

# Airports and Economic Development: An Overview

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Airports and aviation make an important contribution to local, state, and regional economies. A review of literature on the links between airports and economic development indicates that air transport is usually associated with significant portions of local business. The influence on local and regional economic activity extends well beyond the airport site. The location of airports influences the geographic distribution of industries and can be a significant factor in the decisions of certain industries to locate in a specific state or region. Data indicate that access to air transport plays an increasingly important role in the ability of some high-technology industries, such as computers and electronics, to compete, and that the location of airport facilities influences the location of these industries. Tourism industries have also been shown to be sensitive to air travel access.

That airport development acts as a catalyst for economic development, drawing industry and economic activity to an area like a magnet, is often claimed. Some examples seem to confirm this, others contradict it. Although some industries appear to require access to air transportation, airport development in itself does not guarantee the growth of such industries. The impact an airport development project has on an area depends, to a large degree, on the particular economic conditions and characteristics of that area. Therefore, generalizations about whether airports tend to lead economic development, limit it (when not constructed or expanded), or merely follow it, are difficult to make. Better data and more comprehensive analysis of the issue are needed. The information currently available indicates that the impacts of airports on local and regional economies are significant but are not yet fully understood.

Governors recognize that airports and aviation are an integral part of economic development and that there is a need for more comprehensive research on their impacts. Comprehensive analyses of airport development should be integrated into state economic development planning. An expanded state role could result in integrating the planning and development of airports and aviation with state economic development goals, to include responses to such airport and aviation problems as (a) the potential capacity problem at many airports, (b) the discontinuation of air service to less populated areas, and (c) the loss of public use general aviation airports.

The following is an overview of the literature on the link between airports and their local, regional, or state economies.

## INTRODUCTION

The literature that analyzes the relationship between airports and economic development covers a wide range of approaches

and concerns. The literature was reviewed by National Governors' Association (NGA) Center of Policy Research staff as part of the States and Air Transportation project funded by FAA. The library and computer search resources of public and private groups, such as the American Association of Airport Executives and the FAA, were used in the review, which was completed in the last 4 months of 1988.

Most studies of the link between airports and economic development focus on the effects of a particular airport on its local economic or natural environment. Some are more broadly focused, analyzing the link between aviation in general and economic growth at the regional, state, or national levels. Although some aviation studies assess the effects on an area's income and employment, others consider the impacts on particular industries only. Also, some studies focus on the total impact of an airport or of aviation in general, whereas others consider the effects of a change in airport capacity.

Not all of this literature is relevant to states' concerns. It is most useful to governors for understanding the impact of a change in airport capacity on the state as a whole or on the economic regions of the state. Unfortunately, relatively little of the existing literature is aimed explicitly at the state level. As noted, most studies analyze the impacts of individual airports on their local economies, making generalizations difficult. Each airport or airport expansion project involves a unique set of characteristics and circumstances because of its role in the regional aviation system, location, physical features, and other factors. Nevertheless, there appears to be a general consensus that an economic link does exist between airport development and economic development. How this link is conceived and analyzed depends on the particular focus and purpose of a study as well as the methodology it uses.

This paper identifies the scope and limitations of the standard literature, reviews several studies that go somewhat beyond the conventional approaches, and cites data that may be useful to further research. Information is reviewed that is, or could be, used to address state economic development issues, such as whether airport development draws industry into a state, or whether there tends to be a bias to the type of economic development encouraged by increased airport and aviation development.

## CONVENTIONAL APPROACHES

Most of the literature that directly analyzes the effects of airports follows at least one of three general analytic approaches: (a) economic impact, (b) financial feasibility, or (c) cost-benefit. Following is a summary of these approaches describing their methodology, principal users, common findings, and

limitations. Selected examples are presented to illustrate each approach.

### Economic Impact

In terms of sheer volume, economic impact studies on airports and economic development dominate the literature. Impact studies typically measure the economic benefits to a locality or region that accrue as a result of the continued or expanded operation of an airport. These studies follow a fairly standard format, viewing the total economic impact of an airport as the sum of three components: direct, indirect, and induced effects.

