Flight Plans for Development: Aviation Investments and Outputs in Nine Metropolitan Regions, 1990 to 2001

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Abstract

Airports form the logistical core of metropolitan areas. A region's aviation infrastructure strengthens its national and international 'connectedness' with other spaces in the domestic and global economies. Aviation built investments are thought to improve the economic development potential of cities and regions, and are required to meet demand for aviation services and to purchase increases in the future throughput of airport infrastructure. This paper examines the relationship between aviation built investments (runways, terminals, taxiways, etc.) and aviation outputs—enplanements, passengers, freight cargo, and mail—that might be affected by such investments. Nine mid-sized metropolitan regions (five located generally in the Midwest—called competitor regions; and four in other regions exhibiting economic success—called exemplar regions) are examined. The nine areas invested in aviation at different rates during 1990 to 2002 and generated various aviation outputs linked to these investments. The competitor regions spent more on aviation infrastructure than the exemplar regions, apparently 'purchasing' more plane, passenger, and cargo throughput. In several regions, aviation investments in the early 1990s might have increased selected aviation outputs in the late 1990s. The metropolitan regions with the most successful economic performance exhibited lower rates of aviation investment. Some of the findings raise questions about the necessity of large aviation investments to the economic success of regions.

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An important element of economic development is the capacity of metropolitan regions to offer physical environments that help organize production and that provide flexibility in meeting the spatial, communications, transportation, and logistical needs of business firms, both high technology and others (Beacon Hill Institute 2002; Atkinson and Gottlieb 2001; Atkinson, Court and Ward 1999; Lobo and Rantisi 1999; Storper 1997). In particular, the role of logistics in the new economy is crucial. By logistics, we mean the systems that organizations need to procure, distribute, maintain, and replace material and personnel. In this respect, competitive metropolitan regions must have local and regional circulatory effectiveness and national and international networking connections (Kasarda 1996). Therefore, built investments in intraregional (streets and collectors, buses) and interregional and national (highways, airports, trains) transport system are an important part of metropolitan logistical capacity.

Transportation infrastructure possesses basic to advanced networks, from local streets to regional thoroughfares to interstate highways to railroad freight facilities to 'new age' aviation facilities. But in addition to various transportation systems and facilities, a logistical infrastructure requires other kinds of built investments. They also must have storage and warehousing facilities for the movement and temporary housing of materials and goods (Glasmieier and Kibler 1996), including those kinds of built investments needed to 'store' people on a temporary basis—hotels and motels. Thinking about the logistical infrastructure of metropolitan regions requires that components of the built environment be parsed into groups such as surface transportation, storage, and aviation facilities.

By some counts, though, the core of a region's logistical infrastructure lies in the construction and expansion of airport facilities. Airports are considered to be a crucial ingredient in economic success, providing a means by which people and material are brought into and through a region (Irwin

and Kasarda 1991; Debbage and Delk 2001). Airports embody the interregional and international networking capacity of a metropolitan area.

Some regions act on this belief in big ways, earmarking large capital investments for aviation expansion. For instance, Central Indiana has been no different in this respect. The Indianapolis Airport Authority made substantial airport investments in the 1990s, investments that might have supported increased cargo volumes later in the decade (see Figure 1). Now, however, an investment estimated to total $974 million—more than three times the $297 million invested between 1990 and 2002—is planned for Indianapolis International Airport during the next five years. What are the likely returns on this massive level of investment?

Based on the idea that airports are important parts of the logistical infrastructure of urban regions, this report examines the volume of built investments devoted to aviation facilities, and the relationship of these investments to several aviation outputs. It does so by exploring the aviation investments made in the Indianapolis metropolitan statistical area (MSA) and eight other MSAs. These comparison MSAs are broken into two sets, with Indianapolis as the reference region 'in the middle' between spatially proximate competitors and more distant, but reputationally desirable, exemplars. One set of MSAs, the competitors, is composed of city-regions within the Midwest that compete with one another for people and economic development. The other set of MSAs, the exemplars, is composed of city-regions that are seen as generally successful areas experiencing positive growth, and that are roughly similar to the Midwest regions.

In order to explore the effects of aviation investments among these nine regions, the construction costs of building and expanding airport facilities are conceived here as part of the base price paid by regional leaders to purchase particular kinds of activities associated with airports. For instance, various airport facilities such as terminals, gates, and runways are built and modified to increase the processing capacity of airports. It is typically an explicit objective that these investments

will expand an airport's capacity to deliver aviation-related services. In more direct terms, these investments seek the creation of more aircraft landings and departures, more passenger enplanements, and more cargo within the region. In this context, the investments are made to generate particular kinds of returns: more people, more flights, more cargo. Therefore, considering just aviation infrastructure, this comparative analysis of metropolitan logistical facilities will examine the following:

1. Volume and variation in aviation built investments in runways, taxiways, terminals, lighting, and airplane service facilities.
2. Volume and variation in annual aviation outputs for each metropolitan region (share of U.S. aircraft departures, total aircraft departures, total passengers, freight-tons, and mail-tons).
3. Empirical relationships between aviation outputs and aviation built investments

The report is organized into four parts. The first section explores the conceptual elements of aviation investment by regions: what investments in aviation facilities can create and why such investments are thought to potentially improve regional economic performance. The second section looks more explicitly at the MSAs used in the comparison, why they were selected, and a brief comparative examination of the relative economic success of the regions during the last decade or so. The third section presents the empirical analysis, focusing on the questions noted above. The final section presents conclusions about the linkage of aviation investments and aviation outputs.

Aviation in the new economy: how airports enhance regional development

As early as 1942, there was informed speculation that aviation investments would be the next wave of transportation investment to have a major influence on urban structure (Isard 1942). More than sixty years later, aviation investments play an emblematic role in the globalizing new economy. A widely connected airport infrastructure is considered a fundamental component of the new economic structure of metropolitan regions. For national and global success, a metropolis should have an accessible, expandable, adaptable airport system to accommodate the travel needs of business firms and professional workers both domestically and, within the globalization imperative, internationally. In

more specific terms, airports provide the physical underpinning to regional, national, and international networking arrangements. Irwin and Kasarda (1991, p. 525) note that

> the rise of air transportation has been a key factor in creating interarea linkages and has laid the foundation for multi-site corporate complexes, trans-spatial intraorganizational interaction, and the rise of national markets for producer services [and] has boosted growth rates in Sunbelt cities.

They go on to argue that airports and other aviation-related built investments can fundamentally change the intermetropolitan space economy. By having better air travel connections *via* modern airport infrastructure, a metropolitan region could create competitive advantages over other regions with inferior aviation systems in place. As the preceding quote suggests, some regions have used airport investments to their economic advantage. Dallas-Fort Worth, Charlotte, and Atlanta come to mind. As a result, many local political and business officials see airport construction and expansion as basic building blocks for the successful transition to a new economy.

To understand this belief, we should ask how airport investments improve the local and regional economy. The dynamics of this influence can be explored in several different ways, but should first be placed within the broader context of the basic economic demand for and supply of airport facilities. At any given time, the capacity of a region's airport is largely fixed and supportive of some maximum throughput of aviation services. As demand goes up, crowding and the costs of congestion increase, and decisions to invest in expansion will follow. These decisions will be influenced by both a need to satisfy any growing backlogs of demand as well as the desire to expand and modernize aviation facilities for future growth. Thus, the aviation investment-to-output process is cyclical and iterative. Within this basic economic context of supply and demand, we can examine several key factors that make aviation facilities attractive targets of built investment.

