

Button, Kenneth J.; Taylor, Samantha Y

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INTERNATIONAL AIR TRANSPORTATION AND ECONOMIC DEVELOPMENT

Kenneth Button
*School of Public Policy
George Mason University
Fairfax, VA 22030, USA
Tel: 703-993-4647
Fax: 703-993-2284
e-mail: kbutton@gmu.edu*

and

Samantha Taylor
*Senior Transport Planner
PPK Environment & Infrastructure
44 Albert Road
South Melbourne, 3205
Vic, AUSTRALIA
Telephone: +613 9697 3332
Facsimilie: +613 9697 3344*

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ABSTRACT

Legislation in 1977 and 1978 effectively deregulated the US domestic air cargo and air passenger transportation industries. International air transportation, largely as the result of the 'Open Skies' initiative from 1979 has also gradually been liberalized but progress has been geographically and temporally uneven. This study is concerned with extending the Open Skies concept and in accessing the benefits to the US economy of removing the remaining impediments to the provision of free market services involving, in particular, the full transatlantic market. It initially reviews some of the previous work that has looked at links between industrial location and the quality of international air transportation. It develops a modeling framework to examine the implications of further liberalization on the economies of US regions that currently have limited international services. The work involves both a macro analysis of the impact of European international services for 41 Metropolitan Standard Areas and a micro-analysis looking at the developments over time at a smaller number of airports and their surrounding regions.

INTRODUCTION

*A major criterion for measuring the success of our air transportation system should be our ability to use air travel as a competitive advantage in a global economy. The ability of Americans to transport their goods, services and themselves to markets wherever they exit should be an important goal of US public and foreign policy. (National Commission to Ensure a Strong Competitive Airline Industry, 1993)*¹

As exemplified by the above quote from the National Commission to Ensure a Strong Competitive Airline Industry, international air transportation is not only a major industry in its own right but more importantly it is of considerable significance as an input into a rapidly growing international and global economy.² International air transportation is an essential ingredient for the success of tourism in many countries and regions. It is also an important input into the successful development of many, non-leisure-based industries where interpersonal communications are important. It is not only passenger air transportation that is vital to many of these latter industries. Many such firms also rely on a range of air freight services to provide quality service to customers and to operate just-in-time production management.

World trade has historically been the subject of regulation and control by participants. Trade in international air transportation services has been no exception in this. Nations often wish to protect their own commercial air fleet for reasons of national security but the motivation has also frequently been one of economic protectionism. In recent years, there has been a movement away from this as blocks of nations, such as those in the European Union (Button *et al.*, 1998)³, have developed multilateral free markets between themselves. Further, the structure of bilateral agreements between countries governing the terms on which air services are traded have in many cases been liberalized.

¹ At about the same time, but on the other side of the Atlantic, the European Union's, Comité des Sages for Air Transport (1994) was making similar pronouncements.

² The US Department of Transportation Office of Airline Information provides periodic assessments of the sector. The latest was in US Department of Transportation Office of Airline Information (1995).

³ There have also been more limited attempts at liberalization within the APECC states and within South America.

The US, with its Open Skies policy has been at the forefront of this latter trend. A number of barriers to free markets in air transportation, however, remain. One of these is the only partial removal of institutional constraints to free trade in international air transportation. The US's Open Skies policy of the post 1979 era has, for example, led to considerably more openness in many international markets but controls still remain over significant parts of the global network.

This was recognized by the National Commission when it pointed to the existing bilateral system of air service agreements as being, "...no longer sound or sufficiently growth-orientated in the global trade environment". The issue extends beyond this, and simply negotiating more Open Skies agreements, although desirable in themselves, provide only part of the solution. For air transportation to be truly global and for the skies to be cleared of market impediments issues such as allowing full cabotage, the expansion of foreign ownership rights, and less restricted access to many airports still need to be addressed in many countries.

The aim of this paper is to examine some of the benefits that US air transport enjoys from having liberal international air transportation and, hence, the potential gains from further liberalization. It focuses on the economic benefits (largely in terms of employment generation) that communities can enjoy from having direct access to international air services. The airports at the core of the study are medium sized international airports although for comparative purposes it is also necessary to embrace some smaller and larger airports in the analysis. The essential hypothesis examined is that the introduction of international services can benefit the economy of an area, that there are accelerated benefits from having a wider range of international services but that that these benefits of additional services are largely exhausted when the number of international destinations served becomes very large.

To make the work tractable, the study primarily concerns itself with North Atlantic services. This is because it is a large and important market and one where significant institutional constraints still remain. It is also an air transportation market that serves an important link between two major trading blocs, the European Union and the North American Free Trade Area. The empirical analysis looks at a range of US airports and makes use of a wide variety of data sources to normalize for factors other than air service availability that affect employment growth in any particular area. It concentrates on employment in industrial categories where there are location choices (e.g., not extractive industries) potentially influenced by the quality of local transportation services. It uses the shorthand term 'new economy' to describe these industries although in reality they embody a much wider range of industries than those considered at the cutting edge of the new economy. The analysis uses employment as the key economic variable of interest because it is a relatively robust and measurable indicator of a region's economic success. International services are defined largely in terms of European destinations served by direct flights but other supplementary indicators will also be used, for example to indicate quality of service and network effects.

THE INTERNATIONAL REGULATORY REGIME

The modern structure of international air transportation controls can be traced back to the failure in 1944 of the Allied powers at the Chicago Convention to reach an agreement on how the post Second World War air transportation system should operate. The subsequent structure of bilateral agreements that emerged as the *de facto* institutional framework for international air transportation has taken time to change and to begin to meet the contemporary needs of industry and travelers.

At the 1944 Chicago meeting there were conflicting views on how the international market should be regulated. Discussion at the Convention was dominated by governments claiming absolute sovereignty over the airspace above their territories. Opinions ranged from having a single, global carrier under a single authority to a completely free, competitive market. The hope was that those signing would grant to all other signatories freedom of access to this airspace and to airports beneath them. To this end certain freedoms of the skies were identified.⁴

⁴ The 'Freedoms of the Skies' are:

The Convention also gave rise to a United Nations agency (the ICAO) that is largely concerned with safety, technical standards, the collection of statistical data, etc., rather than detailed economic regulation although it has become more involved in this in recent years. It did not make much progress on traffic rights because the commercially important third, fourth and fifth freedoms were not, with some minor exceptions, settled on the hoped for multilateral basis. Instead bilateral deals were brokered. This gave rise to a network of bilateral air services agreements – e.g., the UK and US concluded the first Bermuda Agreement in 1946. Under these agreements two countries agreed upon the gateway airports through which each could enter the other's territory, restricted the entry of airlines to specific routes and shared out the traffic. They were generally restrictive and often allowed only one airline from each country to operate a route. This also meant that fifth freedom operators could only fly on the routes involved if the authorities at both ends agreed. Some 1600 such bilateral air service agreements had emerged by the mid-1970s.

