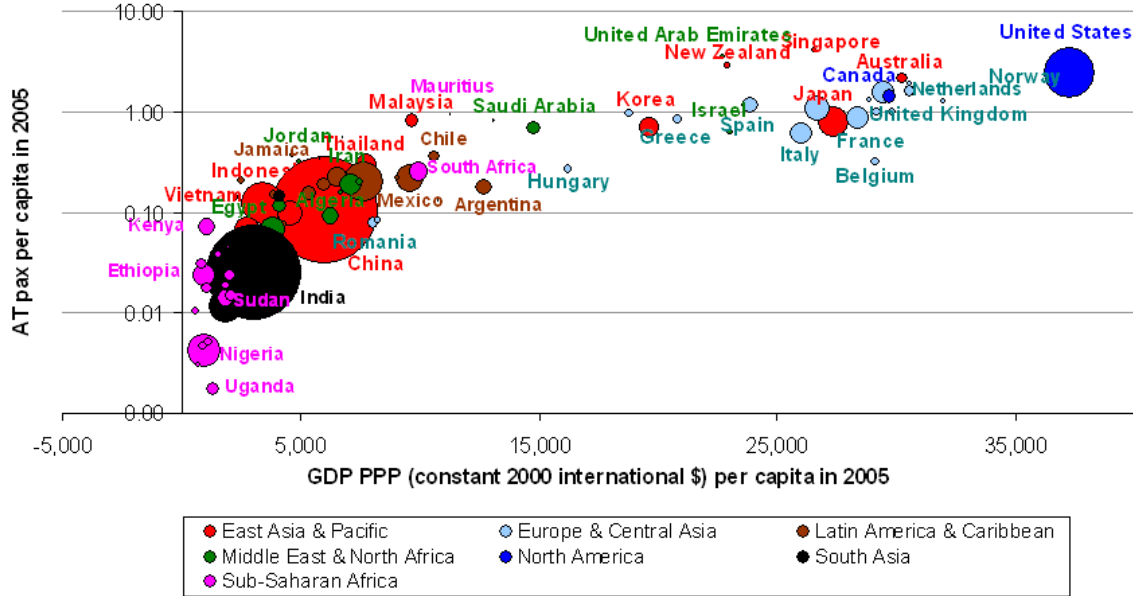


Figure 6: Passenger traffic and GDP PPP per capita for countries with population greater than 1 million. *Notes:* (1) the size of each individual point denotes the country's population; (2) y-axis is a log-scale; (3) Ireland (\$34,600, 10.3) is excluded from the chart; (4) only select countries with population greater than one million are shown for clarity.

Air travel increases with increase in per capita income as shown in the cross-sectional data in Figure 6. These data corroborate the trend identified by Schafer and Victor.²⁷ The authors, following historical analysis of transportation trends across many countries, demonstrated that time and income shares allocated to travel are stable over time and space. Therefore, as income increases, people tend to shift to faster and

more expensive transportation modes such as air transportation. Geographic location, country's size and distance to the main markets play an important role in the country's mobility needs. Nations that are isolated either geographically or economically, such as New Zealand, Singapore, Bahrain, and the United Arab Emirates, have higher than average air transportation needs. On the other hand, European countries, due to the relative proximity of key economic partners and well-developed surface transport infrastructure, have lower-than average air transportation needs. The high mobility of Singapore and the United Arab Emirates is 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. The size of each individual point in Figure 6 corresponds to the relative population size of each country. So, for example, individual Chinese on average travel significantly less when compared to other countries using per capita basis. However, due to the large size of Chinese 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 country's airlines accounted for only 0.5% of the world's passengers.

Since the interaction between air transportation and economic development is dynamic, in Figure 7 we compare the yearly growth rates of air transportation passengers and real GDP based on the data between 1985 and 2005. 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. For example, low or negative air transportation growth trends in Figure 7 reflect the unstable political climate in some of the African countries, such as Libya and Algeria.

