

THE IMPACT OF THE AIR CARGO INDUSTRY ON THE GLOBAL ECONOMY

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for

The International Air Cargo Association
Air Cargo Forum
Calgary, Canada
September 13, 2006

*Based on a study commissioned by the International Air Cargo Association (TIACA).
All analysis, statements and policy recommendations are the authors',
and do not necessarily reflect the position or opinions of TIACA.*

**The authors would like to acknowledge the invaluable assistance of
Stephen J. Appold and Makoto Mori in preparing this paper*

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Overview of the air cargo industry

The global air cargo industry represents almost 100 billion revenue ton-miles of transportation, an estimated \$52 billion in direct revenue in 2005 and substantially more revenues in related trucking and logistics services. In this paper, we combine data from many sources with new analysis of systematic data to characterize the nature of the air cargo industry and examine its impact on the global economy.

Our analysis indicates that the air cargo industry is responsible for transporting approximately 29.9 percent of all international trade (by some estimates, substantially more) and 34.6 percent of non-land-based trade with an annual value of \$2.7 trillion in 2004. With time-definite international transactions, production flexibility and speed characterizing much of the new economy, it is nearly certain that air cargo will play an increasingly vital role in the global economy. No other means of transportation is better equipped to meet the economic realities of the new era where global sourcing and selling, and just-in-time logistics, require that producers receive and ship smaller quantities more frequently, quickly and reliably over long distances.

Global exports (by volume and value) have outpaced production (by volume) which has, in turn, outpaced economic growth indicating a substantial restructuring of production and distribution. Air cargo has outpaced all, increasing by approximately 80 percent, over the last decade despite recessions and other setbacks to air transport. Scheduled air cargo service providing an estimated 4,396,353 tons of weekly air cargo capacity is available at over 3,400 airports in 220 countries. Charter and integrated express companies provide additional capacity.

With McKinsey estimating that the 20 percent of manufactured goods that are traded internationally today will rise to 80 percent by 2020, the air cargo industry is poised for continuing rapid growth at an expected rate of 5.9 percent annually for the next 20 years (according to recent estimates by Airbus) and at 6.2 percent (according to analyses by Boeing).

Our focus here is how operational reforms in the air transport industry, combined with air rights liberalization and continued improvements in supply and distribution practices, will allow air cargo to expand its geographic spread – primarily to the southern hemisphere – and deepen its product mix, thereby further accelerating economic development and the diffusion of prosperity.

The evolving organizational form of the air transport industry

The air transport industry is already quite large. Korean Air, Lufthansa, Singapore Airlines, Cathay Pacific, and China Airlines are the largest combination passenger-cargo carriers, measured by tons of capacity. American Airlines and United Airlines provide substantial cargo service without the use of dedicated freighters. Several, particularly European, airlines such as, Lufthansa, Air France, and KLM, have particularly broad geographic coverage, offering service to more than 50 countries each. British Air offers cargo service to over 100.

Atlas Air, CargoLux, Polar Air Cargo, Nippon Cargo Airlines, and ABX are among the major dedicated cargo airlines. Cargo airlines tend to have less extensive route networks but CargoLux serves over 30 countries. Approximately three-fourths of all international cargo is estimated to travel as belly freight on passenger planes and another 15 percent on all-cargo airlines.

The global air cargo industry is characterized by an implicit alliance among a network of cargo-carrying airlines, freight forwarders, airport logistics handlers, ground handlers, and other parties. BAX Global, Panalpina, Nippon Express, U-Freight, Excel, Geologistics, and Yusen Air and Sea are among the largest freight forwarders but others, specializing in particular routes or types of customers, are also important. Airport logistics and ground handlers are generally local. Each industry sub-sector participant depends upon the others for its operations, growth and survival but also competes with the other sub-sectors for profits.

Air cargo offers clients the benefits of secure handling, speed and geographic and temporal flexibility but, with per kilogram costs that average six times those of ocean container freight, is relatively expensive. That high cost is compensated by reduced inventory and warehousing costs but, unfortunately, air cargo often fails to fully deliver on its promise.

Although door-to-door transit time for air cargo is approximately one-fourth that of ocean freight, dwell time continues to be an issue in the air cargo industry with relatively recent studies (e.g., Air Cargo Management Group, 1999) finding little improvement in the situation over a 25 year period. Air cargo dwell times may even approach those for containerized sea freight. According to a Minneapolis study, first time importers are responsible for the lengthiest dwell times but even experienced forwarders often let air cargo wait for several days before filing import applications. The waiting time inherent in the consolidation of freight to obtain more favorable rates from airlines may account for additional delay. These delays undermine air cargo's potential advantages.