The matter of airfares was in the first instance determined within the ambit of another body – IATA – the international carriers association. It operated a series of conferences where airlines discussed and coordinated fares, the agreements being subsequently ratified by governments. At a later stage membership of IATA did not require airlines to be bound by conference fare decisions and in some sectors (e.g., North Atlantic routes) fixed rates were replaced by zones of reasonableness.

This broad structure still remains in place although there have been important changes. The nature of the bilateral system has altered considerably over the years. As seen in the next chapter, a multilateral system has been initiated within the boundaries of the European Union. The US has, since 1979, pursued a policy of adoption extremely liberal 'Open Skies' bilateral air service agreements whenever other countries will accepted it. In some instances, this policy has been more than passive and US strategy has been to proactively pursue this approach through such tactics as liberalizing agreements with other states competing with the reticent partner.⁵

By 1982, the US had signed 23 liberal bilateral air service agreements, mainly with smaller nations, in pursuit of its Open Skies agenda. This was followed in the 1990s by a major new initiative, with a standard offer of Open Skies 'tenplate' agreements to any who wished to sign, and by a burst of agreements mainly with European states (Table 1 lists the main ones). At the end of 2001 there will be over 45 such agreements. Some of the major Open Skies bilateral arrangements, notably with the Netherlands and Germany, also coincided in agreements on the formation of strategic alliances (e.g., between KLM and Northwest Airlines and between Lufthansa and United Air Lines.)

The 1995 agreement with Canada was not strictly an Open Skies arrangement but has, in a staged manner, opened up trade in air services between the US and Canada. The agreement led to a

1st freedom. The right of an airline of one country to fly over the territory of another country without landing.

2nd freedom. The right of an airline of one country to land in another country for non-traffic reasons, such as maintenance or refueling, while en route to another country.

3rd freedom. The right of an airline of one country to carry traffic from its country of registry to another country

4th freedom. The right of an airline of one country to carry traffic from another country to its own country of registry.

5th freedom. The right of an airline of one country to carry traffic between two countries outside of its own country of registry as long as the flight originates or terminates in its own country of registry

6th freedom. The right of an airline of one country to carry traffic between two foreign countries via its own country of registry. this is a combination of third and fourth freedoms.

7th freedom. The right of an airline to operate stand-alone services entirely outside the territory of its home state, to carry traffic between two foreign states.

8th freedom. The right of an airline to carry traffic between two points within the territory of a foreign state (cabotage).

⁵ In a few instances the agreements have, at least for periods, become more restrictive. Bermuda II in 1977 with the UK is a case in point and for a period in the 1990s the bilateral with France was reduced to a reciprocity agreement.

significant increase in transborder traffic, which was up by 10% to 14.3 million passengers in its first year as seat capacity rose by 30%. Consumers benefited from 102 new transborder routes that offered many cities their first nonstop transborder services. The agreement also enabled US airlines to develop integrated networks across the border, such as those established by American Airlines and Canadian International. Similarly, there have recently been agreed more liberal bilateral ASAs with Japan and France, although again outside of the Open Skies framework.

Partly as a result of these reforms and stimulated by the growth in the global economy, international air transportation is growing particularly rapidly. US traffic grew from 93.4 million passengers in 1993 to 126.1 million in 1998 within the current regulatory regime. The number of passengers on large US and foreign flag carriers traveling to or from the US is expected by the Federal Aviation Administration to increase to 137.6 million in 2000, a 4.2% increase over 1999. This growth is expected to continue at a 5.1% rate each year reaching 239.4 million in 2011. Over the 12-year forecast period, growth is expected to be the strongest in Latin American and Pacific markets, growing by 6.1 and 6.0%, respectively. US air carrier international enplanements are forecast to increase to 55.6 million in 2000 and grow by 5.5% a year, reaching 101.7 million in 2011.

Table 1. United States' Open Sky air service agreements

1992	1995	1996	1997	1998
Netherlands	Austria	Germany*	Singapore*	Japan
	Belgium	Jordan	Malaysia*	France*
	Denmark		Chinese Taipei	Korea*
	Finland		Chile	
	Luxembourg		Costa Rica	
	Norway		Nicaragua	
	Sweden		Honduras	
	Switzerland		El Salvador	
	Czech Republic	Ree	Guatemala	
	Canada		Panama	
			Bruni	

* Progressive implementation of agreements and/or specific cargo features. Phase-in provisions of these ASAs may differ from standard Open Sky benchmarks.

The market, however, is not as flexible as it might be and there are a number of constraints that still act to impede its full efficiency. Many bilateral agreements are still restrictive and, although such actions on the part of airlines as the establishment of alliances can temper their adverse effects, prevent the potential of air transportation being realised.

Another area that poses particular problems concerns the interface between international and domestic air transport networks. While there has been deregulation within many countries and often between countries but the ability of non-national airlines to operate in other countries markets (cabotage) is still often severely constrained.⁶ The same holds for owning foreign airlines; most countries have a limit on the amount of foreign investment and also on the control that foreign investors can exercise over an airline.

This is a particular issue with regard to large domestic markets such as the US where non-US carriers cannot operate and where there are foreign ownership restrictions. From an efficiency perspective, these constraints pose questions regarding the degree to which this lack of internal competition

⁶ The arguments for removing cabotage and ownership controls extend beyond those of stimulating local economic development through greater freedom of international air transportation markets, see Button (1998).

affects the efficiency of the US domestic air market.⁷ From a non-economic perspective, there are national security issues surrounding the need for the US to have control over its commercial air fleet at times of emergency.⁸ There has also been an issue in negotiating particular bilateral air service agreements. Issues of airport access have posed problems in US/UK negotiations, for example, because the existing agreement has limited US access to Heathrow Airport to just two US carriers (United and American). There are also labor, environmental and safety elements involved in the debate.

Where tight economic regulation continues, information is needed in the international horse-trading that is an integral part of the bilateral system of air traffic agreements. Where there are efforts to liberalize the regulatory structure, statistics are needed for private and government sector uses. Airlines, airport authorities, and suppliers of aircraft and other material inputs require quantitative information to make for effective management decision-making and to permit longer-term planning. Labor unions require data to effectively negotiate with employers. Government needs to monitor the state of the industry, to enforce general regulations over such things as anti-trust behavior. Increasingly data are being demanded on the wider, social implications of air transport as matters of safety and environmental damage attract public attention. Finally, academics require reliable and consistent data to perform basic analytical as well as policy-relevant research. The aim here is relatively modest. It seeks to look at the quantitative implications of expanding international air services on local economies in the US.⁹

THE OVERALL ECONOMIC GAINS FROM FREER TRADE IN AIR TRANSPORTATION SERVICES

The economic case for removing the restrictions on international air transportation is identical to those that emanate from freer trade *per se*. The arguments are not new and are some of the most robust in modern economics. At the simplest level, freer trade in any activity, including air transportation, allows customers more choice and ensures that the most efficient producers deliver goods and services. The argument can be seen in diagrammatic terms in Figure 1.

