Melanie Green

Urban Economics Literature Survey

February 6, 2014

The Impact of Airport Development on Economic Development

Cities around the world are separated by physical distance, but individuals can travel relatively easily between cities using various forms of transportation. Air travel not only connects people but it connects economies to further develop the global economy. Airport development has also been linked with economic development. Much research has been done on this relationship, with focuses on different regions and cities around the world. In particular, studies that focus specifically on Chinese and Canadian airport economics, as well as metropolitan airport development in general, provide insight into this important economic relationship and the implications it can have on new airport development.

A new research study that stems from these previously explored relationships can look into the ongoing construction of the new terminal at Raleigh-Durham International Airport (RDU) and its relationship with economic development in the surrounding urban area. The correlation between airport and economic development is important, but determining a cause-and-effect relationship can be very useful in understanding the economics of the Triangle region as well as other regions around the country and the world. Thus, it is necessary to analyze similar situations worldwide to provide a background understanding of the issues at hand, as well as to develop models that can be used to analyze the specific situation at RDU.

Much of the discussion on the relationship between airport and economic development surrounds four key sub-topics: public finance, economic development, transportation and agglomerate economics, and airports in general. Airports can be considered impure public goods; therefore, in order to completely understand their worth, it is necessary to determine each individual's marginal utility that results from the presence of a runway (Green, 2007). Economic development is often linked with infrastructure development, which means that airports are expected to further the development of the economies of the surrounding regions. Transportation in general affects the development of cities, with air travel having a large stake in both short and long distance transportation. Finally, airport economics have often included pricing and congestion

issues in the past, but these issues can be combined with the economic impact of airports to gain a better understanding of urban development in the context of airport development (Green, 2007).

Economists have reached a general consensus that airports do share a relationship with economic development, but the exact cause-and-effect relationship is unclear and depends on many factors. For example, Yao and Yang (2008/07) found, based on a study of the Chinese economy, that a 10% population density increase in population density causes a 1.7% increase in air passenger volume and a 1.2% increase in air cargo. This specific relationship analyzes the effect that economic development has on airport development. On the other hand, according to a study performed by Benell and Prentice (1993), in order to create a one person-year of employment, the average number of additional air-travel passengers must increase by 1126, based on a sample set of airports in Canada. Each one of these additional passengers is expected to add a monetary value of approximately $78.08 to the economy (Benell and Prentice, 1993). In contrast with the previous relationship developed in the research focused on China, this Canadian research addresses the impact of airport development on economic development. A cause-and-effect relationship between airport and economic development is observed in both directions. For example, economic expansion can increase airport demand. An increase in airport capacity then raises productivity and/or demand in other sectors of the economy.

Methods and Findings of Economic and Airport Development Regression Analyses

In *Airport Development and Regional Economic Growth in China,* Yao and Yang (2008/07) perform a regression analysis to determine the effects of several variables on a dependent variable that is divided into two categories: the volume of passengers by air and the volume of cargo by air. The explanatory variables include GDP, population density, openness (trade/GDP), economic structure (share of employment accounted for by the tertiary industry), ground transportation (volume of rail and road transport), location dummy variables (east, northeast and west, using central as a base), and a time dummy for 1995-2001 (Yao and Yang, 2008/07). The data used in this study was collected from various data sources such as *Statistical Data on Civil Aviation of China.* The regression is represented mathematically by the following equation, with all variables evaluated in natural logarithms at 1995 price levels in China:

$$y_{it} = \alpha_0 + \alpha_1 gdp_{it} + \alpha_2 services_{it} + \alpha_3 pd_{it} + \alpha_4 gt_{it} + \alpha_5 trade_{it} \\ + \alpha_6 east + \alpha_7 west + \alpha_8 northeast + \alpha_9 9501 + \mu_{it}$$

Source: Yao and Yang (2008/07)

The researchers of this study concluded, based on the regression analysis, that economic growth and openness (measured by trade/GDP ratio) are principal determinants of airport development and air transportation volume. Further results imply that airport development is positively correlated with economic growth, industrial structure, population density, and openness. Airport development is negatively correlated with ground transportation development. The negative correlation with ground transportation reflects the substitutability between ground transportation options, such as railroads and highways, and air transportation. The less developed regions of China are the west and northeast regions. Yao and Yang's results suggest an incentive to construct airports and promote air travel in these less-developed areas because substitutable forms of travel are costly to implement there due to the presence of vast, mountainous terrain (Yao and Yang, 2008/07). Furthermore, airport development in these less-developed regions can promote economic equality across the country, as airport development is positively correlated with economic growth. While the results of this research are only directly applicable to the Chinese economy, its methods and general findings can be transformed and applied to other urban economies.

Benell and Prentice (1993) conduct a related analysis focused on the consequences of Canadian airport expansion in their study titled *A Regression Model for Predicting the Economic Impacts of Canadian Airports*. The purpose of this research is to conduct an econometric analysis to estimate the relationship between indicators of airport activity and their economic impacts on the Canadian economy. This differs from the Chinese study because it looks at the opposite cause-and-effect relationship. They focus specifically on direct employment and revenue impacts as economic indicators and obtained most of the transportation data from *Airports Group, Transport Canada*. Benell and Prentice (1993) find that passenger traffic, a city's commercial activity, air carrier maintenance bases, air traffic control towers, flight service stations, and selected aircraft movement statistics are key variables that determine the economic impact of a single airport. They run two regressions, one with a dependent variable of "person-years of employment that is directly attributable to the airport (E)" and the other with a dependent variable of "revenue, or economic output, that is the result of airport activity in one year (R)" (Benell and Prentice, 1993). The Ordinary Least Squares (OLS) regression is represented mathematically by the following equations:

$$lnE = lna_0 + a_1 lnP + a_2 lnW + a_3 lnB + u$$
$$lnR = lnb_0 + b_1 lnP + b_2 lnW + b_3 lnL + b_4 lnB + u$$

Source: Benell and Prentice

Please refer to table 1 under references for an explanation of the variables in these equations.