Given the division of labor in the shipping process, there are organizational and operational breaks between the shipper, the originating ground handler, the freight forwarder, the airline, the freight forwarder again, the receiving ground handler, and the consignee, with specialized customs-clearing agencies sometimes called in to help. In addition, there might be transfers between inter-regional and local ground services.

The resulting operational delays can be substantial. A large portion of the delay is due to interruptions in the flow of information between organizations. Often, the interruptions in information are serious with forwarders and airlines often attempting to out-manuever each other to gain a marginal commercial advantage – which can be crucial to profit margins and therefore survival. Because each actor needs to optimize its own operations, no one optimizes the system.

As a result, air cargo service has become increasingly more integrated and ground-linked, characterized by door-to-door service from shipper to customer, as opposed to airport-to-airport. Integrated express carriers, grew, in fact, out of the institutional failings of the airline-forwarder-handler coalitions. Express companies have thrived by

reducing the reluctance to share information among participants and improved optimization because all parties except shipper and consignee are internalized within the same organization. That advantage has allowed integrated express handlers to offer time-definite service and to reduce door-to-door delivery times.

That level of service has been valued by a significant segment of the air cargo market to the point that integrated express now accounts for an estimated 11 percent of the international air cargo market. In the United States, air express actually accounts for over 70 percent of all air cargo shipments, despite its premium cost, and the average weight of each shipment has now risen to approach six pounds. FedEx, UPS, and DHL are the largest integrated air express companies with operations in over 200 countries each and 952,000 employees, collectively. They own or operate 677, 577, and 420 aircraft, respectively, placing each among the largest airlines in the world and they serve over 300 airports internationally.

Transparency and time-definite services are increasingly becoming expected by shippers and consignees. In a 2003 study, The International Logistics Quality Institute found that 70 percent of the 800 companies surveyed would incur significant supply chain problems if their intercontinental air freight shipments were even one or two days late. Fully, 73 percent of respondents expected time-definite service to be common in the future. The backbone task of the air cargo industry will increasingly be in providing high-quality service for routine shipments.

In an attempt to fill this demand and to answer the innovations of the integrated express carriers, the airline-forwarder-handler coalitions are now increasingly offering time-definite services. Airlines have attempted to streamline cargo services by introducing three major air cargo portals (booking platforms): Europe-focused GF-X (Global Freight Exchange), North American-oriented CPS (Cargo Portal Services), and Asian-allied Ezycargo.

Airline-forwarder coalitions may be inherently unstable without an ownership (profit-sharing) relationship. Accordingly, some freight forwarders, such as Nippon Yusen, and express companies, such as DHL, own substantial portions of cargo airlines – NCA Nippon Cargo Airlines and ABX, respectively. Post offices – essentially ground handlers with extensive networks – are increasingly attempting to leverage their assets in new ways and are therefore becoming increasingly involved with air cargo.

Our research found substantial inefficiencies in the air transport process for much of the market and premium prices in the rest. The next challenge for the air transport industry may be delivering integrated express level of service to “commodity” and out-size freight at progressively decreasing yields. Such a re-formation of service – possibly by a WalMart of the air – will allow a greater range of products to be transported by air. A totally different organizational structure may evolve in the attempt to utilize airplane capacity as fully as possible. Given the difficulties airlines often have in coordinating cargo flows, it is possible that they may eventually decide it is advantageous to out-source all cargo operations except flying.

Types of goods shipped by air and the industries dependent upon air cargo

Air transport is critical to the movement of goods in national and global supply and distribution chains. From the beginning, air transport specialized in high value-to-weight products, perishable goods, emergency deliveries for unanticipated shortages, and products requiring the security of increased attention. High value-to-weight ratios imply a relatively light transportation cost burden and high inventory costs if goods are long in transit. Highly perishable goods incur a significant decrease in product value with any delay. The absence of critical components of complex supply or distribution chains means significant assets would lie idle if the components are not delivered in a timely manner.

While those features still apply, today an amazing array of goods is shipped by air from gems to bendy-buses to breeder cattle. The air cargo industry has thrived on the rise of industries incorporating high levels of knowledge into lightweight goods but the industry has been able to move down the value-to-weight ladder.