The efficient price for international air transportation established in a competitive, international environment would be C – the natural, competition based international cost of buying the service. The constraints imposed by restrictive bilateral air service agreements, regulations over foreign ownership, the lack of cabotage rights and so forth, however, add to this cost. The result is that US consumers of air transport are confronted with prices of $(C + T)$. The result is that there are less services consumed and that fares are higher.¹⁰ There is an overall loss to society equal to the triangular area **B** in the diagram. Whilst area **A** is not in economic terms a loss but is seen as a transfer of benefits from consumers (who have to pay higher fares under the restrictive regime) to airlines some of this may also reflect lower efficiency on the part of protected carriers.

⁷ The actual penetration of US domestic markets by foreign carriers is unlikely to be large since the productivity of US airlines tends to be significantly higher than foreign carriers (Oum nad Yu, 1998). The issue is rather more the effect of potential competition in a market where there are currently relatively few suppliers.

⁸ The CRAF program requires volunteer airlines to provide aircraft and crews at times of emergency in return for dedicated contract work from the US government.

⁹ The paper is not concerned with suggesting ways in which international air transportation markets may be further liberalized. The Organisation for Economic Cooperation and Development (1997) has offered a number of general suggestions and outlined alternatives. The Association of European Airlines (1999) proposes a more detailed way forward on the North Atlantic with the creation of what would essentially be a free trade area in air transportation services. The US hosted a major anniversary conference in 1999 in Chicago to look at possible ways of further liberalizing international markets.

¹⁰ Strictly, while the US carriers may be more cost effective than overseas competitors, the inability to provide a full range of services inevitably means that they must ration the seats that are available through a fare premium above that which would pertain in a truly competitive environment. Also the lack of competition between airlines reduces incentives to keep fares to a minimum. Finally, the diagram is couched in terms of fares, perhaps more germane is the issue of 'generalized costs' that embody time and schedule convenience considerations. The generalized cost to an international business traveler tied to the schedule of a limited number of airlines is likely to be higher than when there is more service choice.

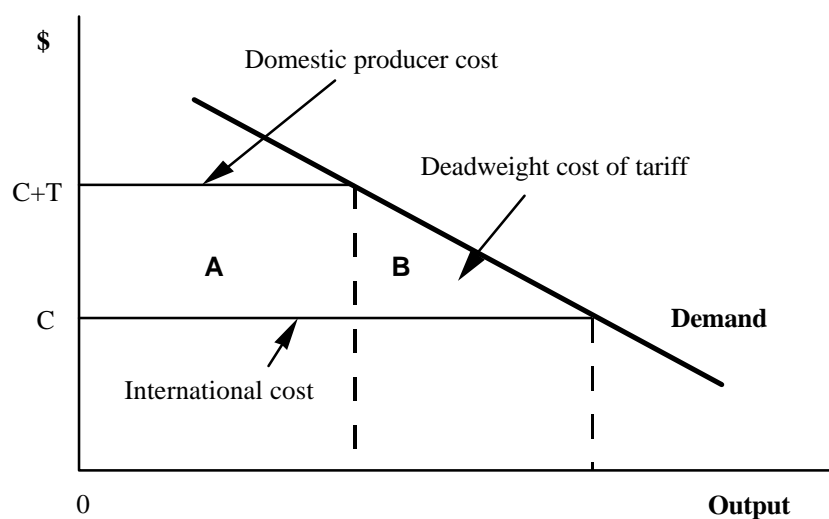


Figure 1. The benefits of freer international air services

The difficulty comes in trying to place numbers on these various elements.¹¹ The challenge is to generate credible estimates of the likely source, magnitude and distribution of incremental costs and benefits that would flow from negotiated changes in bilateral agreements or their removal. Some of these benefits are, in principle, directly quantifiable. These include the incremental economic costs and benefits resulting from policy change, e.g.,

- improvements in economic efficiency
- fiscal objectives: tax revenues and expenditures
- trade exports and imports and the balance of trade
- employment objectives: number and quality of jobs
- development of tourism and related industries
- cost of travel to the business and tourist client.

The difficulty with itemizing effects in this way is that it is virtually impossible to avoid double counting and with it the potential of overestimating the gains from liberalizing the international institutions. Taking individual case studies of airports and then applying conventional multipliers to gain insights into the employment effects of additional international services is another alternative. The problem is that of determining appropriate multipliers for each airport and in holding other, non-air transportation effects constant.

One method of trying to capture some of these effects is by looking at fare changes. The initial thrust of the Open Skies policy in 1979 and prior *de facto* initiatives in stimulating the introduction of more liberal bilateral agreements by the US between 1976 and 1981 were estimated by Martin Dresner and Michael Tretheway (1992) to have generated as much as \$325 million savings in North Atlantic fares alone in 1981. There are severe data problems in this approach. More global analysis was limited by lack of complete data from less developed countries. Even the routes that were included could only be assessed in terms of either the full economy fare or the lowest minimum fare. In addition, it ignores what economists call the consumer surplus benefits that exceed fare savings.¹² These embody the difference between how much individuals would have been willing to pay for a flight and what they actually pay following market liberalization.

¹¹ The main arguments largely in the context of international services to the Washington DC region are articulated by Schefer and Gordon (1999).

¹² A more comprehensive study of removing the international impediments to a free market in air transport within the European Union has produced a figure of over \$600 million (Schipper *et al.*, 2000).

‘NEW ECONOMY EMPLOYMENT’ AND INTERNATIONAL AIR SERVICES

Measuring economic performance at the national level is difficult and poses even greater problems at lower levels of spatial disaggregation. There are issues of what constitutes economic progress and whether indicators such as gross national product are sufficiently comprehensive. In terms of economic growth policy options there is also the issue that some types of industry can simply not be developed in some regions, or only at some very high costs. Extractive mineral industries are perhaps most obviously spatially fixed, but many types of heavy industrial activity are not readily mobile in response to changes in transportation provision.

There is also evidence that, whilst air transportation is used by all categories of business, it has become particularly important for those engaged in what we term new economy activities. These potentially geographically mobile types of industry have been estimated to account for some 9.6% of the US labor force in 1998 (3.6 million more than a decade earlier). This type of industry is not evenly spread across the country. About 90% of this employment was in metropolitan areas with 70% of the total in 50 of the 321 Metropolitan Standard Areas.

It has been estimated by Simat, Helliesen and Eichner Inc. that those employed in the new economy sectors fly over 1.6 times as much as those in traditional industries. Companies in this general area conduct activities requiring considerable inter-personal contacts. These contacts are only possible with high quality transport. To examine the benefits for any areas in terms of job creation in these more dynamic sectors, the analysis, therefore, examines trends in new economy employment in large US cities as it is linked to the provision of international air transportation services.