First, airport facilities, in and of themselves, have become centers of development that generate direct and indirect economic impacts on regional growth. Airports help create what Graham and Marvin (2001, p. 357-358) call "logistical enclaves [which are defined as] spaces within which the

precise and rapid shipment of goods, freight and people across the planet are coordinated, managed and synchronised between various transport modes, along with supportive information and energy exchanges." A recent *USA Today* article (El Nasser 2003) argues that "new 'cities' [are] springing up around many U.S. airports." To buttress this declaration, the article documents rapid job creation around Dulles International (air passenger traffic) in Washington, D.C. and Fort Worth Alliance Airport (non-passenger aviation cargo and shipping facility), and notes the volume and longstanding growth of commercial and residential development around Dallas-Fort Worth International Airport and the Albuquerque International Sunport. In each of these cases, the airport itself is seen as an impetus for energetic development opportunities. Thus, development on and around airport property is thought to be a positive addition to local and regional economic prospects. An additional factor here is the designation of various airports as hubs for passenger and cargo operations of airline companies. This can multiply demand for airport services, and those regions in geographical locations better suited for efficient hub operations can develop an aviation-based advantage over other regions in less beneficial locations (Debbage and Delk 2001).

Second, if we conclude airports are good for the local economy, then we might suspect that expanding runways and terminal facilities is also good. This is because runway and terminal expansions increase the volume of planes and people that can be processed through the aviation infrastructure. Runways are lengthened to reduce the time between sequential aircraft landings, or new runways added to accommodate an increase in multiple landings. Terminals can be expanded and extra gates added to strengthen an airport's overall processing capacity. Expansion projects can be either a response to growing demand for a region's aviation services or a means of creating slack capacity that can generate increased demand in the future. Construction and modification of airport terminals also create new spaces for consumption by airport patrons, as evidenced by the 'malling' of airport terminals to provide shopping opportunities for travelers. Some analysts have argued that

> thanks to all the offices, banks, hotels, restaurants, conference facilities, casinos and shopping centres in the immediate vicinity, the airport has developed into a significant economic centre that is sometimes so large that the airport starts to compete with the very city it was intended to serve (Graham and Marvin 2001, p. 365).

Third, after runways and terminals are expanded, if plane departures and arrivals increase, then it is likely that the number of enplaned passengers will increase. Not only more aircraft but more people will pass through the airport complex and into the metropolitan region. More people passing through, or terminating at a particular place, can increase the demand for restaurants, shopping, hotels, and motels accessible from the airport facility. This has helped increase the 'mallification' of many major airports noted above, as large crowds moving through hub airports must wait for connecting flights. If connections, tourist, and business visits are long enough, higher demand for local hotels, restaurants, shopping, and transportation facilities can result.

Fourth, along with people and planes, more airborne material can be processed as airport capacity is increased. More tons of cargo and more tons of mail are other likely results if the aviation infrastructure of a metropolitan region is expanded and strengthened. Cargo haulers such as FedEx have designated airports as hub operations (e.g., Memphis, Indianapolis), which has a significant impact on a region's cargo processing capacity. As an airport is required to deal with larger volumes of material, it could create additional demand for other processing and storage facilities (e.g., warehouses, break-in-bulk facilities, trans-modal terminals, etc.) both on and off the airport site. This can help establish the kinds of "logistical enclaves" defined by Graham and Marvin (2001), and in some cases become part of specialized cargo-only airport complexes such as Fort Worth Alliance Airport (Nunn 1991) or North Carolina's Global Transpark (Kasarda 1996).

Finally, more air flight connections to more places are made possible—at least indirectly—through the expansion of airport gates, terminals, and runways. For example, airports might build terminals devoted exclusively to international arrivals and departures, thus enhancing the capacity for international connections. From this, increasing connections can make a place more attractive as a site

from which to do business because of the enhanced national and international accessibility. Particular kinds of business opportunities might be enhanced via airport improvements, such as warehousing and logistic functions. Or, high-level business services (e.g., management consulting, professional services) might find a metropolitan area more hospitable if it has ample national and international flight connections.

Comparing aviation investments and outputs across regions

Given this array of dynamics linking aviation investments and outputs, a cross-sectional comparison of regional aviation investments and their relationship with selected outputs can provide useful intelligence about the return that regional leaders might expect from airport investment programs. All regional comparisons are arbitrary, and in this case the idea is to compare aviation investments and outputs in Indianapolis with those in other similar regions that reflect varying levels of economic success. The comparison regions are arrayed into two groups: a set of five 'competitor' MSAs (including Indianapolis) composed largely of Midwestern rust-belt regions, and four 'exemplar' MSAs that are frequently identified as new economy success stories. The regions are noted below, followed by a brief explanation of why they were selected.

Competitor metropolitan regions

1. *Cincinnati*: site of metropolitan university with medical and law schools; frequent competitor region in the Midwest; includes Indiana counties.
2. *Cleveland*: site of metropolitan university with law school and other major university with law and medical schools; frequent competitor; archetypical rustbelt region.
3. *Columbus, OH*: state capitol; large state university with full array of professional schools; central city in an 'undifferentiated' plain.
4. *Indianapolis*: state capitol, large metropolitan university with professional, medical and law schools.
5. *Kansas City*: site of metropolitan university, frequent competitor region, typical Midwestern city.

Exemplar metropolitan regions

1. *Austin*: state capitol; high tech milieu; large university with medical & law schools; sunbelt; very successful economic development.

2. *Nashville*: state capitol; consolidated city-county government structure; sunbelt; major universities with professional schools; attractive economic development environment.
3. *Raleigh-Durham*: state capitol; high tech milieu; large university complex with major professional schools.
4. *Sacramento*: state capitol; on fringe of Northern California's high tech milieu; site of a metropolitan university complex and the University of California Davis, which includes a medical school.

The selection rationale was to pick metropolitan areas similar to Indianapolis. For the other competitor regions, this was straightforward. Columbus was used because it is a state capitol in an adjacent Midwestern state with an old economy heritage and a sizeable education and governmental infrastructure, as well as a player in periodic economic competitions with Indianapolis. Recently, a Columbus-based pharmaceuticals firm, Cardinal Health, Inc., acquired a major Indianapolis corporation, Bindley-Western, Inc., in what was considered an economic development coup for Columbus (Robertson 2001). Likewise, Cleveland and Cincinnati, spatially close to Indianapolis, are included because they are considered frequently in peer comparisons with Indianapolis. Cincinnati and Indianapolis once engaged in interjurisdictional competition to lure a major United Airlines aviation maintenance facility, a competition eventually won by Indianapolis (Nunn and Schoedel 1995). Kansas City is considered a Midwestern metropolitan area, and like Indianapolis sits within a largely undifferentiated geographical plain as well as within a large metropolitan region. A recent profile (Davis 2003) suggested that if "you're looking for a mirror image of Kansas City, it's hard to beat Indianapolis…as measured by such markers of national stature as population, office market size and number of professional sports teams, the two cities are strikingly similar." The two regions are so similar that in June 1997 the NCAA announced that its headquarters would move to Indianapolis after being located in Kansas City since 1952 (Jankowski 1999). The Indianapolis NCAA headquarters started up in 1999.

