CENTRAL INDIANA

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Airport Development Takes Flight

The Indianapolis Airport Authority (IAA) recently began construction of a gigantic public works project: the new Midfield Terminal at Indianapolis International Airport. Scheduled for completion in 2008, the total projected cost is huge—$974 million, or an average annual cost of $244 million, a ten-fold increase in the previous 12 years of annual airport investment. The project includes a complete replacement of the existing 45-year-old terminal.

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" (see www.newindairport.com/news.shtm).

On the IAA's website, *The New Indianapolis Airport* is depicted as a low-slung, spacious, modernist airport with open skylighted ceilings and steel gridwork. The 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.*

As the director of the IAA noted, this "is one of the most significant public works projects ever in Central Indiana."

But will this enormous investment improve the airport's ability to increase flights, people, and cargo? And will it generate the returns regional leaders expect?

As early as 1942, analysts speculated that aviation development would be the next wave of transportation investment to have a major impact on urban and regional structure (Isard, 1942). Now, 62 years later, aviation investments play an emblematic role in the globalizing new economy. For national and global success, a metropolis should have an accessible, expandable, adaptable airport system—one that can accommodate the travel needs of business firms and professional workers, both domestically and internationally.

By offering better air travel connections via modern airport infrastructure, a metropolitan region can create competitive advantages over other regions. Many political and business officials see airport construction and expansion as basic building blocks for a successful new economy.

Central Indiana is no different in this respect. The Indianapolis Airport Authority made substantial airport investments in the 1990s that supported increased cargo volumes. Now, however, the IAA plans a much larger investment. What are the likely returns on this massive level of investment?

Based on the premise that airports have important economic functions in regions, in this report we will examine the volume of built investments devoted to aviation facilities, and the relationship of these investments to key aviation outputs. We will do this by exploring aviation investments in the Indianapolis metropolitan statistical area (MSA) compared with eight other MSAs.

The construction costs of building and expanding airport facilities are part of the price that regional leaders pay to purchase particular kinds of transportation activities. Some airport facilities such as terminals, gates, and runways are built and modified to increase the processing capacity of airports. These improvements may be responses to increased demand for aviation services, or they may be made with the goal of promoting growth by expanding the airport's capacity to deliver aviation services. These investments seek specific returns: more flights (landings and departures), more people (passenger enplanements), and more cargo (regionally). In this brief comparative analysis, we will therefore 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); and
3. empirical relationships between aviation outputs and aviation built investments.

Comparisons with other regions enhance understanding

Comparisons with other regions provide useful intelligence about the returns that regional leaders might expect from airport investment programs. In this case, our objective is to compare aviation investments and outputs in Indianapolis with those in other regions that reflect varying levels of economic success. These comparison regions are in two groups: four *competitor* MSAs in the Midwest, and four *exemplar* MSAs sometimes identified as new economy success stories. Our intention was to pick metropolitan areas similar to Indianapolis. We selected the eight comparison regions based on criteria including population size, economic structure, geographic location, presence of a state capital, and presence of a major research university.

Columbus, the state capital of Ohio, is an adjacent Midwestern state with an old economy heritage and a sizeable education and governmental infrastructure. It is also a player in periodic economic competitions with Indianapolis. Recently, a Columbus-based pharmaceutical 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* are considered frequently in peer comparisons with Indianapolis. Cincinnati and Indianapolis once engaged in interjurisdictional competition to lure a United Airlines aviation facility, a competition eventually won by Indianapolis (Nunn and Schoedel, 1995).

Kansas City is also similar to Indianapolis. A recent profile said 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" (Davis, 2003). The two regions are so similar that in June 1997, the NCAA announced that its headquarters would move to Indianapolis after being located in the Kansas City area since 1952

(Jankowski, 1999). The Indianapolis NCAA headquarters opened its doors in 1999, an economic and political coup for the region.

As for the exemplars, *Austin* and *Raleigh-Durham* are included by virtue of their frequent characterization as icons of the new economy. Both are also state capitals.

Nashville and *Sacramento*, while perhaps a bit less noteworthy than the other two new economy stars, have shown economic success. Nashville, typically considered part of the Sunbelt, has a unified city-county governance structure like Indianapolis, and analysts of new economy urban areas have called it "a highly competitive community" (Johnson, 2002, p. 767). Sacramento, of course, is connected with the silicon economy of Northern California.