Defining new economy industries is not, however, simple. Here a revised-version of the well tested Armington index is deployed.¹³ This is a fairly broad definition of new economy employment but has been widely used in industrial analysis. The index looks at clusterings of new economy employment. In consequence, it avoids the oft-distorted picture that can be drawn when reference is made to the role of a single dominant new economy company in a region. The index is also used in the subsequent analysis of international air transportation services. The sectors that make up the index are listed in Appendix I.

The implications of a new services are seldom looked at in their entity. Instead, they are usually limited to a particular type of impact of the forms outlined below or a combination of some of these. These impacts can be considered in terms of:

Primary Effects. These are the direct and immediate benefits to the region of the creation of new services or the expansion of existing services. They may include the need for physical changes at the airport extend to the benefits to the region of the wages and other incomes the associated workers and companies subsequent spend in the area. These are clear gains to the local community and the local economy but are short term and usually rather limited in their order of magnitude. It is a once for all effect.

Secondary Effects. These are longer term effects and are associated with the local economic benefits of operating the international service – the employment involved in handling the aircraft and passengers, in transporting people and cargo to and from the terminal and so on. There are also indirect effects due to the on-going flow of income that the airport’s operation puts into the local economy. These secondary effects can be extremely important to a local economy in terms of employment, income and, for local government, taxation revenue. The actual size of the secondary effect will vary between airports dependent upon the nature of their operations.

¹³ The original index was developed in Armington (1986). The modified form adopted here is taken from, R. Stough et al., (1996) The indices are based on the US Bureau of Census, *County Business Patterns* data.

Tertiary Effects. Tertiary effects stem from the stimulus enjoyed by a local economy as the result of firms and individuals having international air transport services at their disposal. While most forms of business activity now involve considerable use of transportation, new economy companies make particular use of air transportation. Companies in this general area conduct activities requiring considerable inter-personal contacts. These contacts are only possible with high quality transport. From a local development perspective it is often these types of firm that form the basis for economic growth because they are usually geographically mobile and represent a major growth sector.

Perpetuity Effects There is an increasingly widely accepted school of thought arguing that economic growth, once started in a region, becomes self-sustaining and may accelerate.¹⁴ Linked to this, there is also empirical evidence that infrastructure investment can act as a catalyst for higher economic growth in an area; essentially it can act as a kick-start mechanism (Aschauer, 1990). The major new air services may act, therefore, to set in progress a much larger and longer term development process in a region. This perpetuity effect is in addition to the tertiary effects that relate to the immediate migration of firms to an area with good air transport services. It is longer term and affects the dynamics of an area. By initially attracting undertakings to an area in sufficient numbers, airport service development can lead to the crossing of important thresholds in terms of economies of scale, scope and density. In particular in the context of new economy activities, an area can acquire a vital knowledge base that fosters local research and development and makes the region quasi-independent of others. The regional economy can feed on this to further its new economy activities and hence to accelerate its growth.

A limited amount of prior empirical work has been conducted on the links between new economy employment and the availability of international air transportation services. Much of this has involved interviews with local business. The findings generally indicate that these types of service can be influential in affecting location decisions of employers.¹⁵ An early study in Atlanta, for example, involved surveying 264 foreign based establishments, found that the availability of direct international services was the third most important factor in location decisions of these firms (Atlanta Chamber of Commerce, 1988a). A subsequent study showed that the number of foreign firms locating in the region from a particular country grew significantly after the introduction of a non-stop service (Atlanta Chamber of Commerce, 1988b)

The types of findings are fairly consistent across countries. For example, work by Ernst and Young, looking at location decisions of 57 companies in Europe making decisions regarding the location of a manufacturing plant found that the air transportation network was the third most important factor in the decision process. The study concluded, however, that air services were much more important for service sector companies. Similarly, the Amsterdam Chamber of Commerce found that the availability of an airport was one of five key factors considered in company relocation decisions. A survey of firms around Zurich found that 34% considered the airport as 'very important' and 38% as important as a location factor. The Loudon Chamber of Commerce (in Virginia) found that airport/freeway access was important to 68% of firms. A study of small business firms in the Washington that were engaged in export activities found the availability of easy access to international air transportation one of the six most important factors in their success (Lin Salem, 2000).

A difficulty with this interview approach, however, is to ensure that those questioned are in a position to provide a genuine and educated comment and to couch questions in a neutral way so that respondents are not led in their reaction. Respondents also often have an incentive to support the view of a positive link between their actions and the nature of local air services because they have no direct costs to bear if services are further expanded but only gains are to be had.

¹⁴ This is known as 'endogenous growth theory'.

¹⁵ Evidence from earlier studies indicates that good transport is a necessary but not always a sufficient attribute to attract new economy industry to an area (Button, 1987).

An alternative is to use numerical methods and to focus purely on the more direct effects of air services on a local economy, namely those associated with the airline service *per se* and the multiplier implications of this for the local economy. This was the basic approach underlying a study looking at ten US airports prepared for USA-BIAS (Kurth and Co., 1990). It looked at the implications of a service to Tokyo and one to London. The latter, involving a Boeing 767 operation carrying 100,000 passengers, was calculated to involve direct annual expenditure by the airline (excluding fuel) of \$2.9 million (1990 prices) and expenditure by incoming tourists of \$30.7 million. Applying parameters from an earlier study of Houston-Tokyo services would indicate that a service to London would generate an annual increase in exports of \$84 million (University of Houston, 1988).

A study by the UK's Civil Aviation Authority (1994) looked at the importance of new international services involving airports outside of London. In terms of North Atlantic services, it considered the economic implications of new services between Birmingham and New York and between Manchester and Atlanta. The study essentially used multipliers and found that, after allowing for traffic diversion effects as well as traffic creation, the New York route would generate some £1 million in passenger benefits and the Atlanta service £1.2 million per annum.

A study of hub airports in the US, which embrace the international gateways, found a significant positive correlation between new economy employment and hubbing (Button and Lall, 1999). The analysis compared the situation at three non-hub airports (Nashville¹⁶, Indianapolis and Milwaukee) with the major airline hubs of Cincinnati (which is a Delta Air Lines hub) and Pittsburgh (which is a US Airways hub) and showed a positive correlation between hubs and development. Additional analysis confirmed that the direction of causation was from air service availability to employment rather than the reverse. One factor that distinguishes the hub airports discussed in this study is the extent to which they serve the international market – Nashville served 2 international destinations; Indianapolis, 6, and Milwaukee, 1 whilst Cincinnati and Pittsburgh both served 8.

The general picture regarding links between the clustering of new economy employment in the US and the quality of international air service can be seen in Figure 2. This provides a cross plot of new economy employment in 41 major US metropolitan areas in 1996 and the number of international passengers using the nearest airport. The positive correlation, albeit non-linear, is clear although in practice there is a need to look at this type of data in more depth. There are obviously other factors that account for the differing employment levels in the regions and these must be allowed for to extract the 'pure' international air service effects.¹⁷

¹⁶ For part of the period Nashville was a secondary American Airlines hub and this fact was allowed for in the subsequent statistical analysis.