As for the exemplars, it was assumed that both Austin and Raleigh-Durham (Austin and Raleigh are also state capitols), by virtue of their frequent characterization as icons of the new economy,

might show different patterns of public and private built investment than old economy regions. Nashville and Sacramento, while perhaps a bit less noteworthy than the other two new economy stars, nevertheless have shown economic success, with Nashville typically characterized as part of the sunbelt and Sacramento as having at least a peripheral connection to the silicon economy of Northern California. Also, Nashville has a unified city-county governance structure like Indianapolis, and has been characterized by some analysts of 'new economy' urban areas as "a highly competitive community" (Johnson 2002). Presumably, if differences among these regions' allotments of and trends in aviation built investment can be identified, inferences might be drawn regarding the type of built environment required for success in the new economy.

Have the exemplar regions experienced comparatively better success than the competitors? The short answer is 'yes.' In fact, the exemplar regions have grown more and faster in terms of population, income, and jobs than the competitor regions. As shown in Table 1, the exemplar regions exhibit better growth rates in population, income, and jobs than the competitor regions. The average percent changes are larger in the exemplar regions (in a statistically significant way). In most cases, all three of these metrics in the individual exemplar MSAs were better than those of the competitor MSAs. So, by way of some fundamental indicators of economic success, a partial case can be made that the exemplars have done better than the competitors during the 1990-2002 time period.

Assessing the relationship between aviation investments and aviation outputs

Pubic officials' belief in the developmental potential of aviation facilities probably is not misplaced. Further, we could assert that local and regional officials, by increasing the volume or changing the quality of ongoing airport investments from year to year, are both responding to changes in the demand for aviation services and directly trying to 'buy' favorable aviation outputs.[1] Another way of saying this

[1] A separate component of the costs associated with 'buying' aviation outputs is the cost of planning, managing, and administering aviation facilities. Although these costs can be substantial on an ongoing annual basis, they are not included in this analysis.

is that although some part of airport investments might be devoted to satisfying existing demand or reducing congestion, many are also made in expectation of capturing more aviation products such as flights, people, and freight. The success of such 'buying expeditions' can be examined in several ways.

Hub designations and aviation investments

Perhaps the simplest approach to assessing the impact of aviation investments is to work backward from outcomes considered successful to see whether the investments were linked to those successes. Achieving large hub status, for example, suggests at least a qualified success at developing aviation infrastructure.[2] Altshuler and Luberoff (2003, p. 126-127) document the identities of "large hub airports" in 2000. These are considered by the U.S. Federal Aviation Administration (FAA) to be airport "communities enplaning 1 percent or more of the total enplaned passengers in all services and all operations for all communities within the 50 states, the District of Columbia, and other U.S. areas" (Bureau of Transportation Statistics 2001). Medium air traffic hubs enplane from 0.25% to .999% of total enplaned passengers. Small hubs are composed of all others. Thus, to be considered a large hub—of which there were only 28 in the U.S. in 2000—would place an airport in an elite category defined by the volume of air traffic moving through the region.

Based on these categories, the only comparison metropolitan region to appear on the list of large hubs is Cincinnati. From this, we might anticipate that Cincinnati's aviation investments have been somehow better or more intense than the other comparison regions, both competitors and exemplars. Cincinnati's airport investments during the 1990s ought to have been quantitatively larger, in an absolute or normalized sense, than the other comparison regions; this is in fact true and will be demonstrated more convincingly below. In addition, fluctuations in air travel and a changing

[2] The use of the word "qualified" is needed because hub designations might be considered largely a function of population size. Since hub categories are based on the absolute quantity of enplaned passengers, larger metropolitan areas have the advantage of a larger population base which is likely to generate more arriving and departing passengers. In addition, the geographical location of some places (e.g., a central location, equidistant from various major destinations) will make them more likely to be considered potential hubs.

geography of demand for airport services might affect the hub status of other airports over time. For instance, Altshuler and Luberoff (2003, p. 127) note that two of these other competitor regions, Cleveland and Kansas City, had recently "dropped out of the large hub category," from which we might expect aviation investment profiles similar to Cincinnati, with the other regions trailing behind.[3]

An earlier analysis of the geography of the airline industry classified the competitor and exemplar metropolitan regions in terms of each one's hub or periphery status as of 1993. At that time Cincinnati, Cleveland, Nashville, and Raleigh-Durham were each classified as "domestic hubs [which] serve as major connecting complexes for the airlines…with high degrees of domestic connectivity" (Goetz and Sutton 1997, p. 243). The remaining regions (Columbus, Indianapolis, Kansas City, Sacramento, and Austin) were classified as "semi-core…that do not serve as major hubs or gateways but have relatively high levels of connectivity" (p. 243). Thus, in some ways, each of the metropolitan regions examined here possessed generally well-developed aviation infrastructures at the beginning of the 1990s. Nonetheless, as shown later, there are a number of interesting differences in both the aviation investment patterns and aviation outputs produced by these various regions.

Of course, the success of a region's aviation infrastructure is not strictly measured by one of three simple hub categorizations (large, medium, small) of a metropolitan area's airport status. Falling into those classifications is more a matter of airplane traffic, which could be translated more broadly into several kinds of commerce flows. By building directly from the FAA's hub categorizations, then, it is reasonable to argue that among the various regional outcomes that could be associated with aviation investments, metrics assessing the flow of people through an airport are important. That is, processing more planes into and from the airport facility might be the fundamental operational impact of airport

[3] As noted, Cincinnati and Indianapolis engaged in a fierce economic development competition in the early 1990s for a United Airlines (UAL) maintenance operating facility (MOC), a competition eventually captured by Indianapolis (Nunn, Klacik, and Schoedel 1996). While successful on its face because the UAL MOC was built in Indianapolis, at least part of this sizeable investment by the region was ultimately a bust. Subsequently in 2002, the UAL MOC ceased operations as part of a wider downsizing and bankruptcy by the UAL company. In this context, aviation investments might be successful initially, but not over the long term. However, as shown later for Indianapolis, such investments might nonetheless sustain growth in particular kinds of aviation outputs such as cargo-tons enplaned.

investments. But other metrics are likewise reasonable, and can provide interesting assessments of other aspects of regional success. For example, the flow of material goods through an airport via cargo and cargo handling operations is important, and will likely have an impact on other logistical systems within the region (e.g., create demand for warehouses, trucking, etc.). Thus, use of an airport as a cargo hub (e.g., FedEx in Indianapolis) will potentially generate (or perhaps be enabled by) sustained aviation investments. In addition, a considerable amount of mail is carried by commercial airlines, and the volume of mail moving through an aviation facility could be also an indirect indicator of commerce and communications intensity attempted within a metropolitan region. These statistics are maintained for all U.S. airports on an annual basis (U.S. Bureau of Transportation Statistics, various years). By joining these metrics to the volume of built investment poured into aviation infrastructure, we can develop a useful picture of what a strategy of airport development might beget for a region.