If we can identify differences among these regions' allotments of aviation built investment, we might draw inferences regarding the type of built environment required for new economy success.

Have the exemplar regions experienced comparatively better success than the competitors? The short answer is *yes*. The exemplar regions have grown more and faster in population, income, and jobs than the competitor regions (see Table 1). The average percentage changes are significantly larger in the exemplar regions. 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 did better than the competitors during 1990–2002.

Aviation investments should be linked to aviation outputs

Public officials believe in the developmental potential of aviation facilities. Although some airport investments are made to satisfy existing demand or reduce congestion, many are also made in hope of capturing more aviation outputs such as flights, people, and freight.

Table 1: **Metropolitan Statistical Area Descriptions, 1990 and 2002**

			Population		Population, percent change 1990–2002		Annual growth	
Exemplar MSAs	**No. of counties**	**Area (sq. mi.)**	**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%
Mean		*3,967*	*1,020,606*	*1,409,206*	*40.2%*	*2.8%*	*5.3%*	*3.5%*
Competitor MSAs								
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%
Mean		*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 2000. Cincinnati,Cleveland, and Sacramento are considered primary MSAs.

NOTE: The T-test of means provides a measure that the observed difference between means is significant.In this table, the differences in percent population change, both overall and annual average, and the annual growth in personal income and in jobs all satisfy the con ventional test of significance defined as having a less than 5 percent likelihood of occurring by chance.

Hub designations and aviation investments

One way to assess the impact of aviation investments is to work backwards from outcomes considered successful to see whether the investments were actually linked to those successes. *Hub status* is one measure of success in the development of aviation infrastructure.[1]

Large hub airports 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 percent to 0.999 percent of total enplaned passengers. All others are considered *small hubs*. In 2000, only 28 airports in the United States were considered large hubs.

The only comparison metropolitan region considered a large hub is Cincinnati. On this basis, Cincinnati's airport investments during the 1990s were quantitatively larger than the other comparison regions. In addition, air travel fluctuations and a changing geography of demand for airport services might affect airport hub status. Cleveland and Kansas City recently shifted from large to medium hub status, and they also have aviation investment profiles similar to Cincinnati, with the other regions trailing behind.[2]

Designation as a large hub is not the only measure of success for a region's aviation infrastructure. Some other important metrics that assess aspects of regional success include:

- *The flow of material goods through an airport* (which affects warehouses, shipping, and trucking within the region),
- *The flow of cargo through an airport* (which generates or perhaps is enabled by sustained aviation investments),
- *The volume of mail moving through an aviation facility* (which is an indirect indicator of commerce within a metropolitan region).

The U.S. Bureau of Transportation maintains statistics for these metrics in U.S. airports annually. When we join these metrics to the volume of built investment poured into aviation infrastructure, we can paint a useful picture of what airport development strategies might beget for a region.

Table 2: **Aviation-related Metrics, by Metropolitan Statistical Area, Various Years**

		Total aircraft departures 1990–2001		Enplaned passengers 1990–2001		Non-stop freight-tons enplaned 1990–2001		Non-stop mail-tons enplaned 1990–2001	
Exemplar MSAs	**Mean annual aviation investment (constant $000)**	**Mean annual value**	**Percent change**	**Mean annual value**	**Percent change**	**Mean annual value**	**Percent change**	**Mean annual value**	**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%
Mean	*$11,226*	*47,267*	*15.6%*	*3,612,098*	*33.6%*	*11,534,861*	*40.9%*	*19,088,464*	*–22.3%*
Competitor MSAs									
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%
Mean	*$22,794*	*67,002*	*62.4%*	*4,655,948*	*56.5%*	*32,705,228*	*224.7%*	*36,542,883*	*–18.4%*
T-test of means	*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.

Regional aviation investments and aviation outputs

Table 2 shows aviation-related metrics for the exemplar and competitor MSAs during the 1990s, measured in terms of average annual volumes and 1990–2001 percentage change. The table shows four separate outputs: plane departures, enplaned passengers (strongly correlated with plane departures), freight-tons, and mail-tons (U.S. Bureau of Transportation Statistics, 2000). It also reports one measure of aviation investments.