¹⁷ It is not only the number of people using international air transport that seems to affect the level of local new economy employment, it is also the number of destinations that are being served.

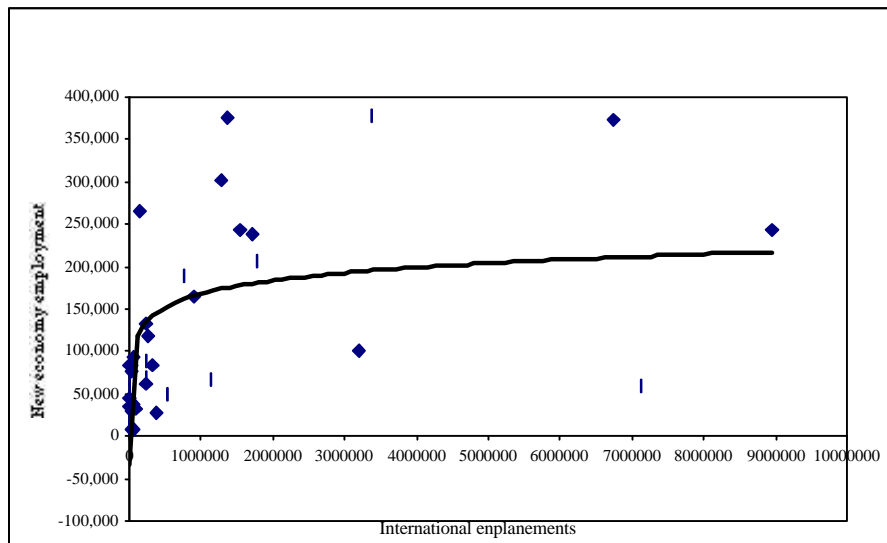


Figure 2. New economy employment and international air passenger traffic at major US airports, 1996.

THE MODELLING FRAMEWORK

The analysis of the role of international air transportation may play in stimulating regional economic development has been paid some attention in the past, most notably in the context of attracting tourism and in particular island economies. It is also an element that is sometimes considered when individual airports seek to expand or modify their physical capabilities. The link between the regulation of international air services and economic development, however, is somewhat less well researched despite its relevance for such things as air service agreement negotiations.¹⁸

The benefits of having an airport in an area would logically be greater the more services it offers and the wider the range of destinations that can be accessed. This applies as much to international services as to domestic services. At the extreme adding an additional service or destination to an airport that already has extensive services would seem unlikely to yield a significant social return. Not only are there already many destinations served but in a commercial market, airlines will provide flights to the most important destinations first and then move to offer services to less important markets. The intuition is that the relationship between the availability of international services and economic growth in any area is non-linear. This is consistent with established theories concerning such things as product life-cycles.

The non-linear relationship between the availability of international air services and the growth of local economies would logically appear to follow a broadly sigmoid (S-shaped) pattern of the form seen in Figure 3. The S-shaped curve can take a variety of detailed forms – e.g., it may be symmetrical or not – and in practice only part of it may be relevant. The concept is, however, a useful one intellectually and it has in other contexts proved very flexible in its application.¹⁹

¹⁸ Indeed the lack of such analysis is implicit in some recent studies by the US General Accounting Office (1995) ‘Data problems handicap DOT’s efforts to place a value upon the access rights to the US market that it relinquishes to foreign governments in exchange for improved access or code-sharing’.

¹⁹ A standard formulation of the type of curve that could be used in this type of work is:

$$\text{Log}\{HT/(S - HT)\} = f(x_1, x_2, \dots, x_n)$$

Where HT is the proportion of new economy employees in each area, Saturation is the assumed maximum level of new economy employment as a proportion of total employment, and x represents a vector of explanatory variables that embraces, besides other things the level of international air transportation services offered by the

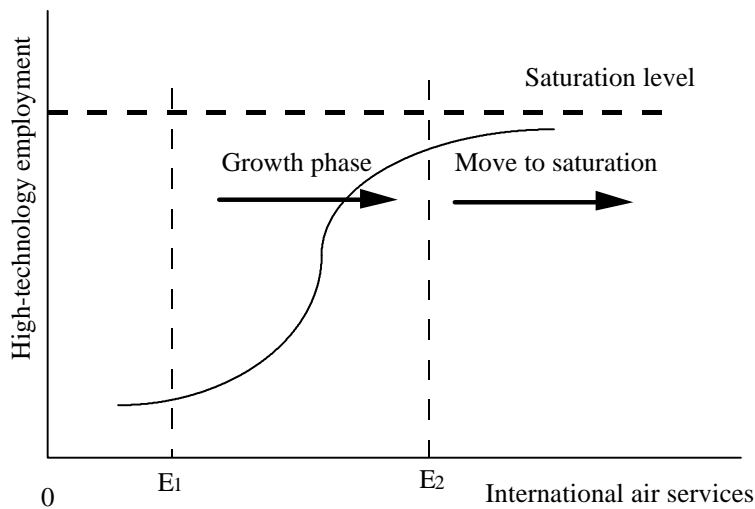


Figure 3. New economy employment and international air transport services in a region.

In practical terms, however, its strict application in the context of the relationship between economic development and international air transportation poses some serious practical problems. To ascertain the full shape of the sigmoid growth path it is important to have an indication of the ultimate saturation level of new economy employment that may be anticipated in an area. This is difficult to determine and is likely to vary considerably according to local conditions. There are also technical problems in determining the parameters that create to sigmoid growth path. More germane is the fact that the path is unlikely to be symmetrical. A relatively small number of international services would seem to have a very large impact on a local economy. This may be partly directly related to the air services offered but may also reflect a psychological view that the area had somehow gone through a sea change in terms of its transportation facilities.

For this reason a simpler form of model that just embraces the growth and saturation phases seen in Figure 5 can be applied. This can be done without the need for any prior specification of a saturation level of new economy employment using a logarithmic or semi-logarithm model formulation. The model specification adopted for this purpose is essentially a semi-logarithmic model. In the estimation process a number of alternative specifications along these lines were tried because there was no prior knowledge of the exact form of the relationship once background effects had been allowed for.

THE DATA

The quantitative analysis makes use of US Department of Transportation, Bureau of Transportation Statistics data. It takes 41 US airports of differing size and from various parts of the country.²⁰ The airports were selected as large and medium size airports. The larger airports are included to allow the

local airport. These last set of variable are designed to allow the specific effects of international air transportation to be isolated from other factors that influence the location and growth of new economy employment. Calculations were performed on the data used in this study to assess the possible saturation level of new economy employment using 1994 and 1996 data and a figure of 23.3% was derived which would seem intuitively reasonable.