Direct impacts are the consequences of the economic activities occurring at the airport site. The suppliers of aviation-related services at the airport itself, such as the airlines, airport concessions, airport management, ground transportation services, fixed-base operators, and other tenants, spend their revenues to employ labor, purchase locally produced goods and services, contract for airport construction and capital improvements, and pay taxes. Data for direct impact estimates are generally collected through direct surveys. Questionnaires or personal interviews are used to collect data on payroll, local purchases, tax revenues, and expenditures by those businesses using the airport.

Indirect impacts are the consequences of economic activities that are directly attributable to, but occur away from, the airport site. These impacts include services provided by travel agencies, taxi cabs, hotels, restaurants, and retail businesses to the users of the airport services (travelers). Data for indirect impact estimates are collected through surveys or estimated from data on direct expenditures. An example of indirect effects estimated from direct data was the use of a rule of thumb per capita estimate, replacing passenger surveys, to gauge visitors' shopping, dining, and lodging patterns. The Aircraft Owners and Pilots Association and U.S. Chamber of Commerce used such a method, on the basis of estimates of average length of stay, daily expenditure, aircraft occupancy rate, and number of planes arriving daily at an airport (1).

Induced impacts, or multiplier effects, are the changes in employment and income generated as the initial direct and indirect expenditures trigger a chain reaction of spending through the local economy. The sum of direct and indirect impacts is called the primary impact. Induced effects, or responding effects, are calculated by applying economic multipliers to the primary expenditures. Multipliers measure the total increase in expenditures, within a defined area, per dollar of initial spending.

Most economic impact studies now use multipliers estimated with input-output models. Many use multipliers produced by the Regional Input-Output Modeling Systems (RIMS II) model of the U.S. Department of Commerce's Bureau of Economic Analysis (BEA) (2). RIMS II provides multipliers for specific counties or groups of counties and for 496 industrial sectors. BEA derives RIMS II multipliers from its National Input-Output Table of Industries, and its County Wage and Salary Data. From these sources, an input-output table reflecting the industrial structure and interdependence of a county, region, or state can be developed. In general, the

larger the study area, the higher the multiplier. This relationship follows because the larger the study area, the more self-sufficient the economy tends to be and the more likely that each dollar of income is spent on goods or services produced within the region.

Therefore, the economic impact of an airport is measured by the cumulative flow of spending that originates at the airport and eventually works its way throughout the local and regional economy. Studies using this methodology usually arrive at a single dollar figure representing the total impact (or economic significance) of the airport. It is also common to impute the total employment impact on the basis of the flow of expenditures.

Impact studies vary widely with regard to the detail and sophistication of the analysis. They also differ as to which of the primary effects are classified as direct and which are indirect. However, they generally share the view that the activity at an airport (i.e., passenger activity and the handling of air cargo) generates four types of impacts:

1. Business revenue,
2. Jobs,
3. Personal income, and
4. Taxes.

These impacts are felt throughout five basic sectors of the economy (3):

1. Airline and airport services,
2. Freight transportation,
3. Passenger ground transportation,
4. Contract construction and consulting, and
5. Visitor industries.

Finally, income multipliers are used to estimate the eventual total effect (direct, indirect, and induced) on these five sectors, and the economy as a whole.

Economic impact analyses tend to produce large impact figures, often in billions of dollars. For example, in recent years the total annual impacts of the Los Angeles LAX and New York Kennedy airports have been estimated to be \$28.6 billion and \$13.6 billion, respectively (4,5). These estimates are for the total economic significance of airports, rather than the impact of a particular change in capacity or activity. Table 1 presents examples of airport and aviation impact estimates for several metropolitan areas and states.

As can be seen from the data, the multipliers range from a high of almost 3 (LAX) to just under 2 (Omaha and Philadelphia). The total impact for LAX, for example, is about three times the sum of direct and indirect impacts. To put these figures in perspective, the total impact estimates for the New York-New Jersey metropolitan area and Vancouver, British Columbia, for example, accounted for over 3 percent of the economic activity of the impact area (3.5 percent for N.Y.-N.J. and 3.1 percent for Vancouver) (6).

Although these studies (particularly those that rely on extensive surveys) provide useful information on the types of jobs and industries that benefit from airport operations and give an indication of the income-generating effects, they say little about how airports influence the type of economic development that takes place around them. By assigning a total

TABLE 1 SAMPLE ECONOMIC IMPACT ESTIMATES

(Note: Figures within direct and indirect columns may not be comparable due to differences in estimation methodologies.)