The numbers in Table 2 show that the competitor regions have higher volumes of aviation outputs than the exemplar regions, as well as higher 1990–2001 growth rates. Cincinnati, Cleveland, and Kansas City had the highest volumes of average annual aircraft departures and enplaned passengers—no doubt linked to their previous or current large hub status. These three competitor regions dominate tons of mail enplaned. However, for most regions, mail-tons processed declined through the 1990s, with only a few exceptions; Austin, Indianapolis, and Columbus showed growth from 1990–2001, while the other regions sometimes experienced substantial declines in mail volume.

Cincinnati, Columbus, and Indianapolis process the largest freight volumes, and Cincinnati enplanes more freight-tons than any other region by more than a factor of three (e.g., on average each year, Cincinnati enplanes more than fifteen times the volume of freight handled in Sacramento, seven times the volume in Austin). In terms of growth rates, Austin and Indianapolis show the most robust increases in freight-tons. Overall, though, Cincinnati is the clear leader among all nine metropolitan regions. It is possible that the more central geographic location of the competitor regions (in comparison to the exemplar MSAs) might explain some of the aviation-based dominance their baseline statistics suggest.

The competitor regions may have bought this dominance by more aggressive investments in the aviation built environment. Apart from their possible spatial comparative advantage, the competitor regions also created a substantially higher volume of investments in aviation-related facilities. They either initiated and thus took advantage of larger capital investments in aviation infrastructure, or they responded to increased demand for aviation outputs. On an average annual basis, the competitor regions as a group invested twice as much in aviation construction (an average of $22.8 million/year) than the exemplar regions (an average of $11.2 million/year).

If we control for population, some observations change a bit (see Table 3). When we consider average per capita values during 1990–2002, aviation investment is still higher (though not statistically different) in the competitor regions. Cincinnati and Indianapolis show the highest investment per capita, and Austin is the highest per capita outlier among the exemplars (and exceeds Indianapolis). There is no significant difference among the regions in annual average aircraft departures per capita during 1990–2001. The numbers for enplaned passengers per capita suggest that the exemplar regions are annually processing more passengers on average than the competitor region. Freight and mail volumes per capita are lower in the exemplar MSAs, although Nashville and Raleigh-Durham compare favorably (but substantially less) with the two leading competitor regions, Cincinnati and Kansas City.

This dominance of the competitor regions in aviation investments and outputs is somewhat unexpected considering the broader economic success of the exemplar regions. If aviation infrastructure is a crucial component of new economy success, and if some exemplar regions are clear leaders in the new economy, shouldn't the regions with new economy status (such as Austin and Raleigh) show higher aviation investments and outputs?

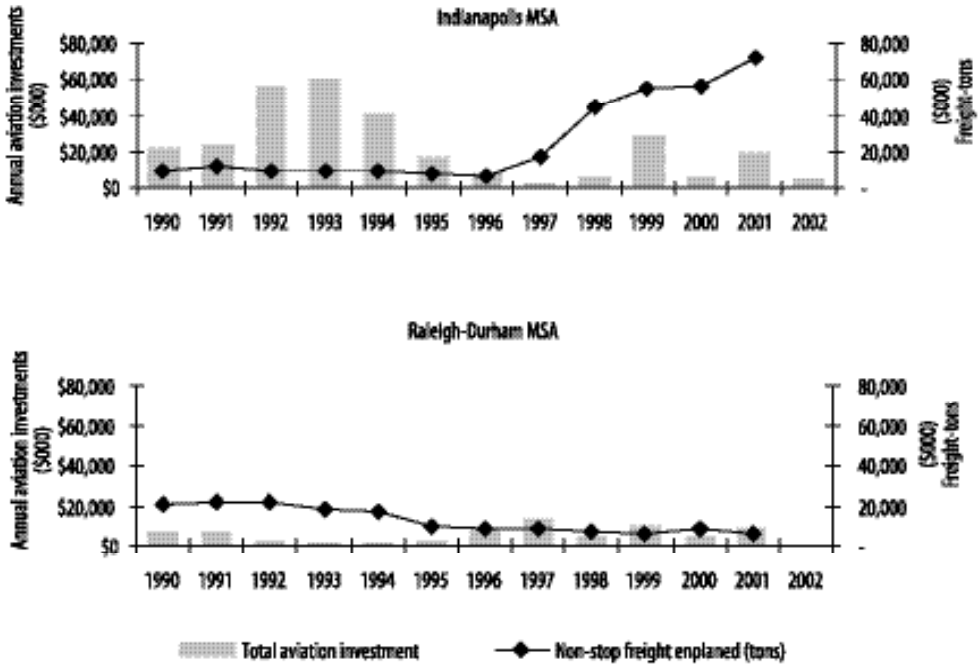
Austin is an interesting case. Consider its average rate of aviation investment: $19 million per year from 1990 to 2002 (see Table 2, page 4), for an average annual per capita investment of $18, more than twice the other exemplar regions. On one hand, some of this investment paid off because Austin's 1990 to 2001 growth in aircraft departures and freight-tons exceeded all other exemplar regions. Austin increased its volume of mail-tons, and it showed respectable growth in enplaned passengers. On the other hand, its high construction expenditures did not produce a commensurate bump in other aviation outputs. When we consider the average annual numbers for all nine regions shown in Table 2, Austin had the fewest aircraft departures, the second lowest number of passengers, and the smallest flow of mail tonnage. It had better success in cargo-tons, possibly linked to manufacturers such as Dell Inc. that ship products from central Texas. But among the exemplars, Austin's aviation output was low compared to its higher annual spending on airport infrastructure, and all but one of the