²⁰ The airports are: Allentown, Albany-Schenectady-Troy, Anchorage, Atlanta, Boston, Baltimore, Cleveland-Lorain-Elyria, Charlotte-Gastonia-Rock Hill, Columbus, Denver, Dallas, Des Moines, Detroit, Fort Lauderdale, Washington, DC, Wichita, Indianapolis, New York, Las Vegas, Los Angeles-Long Beach, Kansas City, Orlando, Harrisburg-Lebanon-Carlisle, Memphis, Miami, Milwaukee-Waukesha, Minneapolis-St. Paul, New Orleans, Oklahoma City, Chicago, Norfolk-Virginia Beach-Newport News, Richmond-Petersburg, Reno, Savannah, Seattle-Bellevue-Everett, San Francisco, San Jose, Salt Lake City-Ogden, St. Louis, Tampa-St. Petersburg-Clearwater, Tulsa.

hypothesis regarding the diminishing marginal gains from additional International air transportation services to be tested. Most of the airports offer international services although not all to Europe (or to the European Union area). The aggregate analysis is largely based on the entire set of airports but the subsequent case study analysis looks only at a sub-set to allow more detailed, evaluation through time.

The regions that the airports serve extend across the US as seen in Figure 4 that provides an indication of the MSA in which they are located. The areas in which they are located also represent a range of geographical types with diversity in their economic compositions.

The passenger enplanement data and destinations served data used in the analysis are from the census of the traffic onboard a flight segment or a market, as reported on Form 41 Schedule T-100 (for U.S. air carriers) or Form T-100f (for foreign air carriers). Only files with recorded flights in the period were used. The requirements for the reported data are included in the basic regulations in 14 CFR Part 241 *Uniform System of Accounts and Reports for Large Certificated Air Carriers* for the U.S. air carriers and 14 CFR Part 217 for the foreign air carriers.²¹

²¹ The T-100 program was instituted by the US Department of Transportation effective January 1, 1990. It covers traffic reports of foreign airlines operating in the US international markets and traffic reports of the domestic and international operations of U.S. airlines. The airlines submit these reports monthly to the Department's Office of Airline Information (OAI) of the Research and Special Programs Administration (RSPA). OAI edits and processes the statistics. The Rules governing disclosure of international T-100 statistics are strict and provide that specific airline data can not be released for three years. Summary data can be released prior to the three-year period provided there are three or more carriers operating in a particular market. Accordingly, where fewer than three airlines are in the market, traffic volume is not disclosed. Data based on T-100 Statistics are distinct from US international air passenger statistics derived from the Immigration and Naturalization Service (INS) I-92 data. For a number of years, the Department issued both a monthly press release (similar in format to this report) and a publication, *United States International Air Travel Statistics*, monthly, quarterly, and annually, all based on INS statistics. The procession of I-92 statistics was discontinued due to budgetary considerations for a while after the April 1991 report. The processing of I-92 statistics has now resumed, as well as the publication the *United States International Air Travel Statistics*. This new series, based on T-100 data, is presented to provide the public with additional information about US international air transportation. While the I-92 and T-100 data systems include information regarding US international aviation traffic, their volumes may differ. This result is not unusual since the two series are collected differently and have some different data elements and somewhat dissimilar scopes.

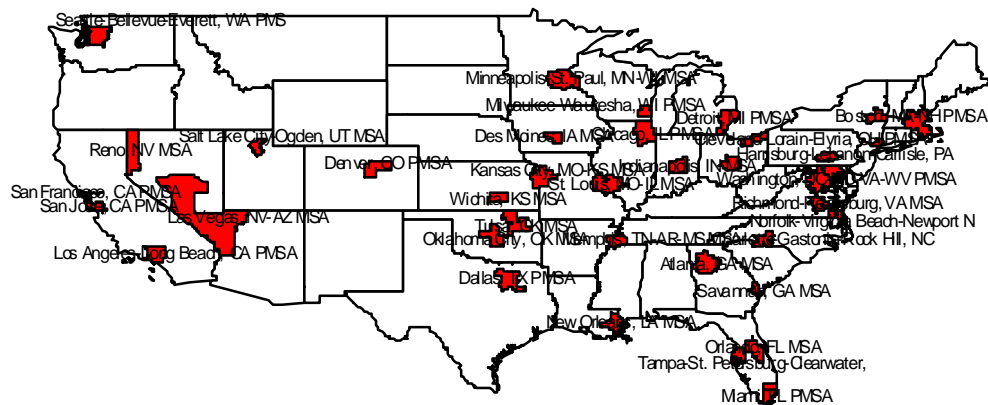


Figure 6. The regions included in the study.

AGGREGATE ANALYSIS

The method of analysis was that of standard ordinary least-squares, multiple regression which was used to determine parameters for a non-linear model linking new economy employment in a region to a set of parameters including the availability of European air services and their utilization. Europe in this context is taken to be the 15 European Union nations²² together with Norway and Switzerland. Information regarding other countries is available but these 17 nations account for the majority of transatlantic traffic and provide a significant business base that allows interaction with the higher technology companies in the US.

The effects of international air transportation on the spatial dispersion of new economy employment are captured in two ways. To reflect the scale of services that are offered by airports and the range of destinations served, variables reflecting both these potential effects are included. The number of destinations served is included directly and the scale of service is proxied by onboard passengers.²³ Since there is an inevitable time lag between the provision of a new air service and its full integration into the economic parameters of a region, the analysis assumes a two year adjustment period. Hence, the employment structure in each region in 1996 is seen as influenced by, amongst other things, the international air transportation services available in 1994.²⁴ Further, since the influence of the quality of European air services is likely to decline the further west a US city is located, an attempt to

²² Italy, Germany, France, the Netherlands, Belgium, Luxembourg, the United Kingdom, Ireland, Denmark, Greece, Portugal, Spain, Sweden, Finland and Austria.

²³ Ideally, seats would be a more direct measure but given modern yield management techniques and the ability of airlines to capture a considerable amount of consumer surplus via dynamic price discrimination, passengers serve as a reasonable proxy.

²⁴ Estimates without a lag produce broadly similar results to those with a lag reflecting the relative short time period covered.

capture this distance effect is made by including a time-zone variable. One would anticipate that this should take a negative sign.

Mobile industries elect to site themselves, and remain in particular location, for a variety of commercial reasons, of which, as we have seen, international transportation considerations are but one.²⁵ To allow for this, and to be able to isolate the air transportation effect, the analysis incorporates a range of other variables that seem intuitively important and have sometimes been found important in other studies of economic development.

Since there is evidence from earlier studies on airline hubbing that high-quality air services are important *per se*, the analysis includes the total number of enplanements to reflect this and to capture the importance of domestic services as well as European international services.

There is evidence from a variety of applied economic studies that successful metropolitan areas, regions or cities attract further economic activity – there is a cumulative and circular effect. The reasons for this are not yet fully understood but seem to be strongly related to the ability of such areas to continually generate new ideas and retain a powerful competitive advantage²⁶ To explore for this, any cumulative effect is captured in the model by a variable reflecting per capita income for each region.

The size of a region is also important. It is to be expected that new economy activity is more likely to be attracted to larger regions with a significant population and a fairly large local market than to smaller, sparsely populated areas. Indeed, some of the evidence cited earlier supports such a trend. This is because such areas offer a larger pool of potentially suitable labor and because it also provides a larger local market for the goods and services produced. Unemployment has also often been considered a factor affecting industrial activity.