Airport/ Area	Economic Impact (\$ millions)			Total <sup>d</sup>
	Direct <sup>a</sup>	Indirect <sup>b</sup>	Induced <sup>c</sup>	
LAX	2,491	7,343	18,770	28,604
NY/NJ Metro Area	n.a.	n.a.	n.a.	18,900
Baltimore/ Washington (BWI)	324	237	755	1,315
Phila.	320	623	874	1,817
Virginia <sup>e</sup>	818	947	2,635	4,400
Omaha	56	58	78	191
Stockton CA	13	13	26	52
Illinois <sup>e</sup>	1,600	1,000	4,700	7,400
Vancouver, B.C.	800	n.a.	n.a.	1,400

<sup>a</sup>Direct impact created by provision of airport services (on-site airport income).

<sup>b</sup>Indirect impact created by use of air transportation services (off-site income).

<sup>c</sup>Induced: Multiplier effect resulting from direct and indirect.

<sup>d</sup>Totals may not add due to rounding.

<sup>e</sup>G.A. airports only.

value to an airport, impact studies are measuring the total value (income) that would be lost if the airport were to disappear, everything else remaining the same. Perhaps a more useful approach would be to ask how the area would have developed had the airport never been constructed. In this case, other things would not, of course, have remained the same—alternative forms of transportation and land use might have developed and consequently other economic activities as well.

Even more useful is the comparison of continual airport expansion or maintenance with alternative uses of revenues and resources. Public officials have sometimes argued that the impact of developing specific airport land for retail, industrial, or residential use outweighs the economic benefit of continuing the operation of an airport. For example, in Crestwood, Illinois, where Howell Airport was put up for sale, Frank Gassmere, the director of village services, claimed that the prospect of \$500 million worth of new building development plus some 4,000 corresponding new jobs “so far outweighs the argument in favor of the airport as to be one-sided.”

Some impact studies have recognized the unrealistic nature of figures for total impact. A 1986 assessment of Vancouver International Airport (VIA), for example, calculated the total

annual impact figure of \$2.4 billion, but noted that “it is unrealistic to assume VIA will disappear. . . . As such, it would not be [of] any value to quantify the total economic impact” (6). The VIA study, therefore, offered several more plausible hypothetical alternatives and asked its survey respondents to describe the effects of a change in the airport’s role on their operations. The alternative scenarios included the sudden elimination of all transborder (Canada-United States) service, the sudden elimination of all international service, and an immediate 20 percent overall increase in activity at VIA. The estimated impacts of the first two scenarios on economic output were \$669 million and \$1.2 billion, respectively. These figures were interpreted as the economic contribution of the two services. The third scenario was not calculated because of inadequate survey responses.

Analyzing such changes in airport and aviation activity, rather than the overall level of activity, can produce impact measures of events that may be more realistic, but the underlying methodology is the same. There are a number of limitations of this methodology that lessen the credibility of some impact studies and may restrict its usefulness in analyzing the airport-economic development relationship. Most of these limitations involve the partial failure to measure the net impact of airport activity. As mentioned, these studies should include

those activities that would not have occurred in the absence of the airport activity being assessed. They should also account for (net out) those activities that would have occurred without the airport activity but did not, as well as economic activities that may have been forced to discontinue their operations or leave the area because of the airport. That is, the methodology tends to measure the airport's benefits only (income and employment gains), ignoring the potential displacement effects of airport activity (jobs and income lost). The expansion of an airport's air cargo services, for example, might compete with and displace activities associated with the preexisting ground transport services.

A common limitation of economic impact studies is the problem of double counting, which occurs in different ways. The most common way is the calculation of the impact in terms of total expenditures or total output rather than in terms of value added to the economy by the airport activity. Total output figures include the costs of goods and services purchased from other firms. Value-added figures are net of these intermediate purchases. The difference between the two approaches can be significant. The 1986 VIA study (6) estimated both. It reported a total output impact of \$2.4 billion and a value-added impact of \$1.4 billion.