Table 3: **Aviation Investment and Average Annual Metrics, per Capita**

		Per Capita Aviation Metrics, 1990–2001			
Exemplar MSAs	**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
Mean	*$9.85*	*0.04*	*3.2*	*10.6*	*16.7*
Competitor MSAs					
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
Mean	*$13.67*	*0.04*	*2.8*	*20.3*	*22.2*
T-test of means	*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.

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.

competitor regions exceeded Austin's airport throughput by a substantial margin.

The paradox here is that despite this comparatively poor showing in aviation outputs, Austin is a robust, innovative, high income, high invention region. Is this an anomaly, or is airport infrastructure less important than some of Austin's other advantages for strong regional economic success?

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

Other ways of examining Raleigh's aviation fortunes suggest a less positive outlook. If we shift the focus from annual averages to the multi-year time series of aviation investments and outputs, the data suggest that the region's aviation investments might not be generating outcomes that are as successful. Compare Indianapolis and Raleigh in their respective volumes of aviation investment and cargo-tons processed within each region (see Figure 1). For Indianapolis, the first half of the 1990s saw substantial investments in aviation infrastructure occurring in parallel with low cargo-ton production, but after the investment spikes declined, a substantial growth occurred in cargo-tons moving through the Indianapolis airport. One interpretation 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. 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 spent between $20 million to $60 million per year, while in the last half of the 1990s, Raleigh invested less than $15 million annually.

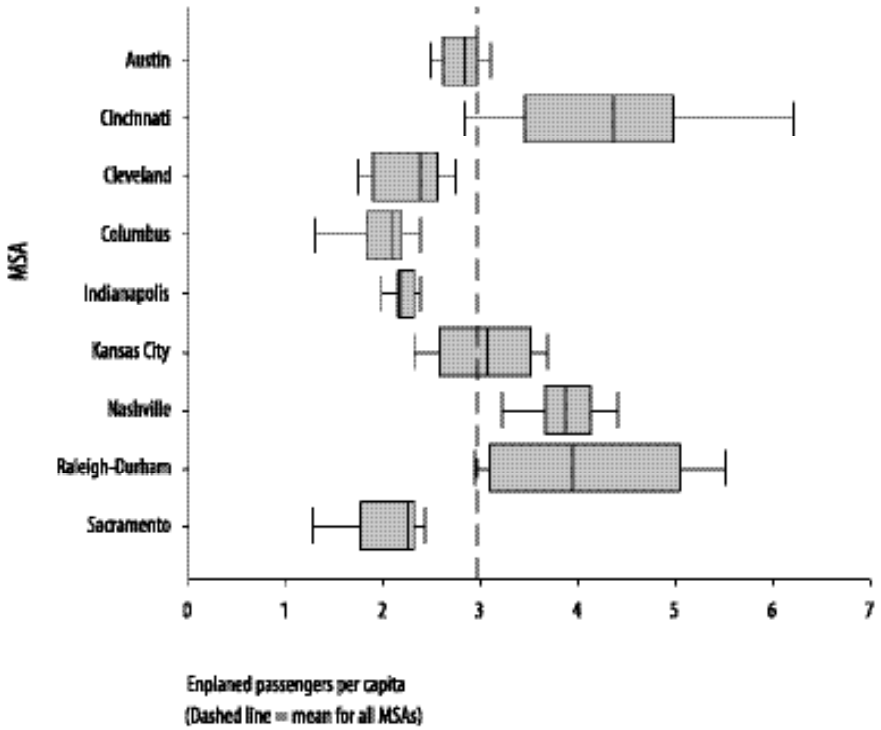
Similar differences hold for cargo outputs: Indianapolis processed about 80 million tons by 2001, but Raleigh never processed more than about 23 million tons. Even after ignoring this difference in the scale of activities, Raleigh was effectively a reverse image of Indianapolis. Raleigh's cargo volumes declined precipitously through 1990–2001, even as its aviation investments increased after 1995.