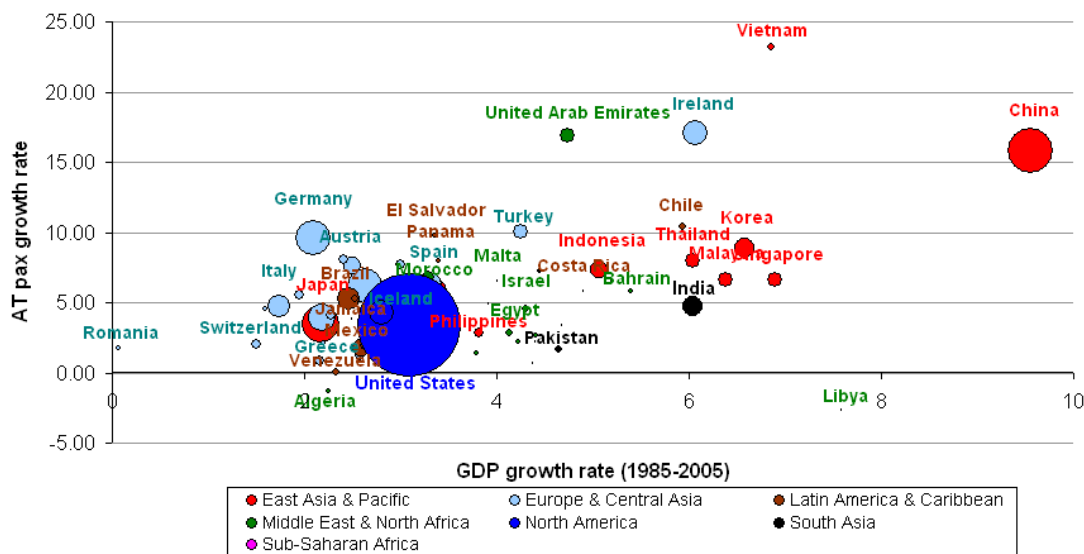


Figure 7: Yearly growth rates for air transportation passengers and real GDP based on constant 2000 US\$ estimates. In this time period, the world passenger traffic grew from 800 million to 2 billion passengers. *Notes:* (1) the size of each individual point denotes the country's share of passengers compared to the world's total in 2005; (2) only select countries with greater than 0.03% share of total traffic are shown for clarity.

Even though there is generally a positive relationship between air passenger and GDP growth rates, there is a considerable variation between countries. Several economies have experienced air passenger growth rates greater than 10%. These economies are Vietnam, Ireland, United Arab Emirates, China, Laos, Vanuatu, Chile, Turkey. Most of these economies are classified as low and middle income, or developing, economies by the World Bank. Ireland and the United Arab Emirates are the only two exceptions. In both of these countries, however, the rapid air transportation growth reflects to a large extent the growth of international networks of their airlines. In Ireland, a low-cost carrier Ryanair established itself as an intra-European

carrier after multilateral liberalization in the early 1990s. In the UAE, the Dubai's national carrier Emirates underwent an extensive expansion program to establish itself as a leading network carrier connecting European and Asian markets through its hub in Dubai.

The high growth rates in the developing economies are partially a reflection of the fact that the airlines have been growing from a very small base. For example, a purchase of one 70-seat aircraft by Lao Airlines resulted in a two-fold increase of air passengers in 1990. Similarly, the Chinese air transportation industry has been growing from a very small base since civil air passenger travel was practically non-existent in China until the mid-1980s. However, due to the large population of the country these high sustained growth rates have had a significant impact on the world's air transportation system. In 1985, China accounted for only 1% of the world's passengers while in 2005, it accounted for a third of the Asian-Pacific traffic and 7% of the world's total traffic with the nation's trip rate increasing fifteen-fold from 0.007 to 0.1 trips/person/year.

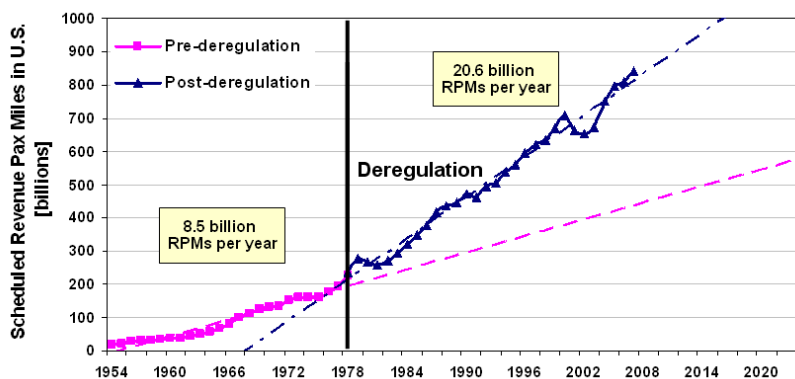


Figure 8: Time series of scheduled Revenue Passenger Miles (RPMs) in the United States — the largest and one of the most mature air transportation systems in the world. The data show that there has been an increase in the traffic growth rate following the United States Airline Deregulation Act of 1978.