New economy products such as microelectronics, pharmaceuticals, aerospace components, medical devices, and other high value-to-weight products account for close to three-fourths of international air cargo by value. Nevertheless, the use of air cargo is quite broad. In 35 of the 67 two-digit product categories (SITC) used to broadly classify goods, at least ten percent of the international trade is shipped by air. In 23 of the categories, at least a quarter of all trade goes via air.

Looking at product categories (SITC 4-digit classification) more closely, reveals that electronic microcircuits account for more air cargo than any other detailed product category by a factor of more than two. Aside from the sectors just mentioned, diamonds, audio and video recordings, chemicals and airplanes themselves are major products that move by air, each exceeding \$50 billion in trade. In 582 of the 1279 4-digit SITC product categories, ten percent or more of the international trade is shipped by air. In 315 of the categories, at least a quarter of all trade goes via air.

Overall, air cargo accounts for 34.6 percent of non-land international trade but only.6 percent of the weight. The average value-to-weight ratio of air shipped goods is 31 times as high as that of vessel-shipped goods. Even within detailed product classifications, goods with higher value-to-weight ratios tend to be shipped by air. On average, within the detailed 4-digit classifications the value-to-weight ratios of air shipped goods are ten times as high as they are for vessel-shipped goods. Looking across product categories, above a fairly low threshold, a small increase in the value-to-weight ratio results in a substantial increase in the average proportion of international trade in that product that travels by air.

The variation in the proportion of traded goods that are shipped by air (air-intensity) can be quite large for products with similar value-to-weight ratios, however. For example, motor vehicle bodies, valued at \$9.14 per kilogram (or specialty motor scooters valued at \$9.30 per kilogram) are shipped almost exclusively by surface freight but 60 percent of specialty chemicals, printed matter, or even specialty leathers (with a roughly equivalent value for weight) are shipped by air.

The degree of variation in value-to-weight of specific products even within these detailed categories may play a role in determining the degree of air intensity but the bulkiness of the product and size of shipment may also be important. Perishability plays a role in the decision to ship by air. For example, approximately 80 percent of the international trade in cut flowers travels by air as does a similar proportion of specialty meats. Two-thirds of the fish traded internationally are shipped by air. Almost all of the trade in large live animals goes by air. Singapore, for example, imports much of its milk, non-tropical fruits, and even some types of mass marketing meat, by air.

Air cargo remains a critical aspect of supply chains even in fields that are not especially aviation-dependent. With a history of over 30 years, the garment industry was one of the first to grasp the competitive advantages of combining Asian labor with air transport in supply chains. Apparel is generally shipped by vessel but the wage advantage of Asian labor compensates for the costs of air shipment for some industry segments. That combination remains current for time-sensitive deliveries and is likely to do so well into the future.

The electronics industry, broadly considered, is heavily air-dependent, accounting for approximately 40 percent of the value of international air cargo by itself. This industry combines high value-to-weight with specialized products, leading to far-flung distribution channels, and complex, labor-intensive production processes, creating international supply chains designed to tap pools of appropriate labor. Since the electronic goods shipped by air are incorporated into apparatus used in many sectors of the economy, almost the entire economy has become air-dependent. But if the entire economy depends upon air freight, air freight depends heavily upon the air electronics industry.

There is a continuing role for air freight on the leading edge of innovation as new industries, especially the broad bio-science sector, expand. With a high value-to-weight, a need for security, and perishability, the basic materials, intermediate products, and finished goods for the bio-science sector all tend to be shipped by air.

Not all of the major product groups in global trade are – or ever will be – shipped by air. Very little petroleum or petroleum products are shipped by air. Few motor vehicles are shipped by air. These two general (two-digit SITC code) product groups are the second and third largest in global trade and they continue to be important to economic policy. Almost none of the trade in iron and steel is by air and these continue to be important components of international trade. Nevertheless, the product range that can be effectively shipped by air can be further deepened by improving the organizational efficiency of air transport.

Air cargo clearly has a major role in the leading edges of the global economy. Four of the top ten broad product groups (two-digit SITC) are highly air-dependent. New products seem to require new means of transportation and an emerging electronic-pharmaceutical industrial complex with its own geography of supply, production, and distribution, may be super-imposing itself on the automobile-oil-chemical complex that previously created its own water-based geography of global production and trade.