The exact direction of causation is, though, not clear. In the past, high levels of unemployment were generally seen as an attraction for firms to locate or expand but this is less clear to-day. A tight labor market is now often seen to reflect a strong regional economy with the type of labor that is attractive to mobile firms. An effort to capture any such effect is through the incorporation of unemployment benefits payments in the model.

Non-transportation factors are also likely to include the level of military activity in a region. The location of military establishments is not based purely on commercial criteria but its presence does influence the composition of the local economy. The civil sector enjoys the spill-over effects of having military employment in adjacent areas both because of income generation it creates and, more important in this context, because of direct employment links.²⁷

The regression model that reflects these various factors is seen below. The definition of variables is set out below the equation. The R^2 parameter indicates that the model explains over 80% of the variation in new economy employment across the 41 US MSA that were included in the analysis.

$$HT = -23257.8 + 0.021POP + 3965.35LnENP + 6122.41LnDEST + 0.559MIL - 1235.91TZ + 0.0015TENP \quad R^2 = 0.82$$

where: *HT* is new economy employment in 1996
POP is the population of the surrounding Metropolitan Standard Area in 1996
ENP is the logarithm of the number of European on-plane passengers in 1994

²⁵ For a discussion, see Button (1998).

²⁶ There are a number of reasons why this is so. The standard economic work on this is Barro and Sala-i-Martin, (1992).

²⁷ For example, the electronic marketing industry that has grown up around Omaha, Nebraska is strongly influenced by the location of the Strategic Air Command there.

DEST is the number of European airports served in 1994
MIL is military expenditure in 1996
TZ is the time zone (East Coast Standard Time = 0)
TENP is total enplanements in 1994
Ln represents a variable expressed in natural logarithms

The coefficients estimated for the impact of the explanatory variables by and large take signs that are intuitively sensible. A number of other variables were tested but added nothing significant to the model fit and were, therefore, omitted to keep the specification relatively simple.²⁸

In the context of the availability of air transportation, the three key variables all have positive coefficients associated with them. The total enplanements variable is small but this may be expected since much of the air transportation affect is taken up by the international dimension of the equation. There is a tendency for larger airports to have more international activities. With regard to international air services, the associated coefficients for both on-plane passengers and the number of destinations served take positive signs. They exert a positive influence on the attractiveness of regions to new economy employers. As important for confirming the robustness of the specification is the fact that variables such as the overall level of air service, population and military employment are positive as would be anticipated.

What these coefficients mean in qualitative terms depends upon the nature of changes in international air services. Often of more interest, given the way serving new international destinations become tractable, is the issue of changing the scale of international services at an airport already having a portfolio of international destinations to serve. But it would normally be incorrect to simply take the introduction of an additional destination without allowing for the additional capacity (here proxied by on-board passengers) that inevitably comes with it. As an example, an increase in EU destinations served from 2 to 3 in itself means about 2486 extra new economy jobs for a region. But an extra destination would almost inevitably mean additional capacity.²⁹ A reasonable assumption is that the

²⁸ In particular, unemployment insurance benefit payments was left out because of the uncertainty of the underlying relationship discussed in the text. (In all models a negative coefficient emerged supporting tentatively the cumulative growth theory.) Per capita income, initially included to pick up any reverse causality effects, was also omitted because of potential simultaneity problems. Income is intuitively related as much to the amount of new economy employment in an area as new economy employment is to income. A fully specified, multi-equation system is too complex to define.

²⁹ There is a fairly strong link between the number of EU destinations served and the on-board passengers carried as can be seen below (the figure omits New York because of its extremely large size but this does not affect the overall picture). As can be seen the slope of the fitted curve indicates that on-board EU passengers do not increase in proportion to the number of destinations served. This correlation between explanatory variables (multicollinearity) can cause problems in forecasting from an equation if it is not allowed for. The relationship seen in the figure also provides a reasonable method of linking the number of EU destinations served and service capacity for the numerical calculations set out in the body of the text.

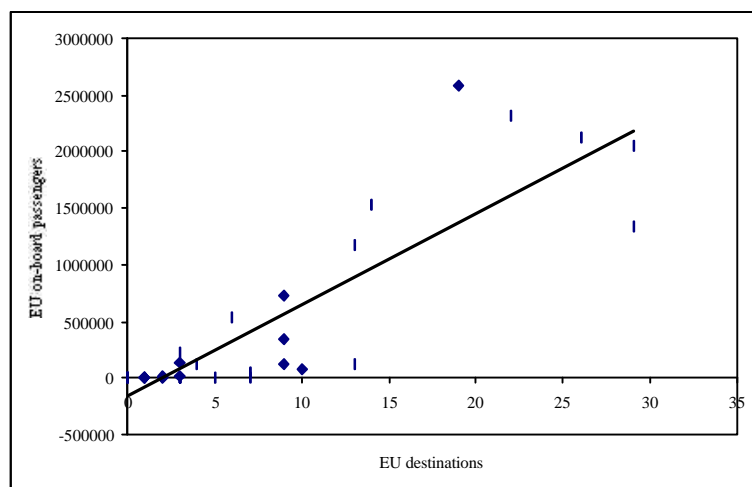
number of on-board passengers increases from about 15,000 to 25,000. The impact of this on new economy employment is an additional 2,070 new economy jobs in the region. Hence the total employment effect is about 4,500. If each job is assumed to be worth \$50,000 per annum (this includes salary and employer contributions to health plans, pensions, etc.³⁰) this is a \$225 million per annum benefit. Discounted at 5% per annum this over 10 years represents a capitalized value of over \$1,737 million.

Taking an airport that already serves a relatively large number of EU destinations and adding an additional service offers to show the diminishing returns to the local economic base. Take the case of increasing services from 9 to 10 EU destinations with onboard passengers increasing in number from 70,000 to 75,000. This generates an additional 1600 new economy jobs worth some \$625 million discounted over 10 years. At larger airports the effect of additional services is even less. If the number of EU destinations rises from 20 to 21 and the number of on-board passengers increases from 145,000 to 150,000 then the new economy employment effect is only about 450 jobs.

What the equations also show is that in general the benefits of additional services and destinations in the EU diminish as the international services provided by an airport increases. Of course, it is not only the number of destinations and the capacity provided that is important, much will also depend on the demand for the particular services that are being offered. The growth of any region's economy, as seen in the estimations above, also depends on attributes other than international air transportation services. These sorts of factors cannot be captured in this sort of aggregate analysis. What it does provide is guidance as to the general importance of international air services to the growth of modern industry in US regions.