However, tracking the ultimate outputs that are 'purchased' by constructing new and improved airport facilities is not a straightforward matter. Aviation investments, like many public infrastructure systems, demonstrate large spikes of construction volume, as when major runways or new terminals are constructed over multi-year periods. Expenditures on aviation facilities might be virtually nonexistent in a region one year, only to be followed by massive 'mega-projects' in subsequent years (Altshuler and Luberoff 2003; Adams 1988). Thus, annual changes in construction activities are likely to be extremely volatile, resulting in widely varying rates of change from year to year as investment volumes fluctuate based on major projects. One result of this is that standard measures such as annual percentage changes in aviation investments might not be particularly meaningful. For example, in 1996 the Cleveland MSA expended only $277,000 on aviation facilities, but invested more than $66 million in 1997—a percentage increase of 23,000%! Thus, developing a picture of change in each region's aviation construction might be more accurate if it based on an analysis of the nominal expenditures made each year. An alternative way of smoothing the spiky pattern of annual investments is to use

other measures such as mean annual investment in order to provide a better sense of a metropolitan region's long-term commitment to improving its aviation infrastructure. Both approaches are used in this report.

Another dimension to the empirical lumpiness of annual aviation investments is that the outputs and outcomes regional leaders hope will follow from aviation investments are most likely to occur some years into the 'future' (i.e., in the years following the lumpy expenditures). As is the case with many types of public infrastructure systems, the construction cycles of major terminals and runway projects often span multiple years, and must be generally complete before the throughput associated with the facility can escalate. As a result, accurate assessments of whether and how airport infrastructure improvements affect the competitive stature of a metropolitan region will need to link past infrastructure investments to more current output measures.

Regional aviation investments and aviation outputs

To begin, Table 2 shows some baseline aviation-related metrics for the exemplar and competitor MSAs during the 1990s, measured in terms of average annual volumes and 1990-2001 percentage change. Four separate outputs from a region's aviation infrastructure are considered: plane departures, enplaned passengers (strongly correlated with the former), freight-tons, and mail-tons (U.S. Bureau of Transportation Statistics 2000), as well as one measure of aviation investments. Aviation investments and outputs are translated into average annual per capita measures for the 1990-2001 period (through 2002 for investments) in Table 3.

Findings from these two tables deserve a few basic observations. In terms of the nominal amounts noted in Table 1 first, the competitor regions reflect substantially higher volumes of aviation outputs than the exemplar regions, and also demonstrate higher 1990-2001 growth rates. This is as Altshuler and Luberoff (2003) would have predicted in their discussion of large hub airports. Cincinnati (currently a large hub), Cleveland, and Kansas City (both former large hubs) all had the

highest volumes of average annual aircraft departures and enplaned passengers. These three competitor regions also dominate tons of mail enplaned. However, for most regions, mail-tons processed have been declining through the 1990s, with only a few exceptions; Austin, Indianapolis, and Columbus show positive growth from 1990-2001, while the other regions sometimes experienced substantial declines in mail volume. Based on these averages, Cincinnati, Columbus, and Indianapolis process the largest volumes of freight, and Cincinnati enplanes more freight-tons than any other region by no less than a factor of three (e.g., on average each year, Cincinnati enplanes more than 15 times the volume of freight handled in Sacramento, seven times the volume in Austin, etc.). In terms of 1990-2001 growth rates, Austin and Indianapolis show the most robust increases in freight-tons. Overall, though, in terms of average annual aviation outputs, Cincinnati is the clear leader among all nine metropolitan regions. It is possible that the more centralized geographical location of the competitor regions (in comparison to the exemplar MSAs, which are mostly located outward from the U.S. center) might explain some of the aviation-based dominance their baseline statistics suggest.

But, consistent with the idea that decisions to invest in airport infrastructure are made with the expectation of returns on those investments, the competitor regions might have 'bought' this dominance by means of more aggressive investments in the aviation built environment. In fact, this appears to have been the case. Apart from their possible spatial comparative advantage, the competitor regions also created a substantially higher volume of investments in aviation-related facilities from 1990 to 2002. They either initiated and thereafter took advantage of larger capital investments in aviation infrastructure, or they responded financially to increased demand for aviation outputs. In either case, the competitor regions invested more heavily in airport infrastructure. On an average annual basis, the competitor regions considered as a group invested twice as much each year in aviation construction (about $22.7 million/year) as the exemplar regions did (about $11.2 million/year).

If we control generally for population (see Table 3), some of these observations change a bit. Considering average per capita values during 1990-2002, aviation investment per capita is substantially higher (though not significantly different) in the competitor regions. Cincinnati and Indianapolis reflect the highest investment per capita, and Austin is the highest per capita outlier among the exemplars (and exceeds Indianapolis). There is virtually no difference among the various regions in terms of annual average aircraft departures per capita during 1990-2001. Enplaned passengers per capita does suggest the exemplar regions are annually processing relatively more passengers on average than the competitor regions; this is explored a bit more later (see Figure 2). Freight and mail per capita are generally lower in the exemplar MSAs, although Nashville and Raleigh-Durham compare favorably (although substantially less) than the two leading competitor regions, Cincinnati and Kansas City.

However, the apparent dominance of the competitor regions in aviation investments and outputs is at least somewhat unexpected if we recall the broader economic success of several of the exemplar regions in our analysis. That is, if aviation infrastructure is a crucial and necessary component of success in the new economy, and some of these exemplar regions are clear leaders in the 'new economy', is it reasonable to expect that those metropolitan regions with new economy status (e.g., Austin and Raleigh) would show higher aviation investments and more aviation outputs?

Austin is an interesting case, especially given its status as new economy icon. Consider its average rate of aviation investment: $19 million per year from 1990 to 2002 (see Table 2), for an average annual per capita investment of $18, more than twice the other exemplar regions. Now, on one hand, some of this investment paid-off because Austin's 1990 to 2001 growth in aircraft departures and freight-tons exceeded all other exemplar regions, it actually increased its volume of mail-tons, and it had a respectable growth rate in the number of enplaned passengers. On the other hand, this high volume of construction expenditure did not produce a commensurate bump in other aviation output metrics. Austin had the fewest average annual aircraft departures among the eight other regions, the second

lowest annual rate of passengers, and the smallest average annual flow of mail tonnage. It had better success in cargo-tons, possibly linked in part to manufacturers such as Dell computer that ship products from central Texas. But among the exemplar regions, Austin's aviation output was low compared to its higher annual spending on airport infrastructure. And most certainly, the competitor regions in all but one instance exceed Austin's airport throughput, typically by a substantial margin. The paradox here is that despite this comparatively poor showing in aviation infrastructure outputs—presumably a necessary ingredient for economic success—Austin is a robust, innovative, high income, high invention region. Is this an anomaly, or is airport infrastructure in some regions less important to strong regional economic success?

Perhaps the importance of airports for some regions is overemphasized. The other new economy icon, Raleigh, is also interesting because, like Austin, it showed evidence of a somewhat underdeveloped aviation infrastructure as well as some surprising variation in its aviation outputs. As shown in Table 2, Raleigh's average annual aviation investment ($5.9 million) was actually the lowest of any region, exemplar or competitor. It was the only one among the nine regions to show a percentage decline in enplaned passengers from 1990 to 2001. However, unlike Austin, some other aviation outputs in the Raleigh metropolitan region were (on average) often competitive with other regions, although its annual volumes of outputs were typically in the 'middle of the pack' of all regions. In short, its aviation outputs remained moderately competitive among this set of comparative regions, but at a construction cost that was the lowest annual average aviation investment among all regions.