Another form of double counting is sometimes found in the calculations of traveler (visitor) spending. Visitor spending by airport users is generally a large portion of the total primary expenditures. The multiplier is applied to total visitor spending to arrive at the total impact. However, a more accurate estimate of the spending impact of air travelers would be based on total visitor spending minus the spending effects of those airport users who left the area (7). This double counting was evidently present in an economic impact study of the Philadelphia International Airport by Philadelphia (8).

The estimation of induced impacts is often criticized as involving double counting. Using inappropriate or arbitrary multipliers, some studies have exaggerated the total impact. Many do not cite their sources for the multiplier used. A multiplier of two is often regarded as a standard rule of thumb, but this is generally true only for large regions where most of the responding effects are played out. Smaller areas must rely more on imports from other areas and consequently have smaller multiplier effects (7).

The use of multipliers that are developed at the national level (reflecting the interindustry relations at that level) and then disaggregated to the specific region, often do not accurately reflect the particular characteristics of that region.

Socioeconomic and environmental effects (such as aircraft noise, air pollution, air safety, ground traffic congestion, land use mix, and locational advantages), which often have economic effects, are typically ignored in economic impact studies.

Perhaps one reason economic impact studies involve such limitations is that their purpose is often more political than analytical. The approach has often been used by proponents of aviation and airport development for promotional and public relations purposes. These studies became widespread when airport noise and forced residential and business relocation created public opposition to airport expansion. One expert notes that without strong economic arguments in favor of airport expansions, a potentially hostile public will not be convinced that the benefits may outweigh the adverse impacts

(9). The purposes of the economic impact studies are three-fold:

1. To provide a tool that enables airport management to assess the economic benefits accrued by the community it serves,
2. To provide a document that can be used by local, elected officials and others to justify requests for financial and political support, and
3. To furnish an educational instrument with which to inform the public and decision makers in both government and the private sector about the tangible and intangible benefits of general aviation.

### Financial Feasibility

One way for state and local governments to decide whether construction of a new airport or expansion of an existing one is warranted is to determine whether the airport (or a cost center within an airport such as a terminal or cargo area) will be self-financing. The financial feasibility approach uses a benefit-cost methodology but focuses on the costs of operation and revenues of the airport as a business concern. The aim of the analysis is to determine whether the investment is financially sound, given expectations about the airport's revenues and costs and the cost of the initial investment. From the government's point of view, the pragmatic focus on cost recovery is justified, because the net income generated by an airport is one measure of the value users place on airport services.

The major components of airport revenues are airline and concession fees, cargo, and government transfers, primarily from the federal government. A recent study showed that federal aid is a major component in the budgets of all public airports and concluded that such aid is "essential to the preservation and expansion of the airport system" (10). The portion of airport revenues that is derived from federal aid decreases with the size of the airport. At large hubs (defined as airports where commercial carriers enplane 1 percent or more of total U.S. enplanements), federal aid accounts for only 10.6 percent of revenues. At nonhub reliever and general aviation airports, the federal government contributes over 50 percent of revenues.

Government expenditures on air transportation are largely covered by tax revenues and other fees. At the federal level, the largest revenue element is the passenger ticket tax, which accounted for about 70 percent of air transport-related revenues in 1987. A recent Department of Transportation study showed that the ratio of air transportation budget receipts to outlays has been increasing over the past 10 years, at federal, state, and local levels (11). In fact, of all the transportation modes in the United States, air is the most user-financed. In 1986, approximately 79 percent of the total government expenditures were covered by user revenues. This compares with 72 percent coverage for highways, 30 percent for transit, and 32 percent for water. At the state and local level alone, direct user revenues covered 77 percent of government expenditures related to air transportation (as compared with 47 percent for highways and 30 percent for transit). These coverage ratios for air transportation are expected to increase in the future, given recent increases in user charges at the federal

and state levels, and federal budget proposals for increased user fees and decreased federal subsidies (11).

Revenues from airline fees, which were 16.7 percent of revenues at large hubs in 1985 (10), were determined by the airport operator's rate-setting methodology for rentals and landing fees and its debt financing structure. The financial feasibility approach is used as a tool on an ongoing basis to set a rate structure that will cover airport costs (12).