So in the case of Indianapolis, one scenario is that its high investment levels in the early 1990s attracted increased cargo volumes, adding to its reputation as a logistics center. This is linked to the FedEx cargo hub in Indianapolis that opened in 1988 and was enlarged in 1998, generating an increase in box-sort throughput from 51,000 to 79,000 pieces per hour. In contrast, relatively robust cargo volumes in Raleigh began to decline in response to declining aviation investment. This investment did not 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 its shortcomings in aviation infrastructure, Raleigh still managed to be a new economy success story. This again raises the question of whether the importance of airport infrastructure to new economic development is overstated. Another take on this concerns the number of people passing through airports, under the assumption that higher numbers of passengers create a more dynamic local economic structure. Debbage and Delk (2001) found a statistically significant relationship between passenger volume and administrative and auxiliary employment in the top 50 U.S. airports between 1973 and 1996. An influx of people, rather than cargo, might therefore be better for a region.

Figure 2 shows boxplots describing the distribution of the number of enplaned passengers per capita in the nine MSA regions. As shown, Raleigh had higher numbers of enplaned pas-

Figure 2: **Boxplots of Enplaned Passengers per Capita,1990–2001**



Note: Boxplots are an exploratory data analysis technique useful for judging differences in the distribution of variables. These boxplots show the range and median 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 1990–2001. Shaded rectangles depict the interquartile range, and the vertical line within the rectangle represents the median value. This technique allows us to compare MSAs across the years for selected variables and shows how the distribution of the variables differ among the MSAs.

sengers per capita than Indianapolis. In fact, Raleigh's passengers per capita distribution is similar to Cincinnati's, which had the strongest aviation infrastructure of all nine regions. So although it had less investment in aviation, Raleigh managed during 1990–2001 to process about the same number of passengers per capita as the busier Cincinnati airport. The Indianapolis MSA passenger per capita metric had the narrowest range and was well below the mean for all MSAs. One simple interpretation is that people entering a region have a more positive impact on economic success than cargo tons. Thus, although aviation investment volumes in Indianapolis improved the region's material throughput, the region's investments did not generate parallel increases in passengers per capita, and they have had a weaker effect on Indianapolis' economic success.

Remember that through this period, the competitor regions spent twice as much on aviation construction, so it is possible that the competitor regions strengthened their aviation infrastructures in other ways that produced higher output metrics. Therefore, another way to consider the payoff generated by expanding the airport infrastructure is to calculate how much each output cost in aviation investment. How much aviation capital was put in place per unit of aviation output?

As it turns out, the average aviation construction cost per unit of output during 1990–2001 in the competitor regions was more per unit, on average, than in the exemplar regions (see Table 4). This was true for aircraft departures and enplaned passengers in particular. In competitor regions, the costs per freight-ton were much closer and the costs per mail-ton were lower. Statistically, the exemplar and competitor regions were not significantly different. Overall, though, among all regions, competitor and exemplar, Austin paid consistently more per aviation output. However, Austin does not appear to owe its overall regional success to a clearly superior aviation system, because other regions appear to be producing more aviation outputs at lower investment costs.