The researchers find that revenue elasticity and labor elasticity can be developed from commercial airport activity. Both values of elasticity can then be used to determine the direct economic impact of an airport, using data such as passenger numbers and local economic conditions. Furthermore, it is apparent that direct labor counts are more reliable economic indicators than revenue indicators. When measuring revenues, it is difficult to avoid double counting, thus estimates become inaccurate. Numerically, Benell and Prentice (1993) find that a 1% increase in annual passenger traffic at a particular airport coincides with a .75% increase in direct employment and a .49% increase in direct revenues. The difference in the elasticity of direct employment and the elasticity of revenues is important for future planning and modeling of airport and economic development relationships.

How Airport Activity Affects Economic Development of Metropolitan United States

Similar studies have been conducted on various metropolitan areas in the United States. Specifically, research conducted by Richard Green (2007) addresses the hypothesis that activity at a metropolitan airport predicts employment and population growth. Green's regression analysis is unique because he uses panels and two instruments to attempt to control for simultaneity and develop proof of causation rather than just correlation. This study uses four measures of airport activity that include boarding volume, passenger originations per capita, whether a city has an airport that is a hub for a major carrier, and cargo activity. The two economic development indicators are population and employment growth between 1990 and 2000.

Based on a numerical regression, using both OLS and Instrumental Variable (IV) tools, Green (2007) finds that boarding per capita, passenger originations, and the presence of a major airline hub have a significantly large influence on population growth. In fact, hub cities grew between 9% and 16% faster than non-hub cities between 1990 and 2000. However, the volume of cargo activity did not prove to cause economic development, according to this study. Green (2007) also explores the concept of negative externalities. While many argue that airport development is positively correlated with economic development, there exist negative externalities in building airports. For example, residents located within close proximity to airports often complain about the

noise, pollution, and overall congestion that airports bring to the local neighborhoods. According to Green, airports can only be considered beneficial if the benefits of economic development outweigh the costs of the negative externalities.

Implications For Future Research

Each of the three aforementioned studies shares similar and dissimilar dependent and explanatory variables in completing regression analyses. This demonstrates the limitations of each study, as they define indicators such as economic activity or airport activity based on a set of individual variables that differ from study to study. It may be possible to combine parts of these individual regressions to create a more comprehensive study. The econometric models that have been created serve as effective templates for further research on this topic. Specifically, in looking at the relationship between the economy of the Raleigh-Durham region and the expansion of the RDU airport, it is possible to apply the specific economic and airport development indicators to create a distinct regression for this specified urban economy. Hypotheses for this specific research may include the following:

1. RDU is currently undergoing expansion because of the increased economic development in the triangle region. Using airport activity as the dependent variable and various economic indicators as independent, or explanatory, variables can prove this prediction.

2. RDU is currently undergoing expansion and this increase in airport activity will cause economic development in the triangle region in the future. One can support this prediction by running a regression with various indicators of airport activity (such as the ones used in the previous three studies) as the independent variables and an economic indicator such as GDP or employment levels as the dependent variable.

While generalizations can be developed regarding the economic impact of airports in general, individual urban economies are unique. A study of RDU and Raleigh-Durham specifically will bring new findings to complement pre-existing research. The study of an airport's relationship to an economy is important because this relationship has the ability to have large implications for the future growth of a city. In addition, because airports connect cities throughout a country, airport development can even transform national economies, such as the example in China that predicts airport growth in less-developed regions can alleviate the income disparity across different regions in the country. Regression analysis is an important tool in determining these relationships

and revealing the importance of airports in local economies.

References

Benell, Dave W; Prentice, Barry E, 1993. A regression model for predicting the economic impacts of Canadian airports. *Logistics and Transportation Review;* Jun 1993; 29, 2; ProQuest pg. 139

Table 1:

The explanatory variables included in the analysis are:

b_0	=	A constant.
P	=	Enplaned and deplaned passengers at the airport in 1988.
W	=	The relative wealth of the community, as measured by the average price of all the houses sold that year.
S	=	The number of movements of small aircraft (<5,670 kg).
M	=	The number of movements of mid-sized aircraft (5,671 - 35,000 kg).
L	=	The number of movements of large aircraft (>35,000 kg).
B	=	1 if there is an air carrier's maintenance base at the airport, 0 otherwise.
T	=	1 if there is an air traffic control tower at the airport, 0 otherwise.
F	=	1 if there is only a flight service station (no tower) at the airport, 0 otherwise.

Green, Richard K. 2007, "Airports and Economic Development, *Real Estate Economics;* Spring 2007; 35, 1; ProQuest pg. 91

Yao, Shujie and Yang, Xiuyan. 2008, "Airport development and regional economic growth in China," Nottingham, UK: University of Nottingham *research paper 2008/07.*