The financial feasibility of the project is calculated using the standard benefit-cost ratio formula:

$$\left[ \frac{R_1 - E_1}{(1+r)^1} + \frac{R_2 - E_2}{(1+r)^2} + \dots + \frac{R_n - E_n}{(1+r)^n} \right] \div C$$

where the expected revenues from the airport ( $R$ ) minus the costs of operating and maintaining the airport ( $E$ ) in each year are discounted by a factor of ( $r$ ), generally set equal to the current market rate of interest. The sum of discounted net revenues is then divided by the initial costs of constructing the airport ( $C$ ). The discount rate used in this analysis should reflect the cost of capital faced by the airport operator under current market conditions. The advantage of using the market rate, which incorporates real interest, inflation, and risk, is that it affords comparison with any other potential investment.

If this exercise yields a benefit-cost ratio less than 1, it usually indicates that the investment is not warranted, because the net income generated would fail to cover the initial construction costs and the cost of capital. However, before rejecting the investment outright, a sensitivity analysis should be attempted to see if changes in the estimates of costs and revenues (e.g., assuming a different fee structure or a greater volume of air traffic) or the discount rate would make the ratio larger than 1.

Even if the benefit-cost ratio remains below 1, the construction of the facility may still be undertaken if the indirect benefits it offers the community warrant its subsidization from government funds. In fact, the indirect economic benefits of the airport might generate revenues to cover the subsidy. For example, if the location of the new airport in a state results in a net increase in economic growth, the state may capture part of the costs of construction indirectly through increases in its general tax revenues.

On the other hand, a project with a benefit-cost ratio greater than 1 might still be ruled out if other costs not measured by the financial feasibility approach are deemed to be too great.

The major weakness of this analysis is that it does not consider the full range of costs and benefits of the airport project. It does not consider job creation or displacement and the broader economic impact associated with airport development. As noted previously, these spread effects have a direct bearing on indirect costs and revenues associated with the airport, and therefore have budgetary implications for the governments financing the investment.

In addition, the analysis does not include intangible effects of airports, or costs and benefits that are difficult to quantify. Many economic activities provide incidental benefits to others for whom they are not specifically intended. Such benefits might include the value of time saved by airport users or the effects on property values close to the airport. Similarly, there are airport activities that indiscriminately impose costs on

others. An example might be the air and noise pollution that an airport brings. An activity generates externalities if it causes incidental benefits or costs to others, and those who generate the externalities do not provide or are not provided corresponding compensation. In the context of airport construction, those who benefit from positive externalities are generally dispersed throughout the community, whereas those who suffer from negative externalities consist primarily of people who live near the airport.

### Benefit-Cost

The traditional benefit-cost procedure involves measuring all the costs of providing a service (economic, social, and environmental) and all the benefits derived from the service, then valuing each of these in monetary terms discounted to a common point in time. The difference in the value of costs and benefits, usually expressed as a ratio, is then used for policy decisions. If the ratio of benefits to costs is greater than 1, the proposed project is warranted.

Benefit-cost analysis has not generally been used to evaluate the economic ramifications of airport development. It appears to have been used primarily at the federal level to establish funding criteria. Benefit-cost analysis has been used regularly, for example, by the FAA to look at proposed airport site improvements involving potential navigational aids (instrument landing systems) in relatively low-activity areas. According to FAA and others, in these cases the analysis was used to determine the minimum level of activity that warranted the expenditure necessary to install the system.

Perhaps the most extensive benefit-cost analysis of airport development was performed by the U.K. Commission of the Third London Airport. The study compared four proposed sites for the location of a third London airport, attempting to measure and compare the economic and social costs and benefits of each location. However, the study's recommendation was not followed. The study determined that Cublington, a site close to London, would be the best site, but the Parliament preferred Foulness, which was the site furthest from London with the worst benefit-cost ratio (13).

The limitations of the benefit-cost approach for analyzing multifaceted socioeconomic issues are well known. The methodology requires that the costs and benefits be quantifiable and comparable in monetary terms. In many cases, this valuation is difficult to justify and appears arbitrary—such as placing a dollar value on passenger time or passenger life when estimating risk factors.