The geographic pattern of air freight

Air cargo service is spread throughout the world, covering more than 200 countries and independent territories. Air cargo is concentrated in some areas more than others, however. The U.S. alone accounts for one-fifth of global air imports and over one-seventh of the air exports. Adding Germany, the U.K., Japan, China (including Hong Kong), and France accounts for half the world's air imports and exports. Singapore, Taiwan, Canada, Korea, Italy, Mexico, the Benelux, and Malaysia bring the total to over three-fourths of global air imports and close to 80 percent of global exports.

The largest international trade flows are *within* the three main prosperous regions of the world, Western Europe, North America, and East Asia. Both Western Europe and North America have well-developed international land routes. Moreover, much of the production of traded goods in Canada and Mexico is located near to the U.S. border. The relatively small size of European states, the increasingly integrated trucking system, and the developed highway, rail, and river-transport systems reduce the importance of air transport for intra-regional trade which is more than twice as large as any other intra- or inter-regional trade flow. In both of these regions small shifts in relative costs or performance or in approaches to supply or distribution channels can have large impacts on the level and nature of air transport.

The major countries of East Asia, on the other hand, do not share land borders. Where land transport is not possible, the proportion of international trade shipped by air tends to be well over one-third. As we note above, in some cases, depending upon the product mix, the proportion exceeds one-half.

Five of the six possible flows between these three main regions follow immediately in terms of magnitude. Other regions have progressively smaller volumes of air and surface-shipped trade. As might be expected, the magnitude of the petroleum trade, tends to decrease the air-intensity of the exports of the major petroleum-producing regions. The proportion of exports shipped by air from the less-developed regions tends to exceed 10 percent.

Air cargo is largely a northern hemisphere phenomenon. The countries accounting for 80 percent of air imports and exports are all above the equator. North America, Western Europe, and East and Southeast Asia are the largest centers of air cargo usage. There is room to expand southward.

Malaysia and Singapore, despite excellent ocean access to busy shipping routes, are heavily dependent upon air freight for their imports and exports. They have been integrated into global production to a large extent by the electronics industry. With a mix of high-quality agricultural and high technology exports, even though a small nation, Israel also relies heavily on air cargo for its trade.

Armenia, Chad the Central African Republic, and other, similar countries are also heavily dependent upon air cargo for their trade. The difference is that luxury items play a major role in the trade of relatively small, relatively underdeveloped economies. If that air-based trade could be deepened to include other products, these countries could become more tightly integrated into the world economy and become more prosperous.

Examining data on the weight of cargo processed or carried allows us to more closely identify the types of regions that are impacted by air cargo. Although the data from different sources are not always consistent, three types of airports – or rather, cities – emerge as important in the air cargo network of traffic. First, half of the busiest ten or 25 cargo airports are gateways of the established consumer centers of the world, Japan, Western Europe, or the U.S. These centers also not only export highly specialized products, they also serve as entry funnels for low-wage country exports. Second, established global production platforms, mainly in China and Southeast Asia, make up over one-third of the busiest 25 cargo airports. The new emerging production platforms in India, Vietnam, and elsewhere, at the leading edge of the flying geese, have been rising in importance but are still not within the top or second tier. Third, two airports that have emerged as intermediary hubs for the Asia-Europe trade (Dubai) and Asia-North America-Europe trade (Anchorage) are in evidence.

These urban areas do not occupy fixed places in an urban hierarchy or geographic division of labor. As the volume of air cargo has increased, the position of particular cities has changed. Looking over time, the rising prominence of Asian airports is striking. Today, five of the busiest cargo airports are located in East or Southeast Asia. In 1991, two were. Economic development and air transport go hand in hand. One-fourth of the busiest cargo airports are located in Asia with India developing a growing presence. Latin America and Africa can follow.

The role of air cargo in fostering economic development

Air cargo service has been a tremendous enabler for economic development. This is because air freight and integrated air express are critical to time-based competition – the frontier challenge for the world's most-advanced firms. Air freight has also facilitated specialization and allowed the most well-developed countries – their producers and consumers – to reap the benefits of ever-closer matches between demand and supply. This is due not just to the speed of air transport but to the geographic reach it allows which enlarges effective market areas to the point that increasingly small product niches reach the threshold of feasible production.