CONCLUSIONS

At a meeting in Chicago towards the end of 1999, called to celebrate and reassess the 1944 Convention after 55 years, and which the US Department of Transportation referred to as a 'beyond open skies ministerial', efforts were made to find common ground to further liberalize international air transportation. The US has been relatively active in seeking to liberalize international air transportation and, indeed, at the 1944 had attempted to have a completely open regime but understandably there was widespread international resistance to this at the time. International air transportation has, however, grown rapidly over the past twenty years. In part this reflects market forces such as rising incomes and the internationalization and globalization of business. It has not, however, grown in a fully free market context but rather often within a heavily constrained regulatory framework. Recent years, in part due to US initiatives, have seen some of these controls relaxed and



³⁰ This may well be a conservative figure. Although the Armington Index involves a very broad definition of new economy employment, and thus embraces some categories of semi-clerical workers, incomes in this sector are generally well above the national average and were in 1996.

more flexible regimes instigated. The airlines have themselves also circumvented some of the limitations inherent in bilateral air service agreements through the creation of strategic alliances.

The US efforts to reform since 1979, and more recently since 1994, have largely involved measures aimed at exploiting the strength of the US in bilateral markets and of picking off individual foreign markets. The Open Skies policy has been successful to a large degree in its strategy. Impediments still remain, most notably in markets such as those involving the UK but also in major markets in Asia such as Japan and China. There has been a general reluctance by the US to widen debates and the policy domain to embrace multilateral structures as seen by the relatively limited support given to the role of the World Trade Organization in air transportation matters. There may be justifiable fears in handing control in such areas as competition policy over the world's largest air transportation service supplier to an external, international agency. The US has found in the past other international agencies, such as ICAO, less than effective in meeting its needs. Nevertheless, there would seem to be significant benefits to the US in pushing forward for further liberalization measures even outside of this institutional structure.

The empirical evidence offered in this study shows that, in an examination of a relatively large number of US airports, there are links between the economic structures of surrounding areas and the availability of international air services to the EU market. In particular, those areas enjoying such services have attracted, retained or internally generated relatively more new economy employment (broadly defined) than those without such services. It is both the number of international destinations that are served and the quality of that service that emerges as important. As one may expect, the benefits are not infinite. As more services are added so the additional gains a region around an airport tend to decline. The overall conclusion is that, within limits, more international air transportation is likely to stimulate further growth in the new economy.

ACKNOWLEDGEMENT

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APPENDIX

The sectors included in the Modified Armington Index

IT Software

- 7371 Computer Programming Service
- 7372 Prepackaged Software

IT Services

- 7373 Computer Integrated Systems design
- 7374 Data Processing and Preparation
- 7375 Information Retrieval Services
- 7376 Computer Facilities Management
- 7377 Computer rental and leasing
- 7378 Computer maintenance and repair
- 7379 Computer related services, etc.

Telecom Services

- 481x Telephone Communications
- 482x Telegraph and Other Comm.
- 484x Cable and other pay TV services
- 489x Comm. services, etc.

Advanced Materials

- 8731 Commercial physical research
- 3827 Optical instruments and lenses
- 3499 Fabricated metal products, etc.

Aerospace

- 3721 Aircraft
- 3724 Aircraft Engines and parts
- 3728 Aircraft parts and equipment, etc.
- 3761 Guided missiles and space vehicles
- 3764 Guided missiles and space propulsion units
- 3769 Guided missiles and space parts and equipment, etc.

Biotechnology

- 2833 Medicinal chemicals and botanical products
- 2834 Pharmaceutical preparations
- 2835 Diagnostic substances
- 2836 Biological products excluding diagnostics
- 3841 Surgical and medical instruments
- 3842 Surgical appliances and supplies
- 3843 Dental equip and supplies
- 3851 Ophthalmic goods

Energy and Environment

- 1311 Crude Petroleum and natural gas
- 1321 Natural Gas Liquids
- 3561 Pumps and pumping equipment
- 3563 Air and gas compressors
- 3564 Blowers and fans
- 3822 Environmental controls
- 8734 Testing Lab Services

Electronics

3571	Electronic Computers
3572	Computer Storage Devices
3575	Computer Terminals
3577	Computer Peripherals
3578	Calculating and Accounting Machines
3579	Office Machine
3651	Household Audio and Video Equipment and Supplies
3661	Telephone and Telegraph apparatus
3663	TV and Cable comm. equipments
3671	Electron Tubes
3672	Printed Circuit Boards
3674	Semiconductor and related devices
3675	Electronic Capacitors
3676	Electronic Resistors
3677	Electronic coils and transformers
3678	Electronic connectors
3679	Electronics components, etc.
3695	Magnetic and Optical Recording Media
3812	Search and navigation equipment
3821	Laboratory apparatus
3823	Process control instruments
3824	Fluid meters and counting devices
3825	Instruments for measuring and testing electricity and signals
3826	Analytical Instruments
3829	Measuring and controlling devices
3845	Electromedical equipments
3861	Photographic Equipment and Supplies(Photocopying Machines)
Transportation	
3511	Turbine and Turbine generator sets
3519	Internal Combustion engines, etc.
3566	Speed Changers, drives and gears
3568	Power transmission equipment, etc.
3714	Motor vehicle parts and accessories (Siemens)
3731	Ship Building and repairing
Managment and Services	
7384	Photofinishing Labs
7389	Business Service, etc..
8711	Engineering Services
8712	Architectural Services
8713	Surveying Services
8732	Commercial nonphysical research
8733	Noncommercial Research Orgs.
8741	Management Services
8742	Management consulting services
8743	Public relations services
8748	Business Consulting, etc.
8999	Services, etc.
Technology Industrial Manufacturing	
2812	Alkalies and Chlorines
2813	Industrial Gases

2816	Inorganic pigments
2821	Plastic materials, synthetic resins, non-vulcanizable elastomers
2822	Synthetic rubber
2823	Cellulosic man-made fibers
2824	Synthetic organic fibers
2861	Gum and wood chemicals
2865	Coal tar, crudes and cyclic intermittents, dyes & organic pigments
2891	Adhesives and sealants
2892	Explosives
2893	Printing Ink
2895	Carbon black
2899	Chemicals and Chem Preparation
3264	Porcelain electrical supplies
3364	Nonferrous Die-Castings
3482	Small arms ammunition
3483	Ammunition
3484	Small Arms
3489	Ordinace and accessories
3492	Fluid power valves and hose fitting
3531	Construction machinery
3532	Mining Machinery
3533	Oil Machinery
3534	Elevators & moving stairways
3535	Conveyors
3536	Hoists, cranes, monorails
3537	Industrial trucks and tractors
3543	Industrial patterns
3544	Special Dies and tools
3545	Cutting Tools, precision measuring devices
3555	Printing Trades machinery and equip.
3559	Special Machinery
3567	Industrial Furnaces and ovens
3569	General industrial machinery, etc.
3594	Fluid power pumps and motors
3612	Transformers
3624	Carbon & graphite products
3625	Relays and Industrial Controls
3629	Electrical industrial apparatus, etc.
3652	Audio records and tapes
3811	Engineering and scientific instruments
3873	Watches and Clocks