### IMPACTS OF AIRPORTS ON REGIONAL SOCIOECONOMIC DEVELOPMENT

As states become more involved in aviation, it is important that the relationship between airports and economic development be well understood, and that the longer-term effects and dynamics be assessed. The issues from the states' perspective are the following: Do airports help foster economic development? And if so, what kind of development is typically encouraged, how does this occur, and at what cost? These questions can be phrased more specifically. Do airports draw

industry into a state or region, leading economic growth, or do they tend to follow development? Do they act as constraints to growth (if they are not built or expanded)? Is there a bias to the type of economic development encouraged, attracted, or supported by airport and aviation development?

As states consider increased involvement in aviation, the financing issues need to be addressed. What are the available sources and required levels of financing and, what additional (associated) expenditures and activities are required to exploit the full economic potential of airport development?

Although few studies address these questions directly, there are areas of the literature that can offer insights into these issues. Following is a review of some of this literature and data that could, in further research, be applied more directly to the previous questions.

### Determinants of Business Location

In order to address the question of whether or not airports attract industry, it is useful to ask first what determines business location decisions generally and how important access to air travel and transport is to those decisions.

The part of industrial location literature that is most relevant is the body of empirical case studies of location factors. These studies attempt to explain industrial location shifts by identifying the factors that influence business decisions to locate or relocate (14–16). Studies generally show plant and industry location decisions on the basis of a variety of criteria including

1. Economic factors such as accessibility of markets, raw materials, utilities, transportation, and labor;
2. Institutional factors such as government characteristics and tax rates;
3. Community factors such as amenities (cultural facilities, natural environment), attitudes, and population size;
4. Personal preferences on the part of the management and owners; and
5. Site factors such as land and buildings (17).

### Access to Air Transportation as a Location Factor

Access to transportation, as well as the speed, convenience, dependability, and frequency of service, is an important location criteria. For example, a research memorandum by the Kansas Department of Economic Development found that a cross match between two industrial location surveys showed “efficient transportation facilities” to be among the nine most important locational factors for more than 50 percent of the survey respondents. The other factors included

- Availability of energy and fuel,
- Tax abatement and incentives,
- Ample area for future expansion,
- Availability of labor,
- Accessibility to markets,
- Proximity to materials,
- Financing inducements, and
- Availability of technical and professional workers (18).

Studies directly addressing the link between airports and economic development vary in their conclusions. Some studies suggest that airports act as magnets, attracting industry and business, or that they are a necessary condition for growth. The Aviation Advisory Commission, for example, has argued that “it has been factually established that few businesses are willing to build plants and other facilities in a community that has no airport” (19). The FAA has claimed that documented cases show the existence of an airport to be a controlling factor in the decisions of industries to move in or out of a community.

Other studies, however, argue that unless there are other factors such as access to materials, an adequate labor supply, and the proper tax structure, air service will not induce new industry to an area (Vitteck, M.I.T. Flight Transportation Laboratory). One study of three small airports in California (Bakersfield, Monterey, and Redding) suggested that economic development tends to drive airport development, rather than vice versa. This study concludes that local air service in many small cities is economically precarious—that “it depends on the presence of strong local demand which, in turn, requires a vigorous local economy.” It notes further that this demand for local air service is less likely to develop if the locality is near a major hub airport (20).

A report prepared for the Appalachian Regional Commission (21) notes that the information concerning the airport’s influence on industrial plant location decisions generally takes two forms: individual airport case studies and industrial surveys. According to the report, industrial surveys show that airports were listed as important by 20 to 30 percent of those involved in the location decision-making process.

In a survey of 330 Nebraska industrial plants, the most important factors determining industrial location decisions included quality, availability, cost of labor, and the existence of a right-to-work law in the state; highway transportation and proximity of markets; reliability of electrical service and availability of natural gas; availability of sites; and the fact that the people who started the plant lived in the area (22). Aviation services were not rated especially important. The study found that air freight transportation and air passenger transportation were, respectively, 33rd and 36th in importance among 43 factors. According to the study, some firms wanted airport facilities nearby for fast shipment of raw materials and finished products.

### Air Travel and Transport Are More Important for Some Industries

Although airport access does not tend to rank near the top of the list as a determining factor in the location decisions of business in general, it is more important for some industries than for others. An important question for states to consider is whether there is a bias to the type of economic development encouraged, attracted, or supported by airport and aviation development. Such a bias might be discernable from data showing which industries depend most on air travel and transport. These data could identify those industries most influenced by access to air in their location decisions.