The evolution of air transportation services can be described using the development and growth stages of the S-shaped growth. Economic reforms and changes in the air transportation regulatory framework and investment are the primary reasons behind the changes in the growth rate. For example, the U.S. air transportation system data in Figure 8 reflect the first two stages of the evolution of air traffic: the development stage and the growth stage following the Airline Deregulation Act of 1978. The high growth rates in the developing countries have been possible because the local air transportation systems were not physically or institutionally constrained. In comparison, 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 with about half of these delays accrued by the flights to and from the 35 largest U.S. airports, even though flights in and out of these airports accounted for only a third of the total number of flights.²⁸ The New York airports had the greatest share of delayed arrivals: almost 40% of gate arrivals were delayed at La Guardia (LGA), Newark (EWR) and Kennedy (JFK) airports^a. 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. 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.

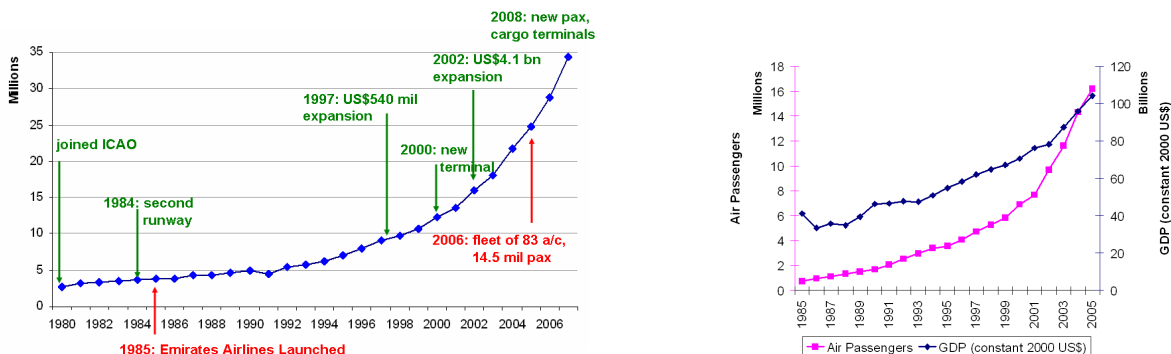
^aData source: Federal Aviation Administration Airline Service Quality Performance (ASQP) database.

IV. Case Studies

In this section we illustrate the interaction between air transportation and economic development using four examples: a high-growth case of Dubai in the United Arab Emirates; a high-dependency case of Jamaica; and two high-growth cases with large population base: China and India. For each case we identify the dominant enabled flows, describe the economy's factor conditions, air transportation supply, and the role government played in influencing the interaction between air transportation and economic activity.

A. Dubai, UAE

The United Arab Emirates is a Middle Eastern economy whose air transportation sector has experienced sustained high growth rates over the last twenty years (see Figure 9). The high air passenger growth



(a) 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>.

(b) 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%.³

Figure 9: Growth in air passenger traffic and GDP for the United Arab Emirates.

rates were in large part generated by the rapidly growing Dubai's Emirates Airline and its hub at the Dubai International Airport. The airline has been expanding aggressively in the recent years 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. In fact, about half of Emirates passengers make a connection at Dubai airport,²² 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.²¹ In addition, as opposed to many other major airports worldwide, the airport has no noise control restrictions and operates 24 hours per day. The airline operates under the open skies policy formulated in the early 1980s.

To match the rate of growth of the Emirates Airline, the Dubai airport has undergone several expansion programs including new runway and terminal constructions noted in Figure 9(a). 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. In addition to establishing itself as a passenger hub, the airport has become an important cargo hub. In 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 Cargo Mega Terminal and the Flower Center for perishable transit cargo.

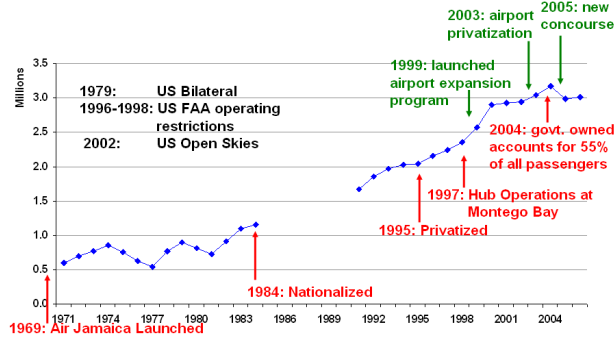
The investment into airport infrastructure reflects the emirate's goal to diversify its economy from oil-exporting activities. Other government initiatives include investment and promotion of the supporting high-quality tourism and service-oriented infrastructure. For example, in 2007, Dubai's two original free-zones housed more than 3,000 companies and Dubai Internet City and Dubai Media City are two new zones under development. Tourism infrastructure investment currently includes construction of \$3bn Palm Islands and the \$9.5bn Dubailand entertainment complex.¹¹ To encourage foreign investment, the government has general commitment to liberal and free market business policies. The Global Competitiveness Report places the UAE's competitiveness index at 37 among the 131 world countries with the United States having the highest rank of 1.²⁶ In the socio-economic sense, the UAE's economy relies heavily on the expatriate workforce. In fact, UAE nationals account for only 15% of the emirate's population, while Indian and Pakistani male workers dominate the demographics.¹¹