But other ways of examining Raleigh's aviation fortunes suggest a less positive outlook. If you shift the focus from annual averages to the multi-year time series of aviation investments and outputs, some data suggest that the region's aviation investments might not be generating outcomes that are as successful. For example, compare Indianapolis and Raleigh in their respective volumes of aviation investment and cargo-tons processed within each region (see Figure 1). In the case of Indianapolis, the

first half of the 1990s was marked by substantial investments in aviation infrastructure occurring in parallel with fairly low cargo-ton production, but after the investment spikes declined, a substantial growth occurred in cargo-tons moving through the Indianapolis airport. One interpretation of this in simple terms is that the early-1990s investments paid-off for Indianapolis with high cargo volumes following on the heels of increased aviation investment. This was not the case in Raleigh. In the first place, the overall levels of aviation construction investments and cargo-ton volumes were far lower there than in the Indianapolis MSA. In the first half of the 1990s, the Indianapolis MSA was spending anywhere from $20 million to $60 million per year, while in the last half of the 1990s Raleigh never invested more than $15 million annually. The same differences hold true for cargo outputs: Indianapolis processed upwards of 80 million tons by 2001, but Raleigh never processed more than about 23 million tons. Even after ignoring this difference in the scale of activities, Raleigh was effectively a reverse image of Indianapolis. Raleigh's cargo volumes declined precipitously through the 1990-2001 period, even while its aviation investments began increasing after 1995. So in the case of Indianapolis, one scenario could be that its high investment levels in the early 1990s attracted increased volumes of cargo processing, thus adding to its image and reputation as a logistics center.[4] In contrast, relatively robust cargo volumes in Raleigh began to decline in response to declining aviation investment, which did not really increase substantially until the last half of the 1990s, too late to salvage higher cargo volumes, which continued to decrease from 1995 to 2001.

Yet, despite these potential shortcomings in its aviation infrastructure, Raleigh still managed to be a new economy success story. Again this raises the question of whether the importance of airport infrastructure to new economic development is possibly overstated. And another take on this concerns

[4] It is also reasonable to assert that because of the UAL MOC competition that Indianapolis "won" from Cincinnati and other regions, higher investments were required in the early 1990s to meet the public commitments to UAL. Then, operations of the UAL MOC began to drive-up the volumes of cargo into the Indianapolis International Airport. In addition, the FedEx air cargo hub in Indianapolis, which opened in 1988, was enlarged in 1998 and generated an increase in box sort throughput from 51,000 to 79,000 pieces per hour.

the number of people passing through a metropolitan airport, under the assumption that more passengers create a more dynamic local economic structure. For example, Debbage and Delk (2001) found a statistically significant relationship between passenger volume and administrative and auxiliary employment in the top 50 urban airports in the U.S. between 1973 and 1996. Figure 2 shows boxplots[5] describing the distribution of the number of enplaned passengers per capita in each of the nine MSA regions. The implication here is that perhaps the influx of people, rather than cargo, contributes to the overall success of the region. As shown in the figure, Raleigh had considerably higher enplaned passengers per capita than Indianapolis. In fact, Raleigh's distribution of passengers per capita is very similar to that of Cincinnati, which had perhaps the strongest aviation infrastructure of all nine regions. So even with smaller volumes of investment in aviation, Raleigh has still managed during the 1990-2001 period to process about the same number of passengers per capita as the much busier Cincinnati airport. In contrast, the Indianapolis MSA passenger per capita metric had the narrowest range of per capita enplanements and was well below the mean for all MSAs. One simple interpretation of this is that people coming into a metropolitan region have a more positive impact on regional success than tons of cargo. Thus, although aviation investment volumes in Indianapolis appear to have improved the region's throughput of material, the region's investments have not generated like increases in passengers per capita, and have therefore had a weaker effect on Indianapolis's economic success.

But remember that on average through the 1990-2002 period the competitor regions spent a *lot* more (twice as much) on aviation construction, so it is also possible that the competitor regions strengthened their aviation infrastructure in other ways that helped produce higher output metrics. Therefore, another way to consider the pay-off generated by expanding the airport infrastructure is to

[5] A boxplot is an exploratory data analysis technique useful in judging differences in the distribution of variables (see Haining 1990, p. 201-202). A boxplot shows quartiles, overall range, interquartile range, and median values, thereby offering a succinct graphic of a variable's distribution. In this case, examining box plots allows a comparison of the MSAs across the years for selected variables, and shows how the distribution of the variable differs among the MSAs.

calculate how much each output cost in aviation investment. In other words, how much aviation capital was put in place per unit of aviation output? Implicitly, this assumes that aviation investments must precede changes in outputs. With different metropolitan regions investing different amounts into aviation construction, the question is whether the differences are associated with better or poorer performance in the production of aviation outputs.

To illustrate using one aviation output (e.g., freight), if there is little difference in the number of freight-tons per dollar of aviation construction among the regions, we could be dealing with some version of a base price system in which there is little variation in the cost per aviation output (e.g., it costs an average of $266 of aviation construction per aircraft departure over an 11-year period, regardless of the metropolitan region). On the other hand, if there is a large variance in the average cost per unit of output, other local and regional conditions may affect the success of aviation capital. As it turns out, if one calculates the average aviation construction cost per average unit of output over the 1990-2002 period, the competitor regions generally paid more per unit, on average, than did the exemplar regions (see Table 4). This was the case for aircraft departures and enplaned passengers in particular. The costs per freight- and mail-ton were much closer. However, from a statistical perspective, the exemplar and competitor regions were not significantly different. Overall, though, among all regions, competitor and exemplar, Austin paid consistently more per aviation output. Given its overall regional success, Austin does not appear to owe it to a clearly superior aviation system, because other regions appear to be producing more aviation outputs at lower cost ratios.

Another aviation output of considerable interest to local and regional development interests is the incidence of international flights within an airport. International connections are thought to broaden the global networks in which metropolitan firms and individuals operate, and offer another mechanism for importing development opportunities into a region and providing a richer and more competitive environment for existing business firms and other organizations with interests outside the

U.S. By this reasoning, a larger share of international flights occurring at a metropolitan airport is good, as it indicates participation in globalization and more international linkages.

Table 5 examines international flight departures as a share of total departures at each of the competitor and exemplar regional airports, and considers possible linkages between built investments in aviation facilities and changes in international flights. To do this, we examine changes in aviation investments and international flights in two different time periods: 1990 through 1995, and 1996 through 2001. During the 1990 to 1995 period, there were two interesting trends. First, there is a significant statistical difference between average annual aviation investments in the competitor and exemplar regions, with the competitor regions on average spending more than three times what the exemplar regions invested. Second, during this same period there was virtually no difference between the two sets of metropolitan regions in the average percentage of total departures that were international. Then, in the post-1995 period, two other trends became evident. First, where there had been no difference in the share of international flights, during the 1996-2001 period, the competitor regions—especially Cincinnati and Indianapolis—increased their average share of international flights, thereby increasing the difference between the exemplars (lower shares) and the competitor regions (higher shares). And second, although the differences in average annual aviation investments between the competitor group and the exemplar group remained, the exemplar regions in effect 'closed the gap' substantially, led by much higher average investments by Austin and Sacramento.