At the same time, air freight allows large pools of, especially Asian, labor to connect with the product needs of wealthy Western European, North American, and Northeast Asian markets. Using traditional ocean transportation, exporters (and their employees and suppliers) in most developing countries are at a considerable shipping time disadvantage to these markets compared to domestic producers. Air cargo, combined with the institutional mechanisms that allow the transfer of production knowledge, goes a long way towards leveling the temporal playing field for developing country producers. Air cargo potentially allows developing country producers 24- to 48-hour access to these markets, compared to the typical 30 days shipping time using traditional ocean transport.

The air cargo industry has allowed the “nimble fingers” of Asia to participate first in the apparel industry and, soon afterwards, the electronics industry. Whether producing cut flowers, fresh vegetables, milk, or fish, air cargo has also allowed otherwise remote agricultural and maritime regions to access world markets. The accessible labor force of the world has expanded as air transport has come together with reformed institutions, rethought supply and distribution processes, and human resources.

Bilateral and multilateral agreements, as important as they are, ignore the static and dynamic needs of the emerging fast and flexible supply chain practices. Those practices require flexibility for air carriers. Air cargo carriers have different needs than passenger carriers. Passengers typically fly roundtrip, whereas the flow of air freight is fundamentally unbalanced. Increased liberalization would allow the more efficient use of air carrier resources. Even most “Open Skies” agreements do not allow seventh freedom rights, domestic cabotage or wet leases for international carriers. The airline industry has been pressed recently and, rather than operate less than profitable backhauls, it might be preferable to fly to second or third countries, carrying cargo picked up along the way.

Today’s supply chains involve multiple nodes that are dynamically linked – shifting with global conditions and market demand. Supply chains need to react to seasonalities and industry and event-specific needs. So do the air carriers that support the supply chains. Flexibility in air cargo service to a country and larger region has become increasingly necessary in such shifting and turbulent markets. Shippers as well as air cargo service providers must be able to adapt to changing conditions in an agile, rapidly responsive manner, shifting routes on a continuing basis.

A recent study shows that 77 percent of the statistical variance in GDP per capita and foreign direct investment cross-nationally is accounted for by just three variables measuring different aspects of aviation liberalization: legal liberalization, administrative liberalization, and operational liberalization as measured by the number of bi- and multi-lateral agreements signed by each country, the quality of customs service as measured by a World Bank-sponsored questionnaire survey, and the perceived level of corruption as measured by questionnaire surveys administered on behalf of Transparency International. Just as air freight and GDP per capita are mutually interdependent and causal, the economic development measures and policy variables are likely to be also. The empirical results from this regression analysis imply that legal aviation liberation, quality of customs and lower corruption contribute to greater economic development (as measured by GDP per capita and foreign direct investment).

Air rights liberalization is a key facilitation factor in the economic growth of both developed and less-developed regions. To extend a common analogy, air rights liberalization allows more of the product “iceberg” to arrive intact and thereby increases the benefits of trade. Additional extension of prosperity will also require operational reform in the air cargo industry and the extension of supply and distribution chain improvements to a wider set of industries.

Three case studies addressing liberalized air cargo services on economic development

We noted three types of cities that were prominent in the network of airports: central consumption area portals, production area portals, and the intermediating portals connecting them. We briefly consider three areas a small production and consumption portal in Latin America, Belo Horizonte, a somewhat larger production platform in Southeast Asia, Ho Chi Minh City, and a large and rapidly growing cargo hub, Dubai.

By briefly considering these cities, we explore how air transport interacts with local critical mass, institutional reform, and infrastructure development in local environments. We found that a long incubation period is behind every economic miracle. The, by far, largest airport we consider here is also growing the most rapidly. It is also the oldest. The smallest is an airport that has many of the right ingredients but that has suffered setbacks since the recession of 2001. The third airport takes an intermediate position in growth but has faced a long period of being on the brink of a breakthrough, due to an uncertain commitment to institutional reform.

With a population of almost 2.4 million and over 5 million in the official metropolitan area, Belo Horizonte is the third largest metropolitan area in Brazil. The capital of Minas Gerais state, located in the southeastern region of the country, Belo Horizonte is supported by a diversified agricultural and industrial complex. Minas Gerais is among the most developed States in Brazil, generating about 10 percent of Brazilian GNP, and 13 percent of its exports – including half of Brazilian coffee. Mineral extraction and processing has a major presence in the state as does coal mining which supplies the region's iron and steel industry. Accordingly, Fiat and Mercedes-Benz have plants in the state. Multinational companies like Arcelor and Toshiba have subsidiaries in the region, along with other textile, cosmetic, food, chemicals, pharmaceuticals, furnishing and refractory companies.