To summarize, the country's unique factor conditions consist of: large hydrocarbon assets; commitment to economic diversification and availability of sufficient investment funds on the part of government for infrastructure supporting business and tourism development; business-oriented institutional framework; and reliance on foreign labor. As a result of these factors, 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. In addition, since Dubai airport is a major cargo and passenger hub, the employment impact of the aviation sector plays a significant role in the regional economy. Several factors have helped establish Dubai as a transcontinental hub: favorable geographic location; availability of sufficient investment funds on the part of government for aviation infrastructure; favorable institutional framework, including liberalized air service agreements; and the first-mover advantage on the part of the Emirates Airline. However, other Middle Eastern economies are in the process of investing heavily into air transportation infrastructure to support their diversification strategies and grow the national airlines. As a result, Dubai airport will soon be competing for traffic with four other airports within a 350 km radius: the Abu Dhabi airport (7 mil pax), the low-cost and cargo-oriented airport at Sharjah (4 mil pax), the Qatar's new Doha International Airport (24 mil pax by 2009), and a new airport in Dubai World Central (120 mil pax by 2017 and the world's largest logistics hub) scheduled to begin operations in 2009.

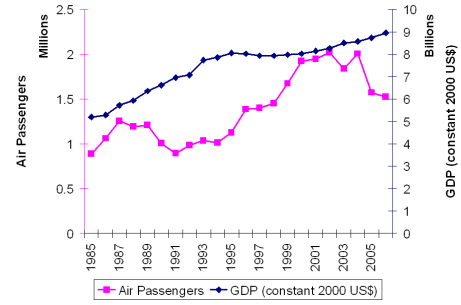
B. Jamaica

Jamaica is an island economy in the Caribbean. The country's economy is dependent on imported consumer goods and raw materials, and on foreign exchange earnings from tourism, remittances, bauxite/alumina and agricultural exports. The Jamaica's economy is dominated by the service sector which accounts for over 60% of the country's GDP and employment.⁹ The tourism industry in turn dominates the Jamaica's service sector with tourism revenues contributing 20% to the country's GDP.⁹ In addition to tourism, remittances contribute up to 20% to the GDP since at least one out of four Jamaican citizens currently lives abroad.^{9,20} The country's government supports economic diversification and encourages foreign investment in areas that earn or save foreign exchange, generate employment, and use local raw materials. However, the country'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 world countries.²⁶ This modest ranking is due to crime, inefficient government bureaucracy and poor macroeconomic conditions which hinder investment. The government also has overall commitment to public infrastructure investment. However, due to a high public debt burden, the country lacks sufficient funds for proper social and infrastructural investment levels.¹² 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, almost 80% of the people arriving to the island by airplane declare leisure as the primary purpose of their visit. Since the economy is highly dependent on tourism, most of the air transportation flows are flows of leisure passengers, particularly from the United States: U.S. nationals account for more than seventy percent of all tourist arrivals.⁷ In addition to tourists, air travel is essential for the expatriates living abroad whose remittances contribute substantially to the GDP.

Since air transportation is essential for providing access to tourists, the government considers air transport to be a catalyst for economic growth and development. Since without a national airline Jamaica's tourism



(a) 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/>.



(b) 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%.³

Figure 10: Growth in air passenger traffic and GDP for Jamaica.

industry would be dependent solely on the foreign carriers, the government currently maintains one national carrier, Air Jamaica, which operates a total of twenty-six destinations to London, Toronto, and the U.S. The government also maintains 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. Figure 10 shows that Montego Bay airport, which accounts for 60% of the air travelers, has experienced moderate growth and incremental efforts in infrastructure improvements. Overall, both the country's air transportation industry and economy have experienced an average growth rate of under 3% over the last twenty years.