One possible interpretation of these findings is that the higher levels of aviation investments in the first half of the 1990s in the competitor regions enabled increases in the proportional volume of international flights in the 1996 to 2001 period. Indianapolis and Cincinnati, both of which had the highest annual aviation investments in 1990-95, demonstrated the largest increases in international flight proportions. Among the exemplar regions, only Austin experienced an increase in international flight shares, and this was accompanied on the investment side by the highest annual investment

average among the exemplar regions. If this interpretation is reasonable, there is a likely linkage between higher investments in aviation infrastructure and positive changes in the proportional volumes of international flights. Furthermore, if international connections are an important part of future development potential, then aviation investments might have high pay-offs in the future when they enable metropolitan regions to process larger numbers of international flights and passengers. In addition, the increased aviation investment levels in the exemplar regions in the 1996-2002 period suggests that shares of international flights in these regions during the remainder of the 2000-10 decade might increase.

Conclusions

As one part of a metropolitan region's logistical assets, aviation infrastructure plays a crucial role in national and international networking, business and personal travel, materials processing, and regional economic development. To improve the performance of their respective airports and ancillary facilities, the metropolitan areas examined here have invested in aviation at different rates during the 1990 to 2002 period and have generated various aviation outputs linked to these investments. The competitor regions, including Indianapolis, have spent a lot more on aviation infrastructure than the exemplar regions, and have accordingly 'purchased' higher volumes of plane, passenger, and cargo throughput. In several regions, there is a positive relationship between increased aviation investments and subsequent increases in selected aviation outputs. For example, the high level of built investments in the Indianapolis airport infrastructure was followed by a substantial increase in cargo processing, suggesting that as new aviation capacity is developed, regions can take advantage of it by increasing throughput of people and materials.

However, despite the imbalances in aviation investment between the competitor and exemplar regions, at least two key observations are warranted. First, while aviation investments between the two sets of regions are substantially different in a statistically significant sense, the mean annual aviation

output metrics largely are not (mail-tons enplaned are significantly higher in the competitor regions). The construction cost-per-unit of aviation outputs, while generally higher in the competitor regions, also is not significantly different, nor were the comparative proportional shares of international flights. So, even if the competitor regions are in fact investing substantially more in aviation facilities, and perhaps even 'buying' nominally higher volumes of aviation outputs, the exemplar regions' outputs are still more similar to the competitor regions than they are different. Second, the exemplar regions appear to be economically better off than the competitor region. Based on a few fundamental economic indicators such as population, jobs, and income, growth in the exemplar regions exceeded that of the competitor regions.

Finally, this begs a question about the role of airports in absolute economic success. Are aviation investments truly necessary ingredients of new economy success? Certainly having a well-developed aviation infrastructure is important to a region, but on its own even a 'cutting-edge' airport might not be capable of sustaining adequate regional economic growth. Metropolitan regions have other assets important to economic growth (e.g., skilled work force, competitive firms, clusters of self-reinforcing business organizations, good weather, environmental amenities, and so on) that can sustain regional development even if the aviation infrastructure is not in an elite category. The findings in this report suggest that the exemplar regions do in fact possess other factors (that were not examined here) crucial to successful growth outcomes. Although competitor regions like Indianapolis can be proud of their success in generating positive aviation outputs, political and business leaders in these regions might continue building other combinations of assets linked to their strong aviation infrastructure as a way of broadening regional economic growth and income.

Regions considering major aviation investments should look at the findings of the analysis. For the Indianapolis region, these findings are relevant to a gigantic public works project recently begun: the Indianapolis Airport Authority's (IAA 2003) construction of the new Midfield Terminal at Indianapolis

International Airport (IIA). The projected cost of the Midfield Terminal is $976 million, which represents a complete replacement of the existing terminal (it opened in 1957). Will the investment in aviation capital produce increased outputs? How will the terminal improve the ability of IIA to increase flights, people, and cargo? If it allowed the IIA to capture one percent of national air passenger enplanements, large hub status would be achieved. Although the Midfield Terminal will increase the spaciousness and passenger processing capacity of the concourse, only an increase in arrivals and departures or larger commercial aircraft can increase the number of arriving and departing passengers. Regional leaders should consider how the terminal expansion will improve the airport's airplane processing capacity, as one way of increasing passenger volume. Included in the project is a new air traffic control tower, which could conceivably enhance airport carrying capacity. Its greatly increased height (340 feet, compared to the current 140 feet) might extend aircraft control over a wider area. The IAA states that "the new building will provide enhanced future terminal and airfield capacity, balance landside and airside capacity, reduce ground delay and taxiing times, increase margins of airfield safety and improve terminal security."[6]

With the November 2003 groundbreaking, the Indianapolis Airport Authority posted a 'fly-thru' animation of the $974 million Midfield Terminal on the IAA website entitled *The New Indianapolis Airport.* It is depicted as a low-slung, spacious, modernist airport with open skylighted ceilings and steel gridwork. The IAA designers describe the terminal as an artistic public place:

> The heart of the terminal building is a civic plaza, a central gathering point whose circular shape recalls the shape of the City's central public space, Monument Circle. Although the plaza will serve the necessary functions of both security and concessions, the room is designed to incorporate artwork, provide public event space and enable visitors to sample the character of Indianapolis and the region….The form of the terminal roof is shaped to create a symbolic threshold to the city and state, emanating from the civic plaza. The form is generated by joining the sheltering, centralized shape of an arch with the rise and fall of the building from check-in

[6] All Indianapolis Airport Authority quotes can be found at http://www.newindairport.com/news.shtm.

> to departure. Encompassing high glass walls, the building form rises over the plaza to reveal a view of the aircraft apron and the city skyline.[7]

At $974 million, this is a gargantuan investment, considering that between 1990 and 2002, Indianapolis invested a *total* of $297 million in aviation built structures, or about $23 million per year (see Table 2) (McGraw-Hill, various years). The New Indianapolis Airport is scheduled for completion in 2008, and will require four years of construction at an annual average cost of $244 million, representing a tremendous increase in the previous 12 years of airport investment. The project will require a tenfold jump in previous average annual capital investments during the 1990-2002 period. As the director of the IAA noted, this "is one of the most significant public works projects ever in Central Indiana." Will the investment generate the returns regional leaders expect?