Table 4: **Aviation Output Measures, Average Annual Cost by Metropolitan Statistical Area,1990–2001 ($cost/output)**

Exemplar MSAs	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
Mean	*$266*	*$3.37*	*$1.11*	*$0.78*
Competitor MSAs				
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
Mean	*$361*	*$5.11*	*$1.14*	*$0.66*
T-test of means	*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.

Conclusions

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 airports and ancillary facilities, the metropolitan areas examined here invested in aviation at different rates during 1990 to 2002 and generated various aviation outputs linked to these investments. Indianapolis and the competitor regions spent more on aviation infrastructure than the exemplars, and perhaps have purchased more plane, passenger, and cargo throughput. In several regions, there is a positive relation between increased aviation investments and subsequent increases in selected aviation outputs. The high level of built investments in Indianapolis airport infrastructure was followed by an increase in cargo processing, suggesting that as new aviation capacity is developed, regions can increase throughput of people and materials.

Despite the imbalances in aviation investment among the competitor and exemplar regions, at least two observations are warranted:

First, while aviation investments between the two sets of regions are different in a statistically significant sense, the mean annual aviation output metrics largely are not (although mail-tons enplaned are significantly higher in the competitor regions). The construction cost-per-unit of aviation outputs, while higher in the competitor regions, is not significantly different. So, even if the competitor regions are investing 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 regions. Based on fundamental economic indicators such as population, jobs, and income, growth in the exemplar regions exceeded that of the competitor regions.

Finally, this analysis begs a question about the role of airports in economic success. Are massive aviation investments truly necessary for new economy success? A sound aviation infrastructure is important to a region, but even a cutting-edge airport might be incapable, by itself, of sustaining adequate regional economic growth. Metropolitan regions have many other assets that are important to economic growth, such as skilled labor, competitive firms, clusters of linked business organizations, good weather, and environmental amenities. These assets can sustain regional development even if the region's aviation infrastructure is not in an elite category.

These findings suggest that the exemplar regions possess other factors crucial to successful growth. While 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.

For the Indianapolis region, although the Midfield Terminal will increase the spaciousness and passenger 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 flight capacity as one way of increasing passenger volume. Included in the project is a new air traffic control tower that could conceivably enhance airport flight capacity. Its greatly increased height (340 feet, compared to the current 140 feet) might extend aircraft control over a wider area. In the end, however, the test of whether this leap in aviation investment is successful will be shown by positive and substantial changes in aviation outputs in Indianapolis.

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Endnotes

[1] Hub designations are partly a function of population size. Larger metropolitan areas have the advantage of a larger population base which is likely to gener ate more arriving and departing passengers.In addition,the geographical location of some places makes them more likely to be considered potential hubs.

[2] Cincinnati and Indianapolis competed fiercely 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 initially successful because the UAL MOC was built in Indianapolis, part of this sizeable investment by the region was ultimately a bust because in 2002,the UAL MOC ceased operations as part of UAL downsizing and bankruptcy. However, as shown later for Indianapolis, such investments might have increased growth in aviation outputs such as cargo-tons enplaned.

Central Indiana's Future: Understanding the Region and Identifying Choices

Central Indiana Region

Central Indiana's Future:Understanding the Region and Identifying Choices, funded by an award of general support from Lilly Endowment, Inc.,is a research project that seeks to increase understanding of the region and to inform decision-makers about the array of options for improving quality of life for Central Indiana residents. Center for Urban Policy and the Environment faculty and staff, with other researchers from several universities, are working to understand how the broad range of investments made by households, governments, businesses, and nonprofit organizations within the Central Indiana region contribute to quality of life. The geographic scope of the project includes 44 counties in an integrated economic region identified by the U.S.Bureau of Economic Analysis.

Current research at the Center is focused on investment strategies to enhance the quality of life in Indiana communities. This report is one result of that research. It is also part of a ongoing study in which Center analysts are comparing Central Indiana with eight other regions around the nation (see Kirlin, *Regional Comparisons Reveal Strengths and Challenges for Central Indiana*, available on the Center Web site). Many regions consider aviation investments critical components of economic development strategies, and Indianapolis has ambitious airport construction plans.

The Center for Urban Policy and the Environment is part of the School of Public and Environmental Affairs at Indiana University–Purdue University Indianapolis. For more information about the Central Indiana Project or the research reported here, contact the Center at 317-261-3000 or visit the Center's Web site at www.urbancenter.iupui.edu.

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