The Jamaica's government supports air services liberalization as long as its airlines have a sustainable competitive position in their main markets and are not marginalized.¹⁵ For example, 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.³¹ For example, Jamaica-U.S. market has some entry and fare restrictions. These restrictions 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.³¹

To summarize, the country's economy depends heavily on exploitation of natural resources, especially tourism and bauxite. The government encourages economic diversification and foreign investment, but the country's global competitiveness ranks poorly compared to other nations. As a result, leisure (80%) and personal business (15%) passengers account for most of the air transportation arrivals to the country.³³ Since travel need is mostly generated by the consumers in the United States and other developed countries, 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. To ensure air access and sustainability of the tourism industry, the government currently maintains a national carrier and supports infrastructural and institutional changes.

C. China

China is the world's largest country with rapidly growing consumer demand and increased usage of air transportation (see Figure 11). China is a top-down state with an efficient government and good physical infrastructure which opened its economy to foreign investment in 1978. Chinese government supports foreign

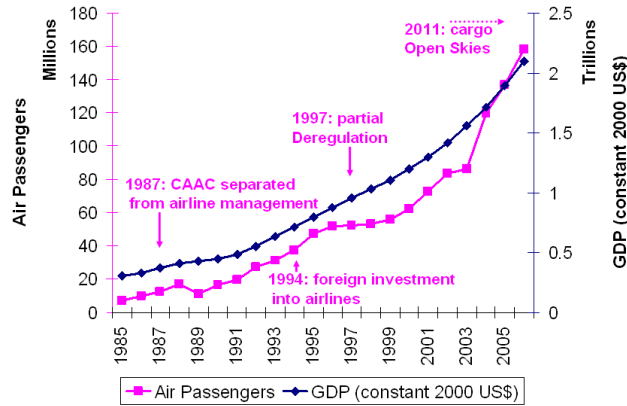


Figure 11: China: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by China's airlines and GDP were 15.8% and 9.6%.³

investment and relies on good infrastructure and manufacturing for economic growth. In 2005, goods and services exports contributed 40% to the country's GDP.³ Since undeveloped domestic capital markets force entrepreneurs to rely on the overseas capital, capital flows from the diaspora play a significant role in economic development.¹⁹ In addition to providing a source of capital, a growing number of Chinese expatriates returning home contribute knowledge and skills.¹⁹ China is ranked at 34 among the world's 131 countries by the Global Competitiveness Index.²⁶ The report lists access to financing, inefficient government bureaucracy, corruption, and policy instability as the most problematic factors for doing business in China. China has poor economic and political information dissemination making it difficult to find reliable data.

The regulatory changes in China's air transportation system reflect the general economic reforms in the country. These reforms started in the late 1970s as the economy started moving away from the centrally planned toward a market economy. As part of the changes, the Civil Aviation Administration of China was separated from the Air Force and came under the direct supervision of the state council.³⁵ Since then, deregulation, privatization and consolidation were encouraged by the government to increase operational efficiency and profitability of the airline industry. China started 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 currently the government maintains control over air fares and requires a permission for entry to and exit from a route. 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. However, research shows that China's domestic markets have, de facto, been deregulated since the government has 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 the busiest airports.³⁵

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. All-cargo flights will receive open-skies benefits in 2011. 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. This policy results in restrictive flight planning for domestic and international air routes over China. According to the International Air Transport Association, these restrictions result in delays and increased cost to the airlines due to the waste of time and fuel.

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 190 by year 2010 —

most of them regional. 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.²⁴ To promote airport development, reforms have been initiated to allow private sector involvement as well as international financing. However, institutional reforms, particularly information transparency, are still lagging behind and often do not support the larger policy objectives.³⁴ Some of the recent airport investments were spurred by the 2008 Olympic Games. For example, the country's largest airport in Beijing opened a new terminal in February 2008 which doubled its capacity to 76 million passengers.

To summarize, China's economic reforms and partial deregulation resulted in consumer market growth and development of domestic air services. Both domestic passenger and cargo traffic experienced growth over the last twenty years. While the domestic market has been effectively deregulated, international services are still operated under strict bilateral agreements with all-cargo flights scheduled to be liberalized in 2011. To accommodate the growth in demand, the government has invested into the aviation infrastructure with particular emphasis on development of regional aviation to promote economic development. 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, good infrastructure, low-cost labor, 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 sectors.