[7] See various graphical links accessible at http://www.newindairport.com/design.shtm

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Table 1: MSA descriptions, 1990 and 2002

MSA	No. of counties	Area (sq.mi.)	Population		Population, percent change		Annual growth	
			1990	2002	Overall	Average annual	Personal income, 1990-2001	Jobs, 1990-2000
Austin	5	4,224	850,619	1,349,291	58.6%	3.9%	7.2%	5.1%
Nashville	8	4,073	988,710	1,270,520	28.5%	2.1%	4.8%	3.2%
Raleigh	6	3,489	864,269	1,267,676	46.7%	3.3%	5.5%	3.4%
Sacramento	3	4,081	1,378,825	1,749,335	26.9%	2.0%	3.6%	2.3%
Means		3,967	1,020,606	1,409,206	40.2%	2.8%	5.3%	3.5%
Indianapolis	9	3,523	1,385,411	1,655,097	19.5%	1.5%	3.6%	2.3%
Cincinnati	12	3,342	1,529,216	1,669,136	9.1%	0.7%	2.8%	1.8%
Cleveland	6	2,707	2,203,378	2,250,347	2.1%	0.2%	1.6%	1.1%
Columbus	6	3,141	1,350,333	1,583,907	17.3%	1.3%	3.5%	2.5%
Kansas City	11	5,406	1,587,103	1,828,247	15.2%	1.2%	3.6%	2.0%
Means		3,624	1,611,088	1,797,347	12.6%	1.0%	3.0%	1.9%
T-test of means		0.55	0.02	0.06	0.01	0.01	0.03	0.03

Source: Population calculated from U.S. Census, various years. Income and job data adapted from U.S. Bureau of Economic Analysis, various years. The counties included in each MSA are based on the boundaries in place in 2000. Cincinnati, Cleveland, and Sacramento are considered PMSAs.

Table 2: MSA aviation-related metrics, various years

MSA	Mean annual aviation investment (constant $000), 1990-2002	Total aircraft departures performed, 1990-2001		Enplaned passengers, 1990-2001		Non-stop freight-tons enplaned, 1990-2001		Non-stop mail-tons enplaned, 1990-2001	
		Mean annual values	Percent change	Mean annual values	Percent change	Mean annual values	Percent change	Mean annual values	Percent change
Austin	$19,303	36,567	52.0%	2,938,673	63.1%	12,267,726	383.6%	9,863,346	12.6%
Nashville	$9,462	56,970	9.3%	4,316,835	21.7%	15,182,119	74.9%	22,856,165	-30.3%
Raleigh-Durham	$5,942	57,121	8.6%	4,079,336	-3.8%	12,934,319	-71.5%	21,675,224	-44.7%
Sacramento	$10,195	38,410	8.8%	3,113,546	123.6%	5,755,280	68.0%	21,959,120	-3.0%
Means	$11,226	47,267	15.6%	3,612,098	33.6%	11,534,861	40.9%	19,088,464	-22.3%
Indianapolis	$22,838	44,710	11.6%	3,298,857	19.2%	25,634,009	661.1%	26,794,836	0.5%
Cincinnati	$30,069	92,167	122.9%	6,859,798	98.2%	87,839,431	278.8%	52,715,379	-13.4%
Cleveland	$24,294	94,054	51.7%	5,082,320	27.0%	11,843,453	-65.7%	27,339,984	-55.2%
Columbus	$14,882	41,127	47.1%	2,840,126	66.1%	26,249,595	178.5%	27,306,047	-50.0%
Kansas City	$21,886	62,951	54.5%	5,198,640	67.6%	11,959,653	26.8%	48,558,169	15.3%
Means	$22,794	67,002	62.4%	4,655,948	56.5%	32,705,228	224.7%	36,542,883	-18.4%
T-test	0.02	0.19	0.14	0.27	0.88	0.23	0.56	0.04	0.84

Source: Aviation investment data adapted from McGraw-Hill Dodge construction, 1990-2002. Aviation-related output measures adapted from Bureau of Transportation Statistics, as of September 2003.

Table 3: Per capita aviation metrics, 1990-2001

MSA	Average annual per capita, 1990-2001				
	Aviation investment (1990-2002)	Aircraft departures	Enplaned passengers	Non-stop freight-tons enplaned	Non-stop mail-tons enplaned
Austin	$18.12	0.04	2.8	11.2	9.5
Nashville	$8.85	0.05	3.9	13.8	20.9
Raleigh-Durham	$5.69	0.06	4.1	13.4	21.8
Sacramento	$6.72	0.03	2.0	3.8	14.5
Means	$9.85	0.04	3.2	10.6	16.7
Indianapolis	$15.59	0.03	2.2	16.6	18.0
Cincinnati	$18.99	0.06	4.3	54.5	33.1
Cleveland	$10.91	0.04	2.3	5.3	12.3
Columbus	$10.11	0.03	2.0	18.1	19.1
Kansas City	$12.73	0.04	3.1	7.1	28.7
Means	$13.67	0.04	2.8	20.3	22.2
T-test	0.26	0.73	0.50	0.38	0.30

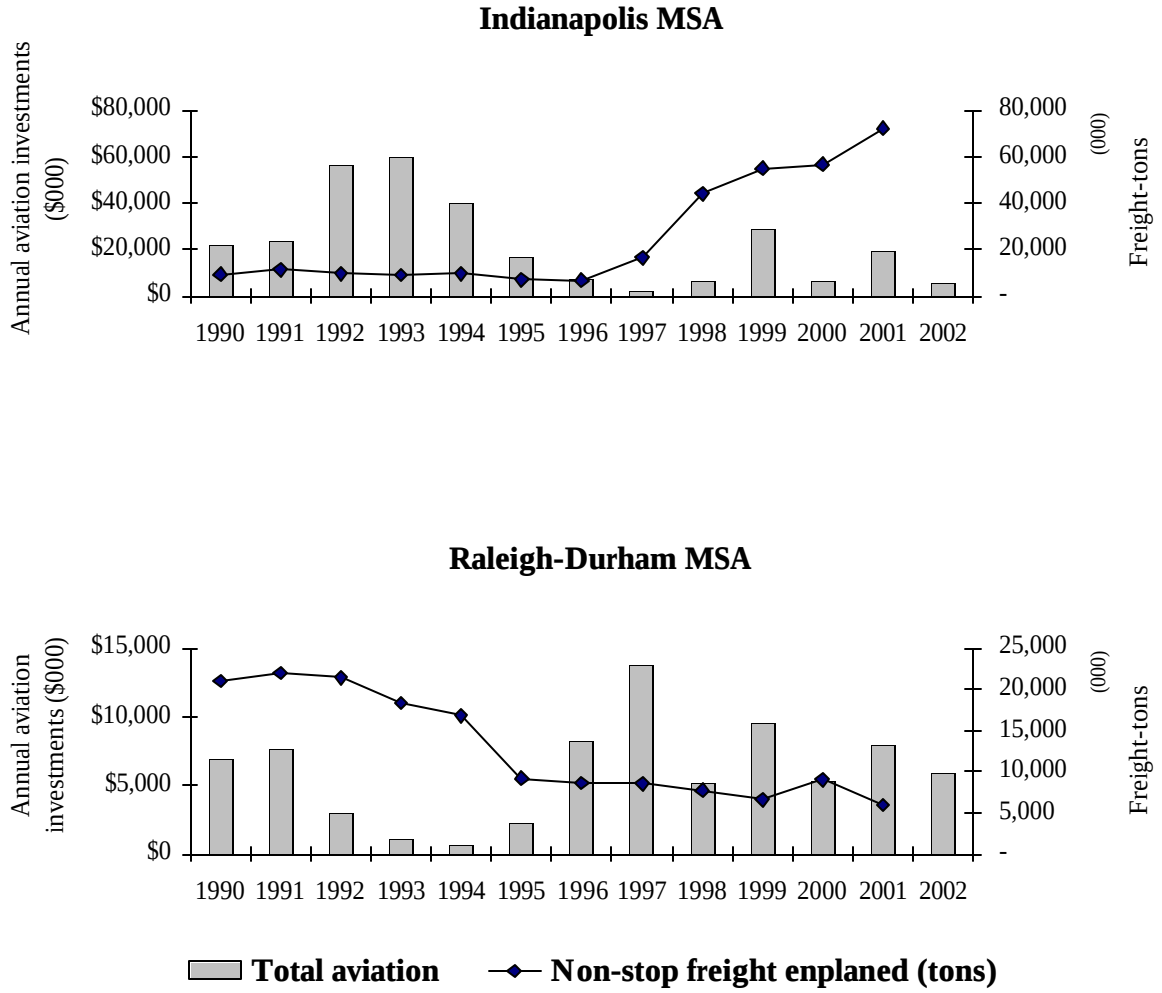
Source: Aviation investment data adapted from McGraw-Hill Dodge construction, 1990-2002. Aviation-related output measures adapted from Bureau of Transportation Statistics, as of September 2003. Population calculated from U.S. Census, various years.