An analysis of industry location by the Kansas Department of Economic Development (18) attempted to identify aviation-oriented industries that would be attractive and

attracted to Kansas. The report cites data from another study that classified 83 of 143 industries as "aviation oriented" (23). The report then groups these 83 industries according to their locational goals and state preferences. The report identified several industries that (a) do not require urban orientation, (b) are not primarily seeking cheap labor, and (c) would consider relocating to Kansas. These were grain mill products, beverages, household appliances, and electric lighting and wiring equipment.

This study reflects the types of efforts some states have made to assess the development effects of greater airport and aviation development. It also reflects the lack of adequate data. The list of industries identified as aviation-oriented refers to industries economically associated with aviation. But this does not necessarily mean that these industries need or prefer to locate near airports. Survey data directly addressing this question are needed.

A forthcoming study of the air cargo-air express service industry identifies the industries most dependent on this service (24). Ranked by shipment value, the top six industries are

- Computers and computer equipment,
- Radio and TV communications equipment,
- Semiconductors and related devices,
- Aerospace—vehicle equipment,
- Aerospace—engines and parts, and
- Electronic components.

The study notes that "because of market requirements, competitive pressures, and highly interrelated production/distribution process, manufacturers are shipping greater proportions of their output by air at a continuing rate. The speed, reliability, and security of air cargo services are sufficient to command premium rates" (24). Small, high-technology manufacturing plants are the major users of air cargo and air express services. The study also found that the average size of shipment, by weight and value, had dropped between 1983 and 1987. It concluded that air cargo and air express services have been instrumental in facilitating new industrial distribution systems (such as just-in-time inventory management) that require more frequent shipments of smaller average size.

In 1984, a 64,000-ft<sup>2</sup> cargo terminal was opened at the Norfolk, Virginia, airport. In 1985, it was reported that economic agencies there indicate that "bringing in Federal Express will boost many businesses in the region" (25).

A survey of firms in suburban Philadelphia found that access to Philadelphia International Airport is much more important to high-technology firms than non-high-technology firms (26).

In some cases, the tourism industry has been closely tied to airport development. A recent example of the importance of an airport development project to this industry is the expansion and initiation of commercial jet service to the Yampa Valley Regional Airport in Colorado. These changes, financed by both public and private sources, have been responsible for turning the local economy, which had been depressed and suffering from the collapse of the coal industry, toward growth based on the expanded use of the local ski resort.

As is the case with high-technology industries, the available studies on tourism industries suggest a strong link between the development of these industries and access to air transportation. But most of the information tends to be anecdotal

and generalizations are difficult. There is a clear need, therefore, for improved data systems and broader analysis of the issue if state development policy makers are to be able to understand and anticipate the effects of airport development on state and local economies.

## CONCLUSIONS

The literature that analyzes the relationship between airports and economic development covers a wide range of approaches and concerns. Although the literature is voluminous, little of it directly analyzes the airport and economic development relationship in a comprehensive way. Few studies look at the issue from the state perspective. Most agree, however, on one point—that airports do contribute significantly to, or at least influence, the economic activity beyond the airport site itself.

Some general findings of the literature are as follows:

- The location of airports influences the location and geographic distribution of some industries, and can be a significant factor in the decisions of certain industries to locate in a given state or region. (Data indicate that access to air transport plays an increasingly important role in the competitiveness of some high-technology industries).
- The impact that an airport development project has on an area depends on the particular economic conditions and characteristics of that area.
- There is a need for more comprehensive studies of the issue. Several data sources could be more fully explored, which could shed added light on the complex relationship between airports and economic development.

How can this literature be used to address state economic development issues? As noted, little of the existing literature speaks directly to the analytical needs of governors' offices as they budget their states' resources for economic development purposes. Nevertheless, many studies contain useful information and methodologies, and others identify sources of information that could be helpful.

For example, even though the final dollar figure arrived at by most conventional economic impact studies may not be appropriate or useful to a comprehensive view of the airport-economic development linkage, these studies contain detailed information on the specific industries and enterprises directly and indirectly associated with airports. This type of information is a necessary ingredient in any comprehensive analysis of this issue.

Similarly, the methodologies used and classifications developed in the financial analyses of airports should be used by governors' offices when contrasting airport development with other potential development investments.