D. India

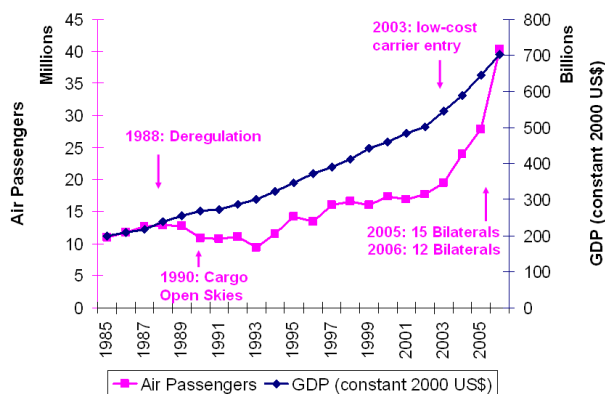


Figure 12: India: growth in air passenger traffic and GDP. Between 1985 and 2005, the average growth rates for the number of passengers carried by India's airlines and GDP were 4.7% and 6.0%.³

India has a growing economy which underwent economic liberalization reforms in 1991. The country has a democratic and inefficient government, poor infrastructure capability, institutional framework that supports information transparency and property rights, and a large pool of skilled English-speaking university graduates. India's economy relies on services and information technology with exports in goods and services contributing 23% to the GDP.³ Remittances and investment from the diaspora as well as remittances from the migrant workers in the Middle East also contribute to the GDP. The Global Competitiveness Index ranks India at 48 among the world's 131 countries.²⁶ The report lists inadequate supply of infrastructure, inefficient government bureaucracy, restrictive labor regulations, and corruption as the most problematic factors for doing business in India. In comparison to China, which encourages foreign investment, India provides little support to foreign investors while promoting indigenous entrepreneurship and innovation.¹⁹ Even though

its support of foreign investors and infrastructure levels are worse when compared to China's at the country level, India has been successful at establishing niche technological clusters around the country. For example, Software Technology Parks of India are high-tech clusters which 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. The availability of air services allows India to access markets, particularly in information technology, and foreign investors, it 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.

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.³² India's domestic traffic has experienced unprecedented growth starting in 2003 following the entry of the first low-cost carrier Air Deccan which enabled personal air travel for the growing middle-class. According to the India's Ministry of Finance website, private airlines currently account for around 60% of the domestic passenger traffic. Some of the industry's operational aspects are still regulated such as fuel hedging, staffing levels, outsourcing and ownership restrictions, such as barring investment in domestic airlines by foreign carriers.²³

The majority of the international services are regulated by bilateral air service agreements. India is gradually opening up to foreign airlines, 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 U.S. India has had an open-skies policy for air cargo since 1990.

The growth of Indian aviation industry is restricted by overcrowded airports, strained airspace infrastructure, antiquated ground handling equipment and a shortage of pilots and engineers.³⁰ India has a poor record of airport infrastructure investment in large part due to bureaucratic hurdles and hence 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. In order to promote airport development, the government aims to attract private investment into aviation infrastructure. As a result of this strategy, India is pursuing public-private partnerships to upgrade Delhi and Mumbai's airports and build new international airports in high-tech hubs Bangalore and Hyderabad.

To summarize, domestic air services deregulation was one of the reforms India undertook while liberalizing its economy in the early 1990s. Since then, private airline participation and traffic have been growing, particularly since the introduction of the low-cost carriers in 2003. India is pursuing liberalization of its international services and has had an open skies framework for air cargo since 1990. However, further traffic growth may be constrained by the aviation infrastructure and the availability of skilled personnel. 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, 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. Air passenger flows enable flows of foreign investment; enable flows of remittances, knowledge and investment from the diaspora; affect the demand conditions by giving access to markets for the firms exporting services; and enable international and domestic tourism flows.

V. Conclusions

Air transportation services and economic development interact through a series of feedback relationships. The aggregate trend analysis shows that there is a correlation between air travel and GDP, however growth rates and the mechanisms behind the interaction differ for individual economies. The interaction is defined by the economy's unique factor conditions and air transportation supply. Government plays an important role in this relationship since its policies can influence both economic and air transportation attributes through regulation and infrastructure investment. In general, the evolution of the air transportation system has three distinct stages: the start-up development phase, the growth phase, and the saturation phase. As the air

transportation system evolves, so does its interaction with an economy. In particular, as the system becomes saturated the cost of delays has an adverse affect on economic activity especially at the regional level. While many of the developing countries are still in the first two stages of air transportation system development, there are indications that some mature systems, such as the U.S. air transportation system, may be nearing the saturation phase.

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