Table 4: Average annual cost of various aviation output measures, 1990-2001

	Average annual aviation investment per average annual unit of output ($cost/output)			
MSA	Aircraft departures	Enplaned passengers	Non-stop freight-tons enplaned	Non-stop mail-tons enplaned
Austin	$528	$6.57	$1.57	$1.96
Nashville	$166	$2.19	$0.62	$0.41
Raleigh-Durham	$104	$1.46	$0.46	$0.27
Sacramento	$265	$3.27	$1.77	$0.46
Means	$266	$3.37	$1.11	$0.78
Indianapolis	$511	$6.92	$0.89	$0.85
Cincinnati	$326	$4.38	$0.34	$0.57
Cleveland	$258	$4.78	$2.05	$0.89
Columbus	$362	$5.24	$0.57	$0.55
Kansas City	$348	$4.21	$1.83	$0.45
Means	$361	$5.11	$1.14	$0.66
T-test	0.35	0.17	0.95	0.76

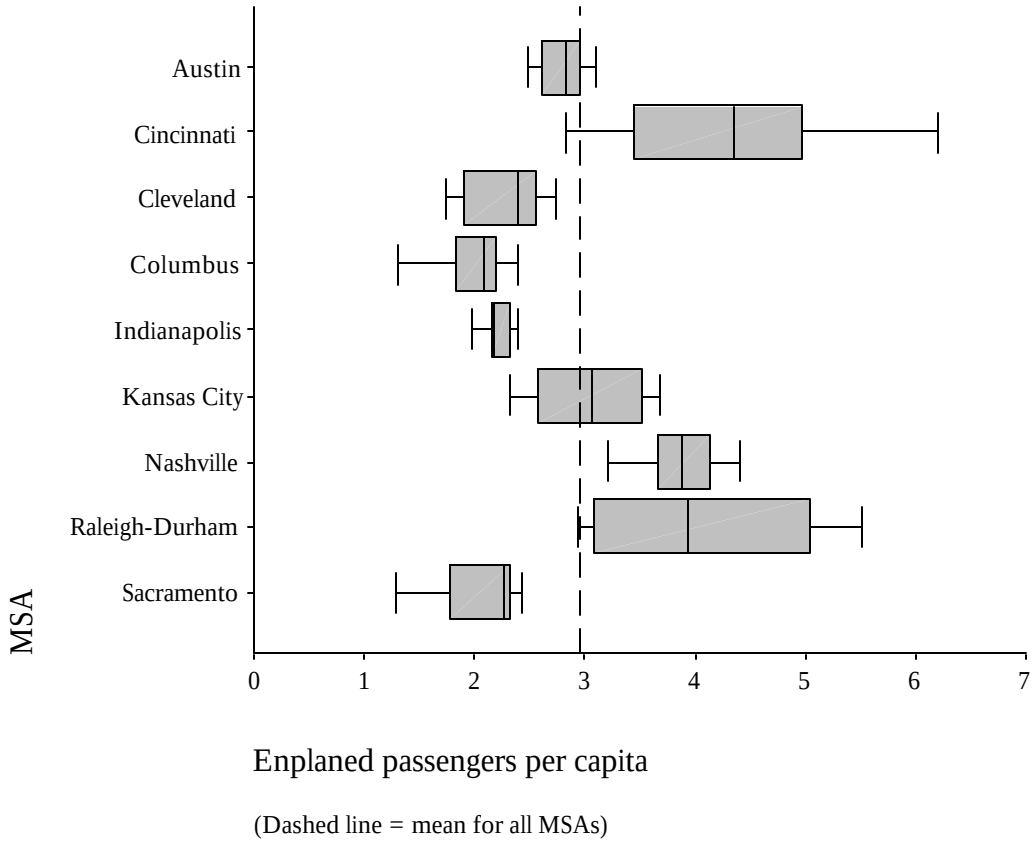
Source: Aviation investment data adapted from McGraw-Hill Dodge construction, 1990-2002. Aviation-related output measures adapted from Bureau of Transportation Statistics, as of September 2003.

Figure 1: Aviation investments and cargo-tons processed in Indianapolis and Raleigh, 1990-2002



Source: Aviation investment data adapted from McGraw-Hill Dodge construction, 1990-2002. Aviation-related output measures adapted from Bureau of Transportation Statistics, as of September 2003.

Figure 2: Boxplots of enplaned passengers per capita, 1990-2001



Boxplots depict the range, median, and quartile values of the variable. The vertical lines divide the range into quartiles. Each quartile contains one-fourth of the MSA's annual per capita enplaned passenger measure for the 1990-2001 period. Shaded rectangles depict the interquartile range, and the vertical line within the rectangle represents the median value.

Table 5: Average annual international flight percentage and total aviation investments, various years

MSA	Annual averages, various years					
	International flights as percent of total departures			Total aviation investment (constant $000)		
	1990-95	1996-2001	Change	1990-95	1996-2002	Change
Austin	0.01%	0.68%	0.67%	$7,000	$29,848	$22,848
Nashville	1.79%	0.42%	-1.37%	$14,916	$4,788	-$10,128
Raleigh-Durham	2.37%	2.14%	-0.23%	$3,583	$7,965	$4,382
Sacramento	0.02%	0.02%	0.00%	$5,740	$14,014	$8,275
Means	1.05%	0.82%	-0.23%	$7,810	$14,154	$6,344
Indianapolis	0.68%	1.40%	0.72%	$36,527	$11,104	-$25,423
Cincinnati	2.14%	4.17%	2.02%	$43,552	$18,512	-$25,040
Cleveland	2.06%	1.72%	-0.34%	$20,857	$27,240	$6,383
Columbus	0.20%	0.18%	-0.02%	$10,198	$18,898	$8,701
Kansas City	0.10%	0.27%	0.17%	$17,344	$25,779	$8,435
Means	1.04%	1.55%	0.51%	$25,696	$20,307	-$5,389
T-test	0.99	0.45	0.26	0.05	0.33	0.32

Source: Aviation investment data adapted from McGraw-Hill Dodge construction, 1990-2002. International flight measures calculated from Bureau of Transportation Statistics, as of September 2003.