Finally, detailed information on the industries that rely most heavily on air transport (i.e., those most likely to be attracted by improved air transportation) and those that are apt to be displaced in the event of airport development should be developed as the basis for predicting the type of economic development that is likely to occur as a result of enhanced air transport facilities and capacities. This kind of information currently exists in a few specialized studies, but has not yet been collected and analyzed on a broad enough basis to yield reliable generalizations.

Although little of the existing literature directly answers the questions governors are asking about the relationship between air transportation and economic development, it does contain information, analytic approaches, and data bases that can be effectively used by state and regional analysts to address the issue within the broader framework of statewide and regional development goals.

## APPENDIX

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# Economic Impacts of Improving General Aviation Airports

GLEN WEISBROD

Every state and many communities face the issue of setting priorities for investments in airport facilities. This issue has received the most public attention regarding the regional economic importance of investments in major new commercial airport facilities but relatively little attention has been given to the role of general aviation (GA) facilities. As a result, the issue of investment priorities is particularly problematic for GA airport facilities because their contribution to local and state economies is not well understood. The state and local economic impacts of GA airports are defined and measured, and the benefits of improvements to those airports are assessed. General aviation today is briefly summarized, and the measurement of airport benefits is examined with particular attention to the different approaches for economic impact analysis. Results are presented from a survey of businesses that use GA, which focused on the relative importance of GA for those businesses. A basic model system for evaluating GA benefits, developed for the Massachusetts Aeronautics Commission, is presented.

General Aviation (GA) refers to private aircraft that are not used for scheduled air services (passenger or cargo) or for military uses. Typically GA aircraft are small, propeller- or jet-powered airplanes or helicopters that may be owned by individuals or by corporations. Aircraft available for charter services (air taxi) or flight training are included in the GA category as well.

Contrary to the popular view, flying private planes is far from just a recreational activity. Nationally, according to a survey by the Aircraft Owners and Pilots Association, it is estimated that at least 26 percent of the GA fleet is operated exclusively for business and that 60 percent is used at least partly for business purposes. Other key findings from prior studies are as follows:

- Nationally, an estimated 34,000 firms operate 68,000 private aircraft.
- Of the Fortune 500 list of largest publicly held U.S. corporations, 363 operate their own business aircraft (1).
- Business turboprops and business jets in North America now number over 10,000, and are growing at a pace of over 3 percent annually (2).
- More than two-thirds of all business aircraft trips make use of GA airports rather than commercial air terminals (3).

Nationally, the importance of corporate access to GA airports is increasing as manufacturing and other corporations decentralize. As noted by one executive:

In this day and age, if you don't have a good all-weather airport, you're substantially jeopardizing your ability to grow and attract business. The more we grow, the more of a problem it becomes to us. The more reason we have to travel around (4).

## MEASUREMENT OF AVIATION BENEFITS

GA facilities (and improvements to those facilities) can provide a range of potential benefits:

- **User Benefits.** Provide travel time and operating cost savings, as well as safety improvements, for travelers.
- **Economic Benefits.** Promote business expansion and attraction by generating jobs and business income and by providing necessary facilities to attract new businesses.

User benefits of an airport or airport improvement result in subsequent economic benefits for business expansion and attraction.

### User Benefits

Transportation system efficiency impacts from transportation projects are evaluated through user benefits. For any given transportation improvement, the aggregate economic value of time savings, out-of-pocket cost savings, and safety improvements for all travelers can be compared to current or base case conditions. User benefits associated with a project can then be compared to the costs involved and can also be used to compare the net benefits of alternative projects and for ordering projects by priority in statewide airport system plans. Such a process is actively used by the state of Wisconsin in its statewide Airport Benefit Cost computer system and also in FAA's Airport Data Analysis microcomputer program.

Application of benefit-cost analysis on the basis of transportation efficiency (user) impacts is a respected approach used in project evaluation for highways and seaports, as well as aviation facilities. However, it is increasingly being recognized that user benefits can understate the full economic benefits of a project, particularly when the proposal is a new facility or expansion of an existing facility that is motivated by its potential role as a catalyst for local economic development.

### Economic Benefits

Much confusion exists about how to measure economic impacts of GA airport facilities. In fact, different measures are appro-

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