With over a dozen universities, the city has become an international center for Information Technology and Biotechnology. Over 16 percent of the Brazilian biotechnological firms are located in Belo Horizonte and the city is an advanced center for the development of biodiesel fuel. It is also one of Brazil's major IT centers and has been active in artificial intelligence research, software development, and global outsourcing. Oi, a Brazilian telecommunications firm, has its headquarters there. Google has a full-fledged R and D center in this city (one of just a few outside the U.S.).

So far, however, air freight has struggled in the city and the city's economy has yet to experience a take off. Until just this month, all of the air freight access for the past five years has been national. Access to global destinations is, however, provided via Sao Paulo but signs are encouraging and freight may yet grow.

With an estimated population of approximately 80 million and an active labor force of approximately 38 million, Vietnam knows how long an economic take-off can wait before lift-off. Vietnam has a long history of uncertain administrative and legal reform stretching back to at least 1979 which alternately speeds and slows. Property laws have been amended; the credit system revamped; and regulations revised. Between 1988 and 1991 state-owned enterprises shed nearly 800,000 employees and possibly

one million members of the armed forces were demobilized. Beginning in 1989, laws regulating private enterprise were liberalized. Few state-owned enterprises have been privatized, however, and despite nominal legal reforms, state capacity to enforce laws is questionable and observers note a continuing need for legal and administrative reform.

Over the past several years, child malnutrition has fallen rapidly, unemployment is low and labor force participation rates have risen, and poverty rates have fallen rapidly, resulting in relatively broad-based improvements in welfare. Much of that growth is centered in and around Ho Chi Minh City.

Vietnam provides a sizeable, relatively well-educated labor force but the issues just discussed work to isolate them from the global economy. By making direct connections with customers possible, air cargo service has played a major role in encouraging the development of pockets of reform to tap the export market. Aviation liberalization alone did not bring about the favorable results. Much of the export production takes place within export-oriented industrial parks that insulate operations from sometimes predatory local governments.

Geographical accident is a major factor in Dubai's success. It is located along the east-west Asia to Europe trade routes while it is also well positioned for delivery to the growing North African and Middle Eastern economies. Dubai has access to inexpensive, imported labor and has the capital to invest in facilities. Of course, several places in the region also have these advantages. Dubai's stable government and liberal commercial environment have had a role in its growth by deciding to modernize and expand the air cargo terminal at Dubai Airport and to grant 'open skies' rights to passenger and cargo airlines.

Open skies put air cargo in Dubai on a rapidly rising trajectory. By 1998, the airport was handling 300,000 tons annually in its Cargo Village, with another 120,000 tons flowing through temporary areas. Since then, cargo growth at the airport has continued its breakneck pace and construction has followed suit. A new Mega Cargo Terminal was planned, with annual capacity at completion in 2018 expected to be 5 million tons of cargo. Dubai airport's history, however, began in 1959 – long before the current well-deserved media attention.

Conclusions

Air freight has not only been a useful way to distribute specialized high value-to-weight products to discerning customers, it has also been an effective way of connecting mainly Asian labor with Western European and North American markets – once particular institutional challenges have been met. The availability of unfettered air freight has therefore led to development of selected production platforms – and the diffusion of such methods of productions to an ever-widening, but not yet universal, geography.

Both the administrative advantages, such as partially by-passing Byzantine seaport clearance practices, and technical advantages, such as the ability cargo to move swiftly between continents, have been important in leading to such development. These have led to both regional development and the expansion of the air cargo industry.

The combined reforms in the operations of air cargo processing, government regulatory practices, and manufacturer supply and distribution chain processing promise to allow aviation to transport a deepening array of goods which means that a larger labor pool and broadening geography can be more effectively integrated into the global economy. At the same time, competitive pressures from other modes of transport put additional pressure on the air cargo industry to increase its own efficiency and live up to its potential.

In that regard, air rights liberalization presents the industry with a management challenge. Essentially, liberalization implies a switch from earning profits by seeking a politically-enforced monopoly to earning profits by accumulating detailed practical knowledge and expertise. Aviation liberalization both creates the motivation and opportunity to improve efficiency by increasing load factors, decreasing dwell times, and enhancing the use of assets (planes) while reducing the “frictions of trade” that decrease human welfare.



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