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Determining the Economic Impact of Airline Stations

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ABSTRACT

Increasingly, makers of public policy depend on economic impact studies to justify difficult and expensive decisions. An important process in determining these impacts is developing models to estimate the number of jobs, total wages and final demand. This paper examines past approaches to this process as they pertain to the impacts generated by a key airport sector—airlines—and suggests steps which might refine these techniques. These models depend on the tests of logic courtesy of the regional earnings coefficient from the Bureau of Economic Analysis' RIMS II input-output model and common sense.

I. INTRODUCTION

The idea behind airport economic impact studies is simple: facing real or potential public opposition and wishing either to enlarge the airport or prevent its diminishment, the supporters of the airport sponsor a study to extract the precise portion of the regional economy dependent on the airport. In other words: what are the concrete benefits from an airport. An economic impact study measures jobs, wages and final demand, the latter of which consists of sales, commissions or operating budgets.

Many studies of airport economic impacts have restricted their data collection to firms on, or in close proximity to, the airport, while indiscriminately assigning all of a firms' final demand to the airport. Although an airline may depend solely on the airport, the airport hotel located on the interstate may not, because it may also depend on the highway for its customers.

Some studies have taken the total revenues of firms using the airport (for transport of packages or people), added them to the revenues or operating budgets of on-airport firms, and called that the total economic impact of the airport, forgetting that other forms of travel exist and that the final demand of on-airport firms depend on the people and packages passing through the airport, thus these studies twice-count the impacts.

By way of apology, both for this paper and for the work of others, airport economic impact studies are more art than science. There are no rules and little guidance. Realizing this, the FAA has begun to collect examples of airport economic impact studies in an effort to create standards for assumptions and methodologies.

The following pages look at a first effort at determining the economic impacts of airports—specifically, the impact of airlines in terms of final demand, wages and employment—and then after additional data collection, an improvement over our earlier methods.

II. FIRST ATTEMPT

We collected our data using an extensive survey instrument mailed to airline station managers (at the two airports we were then studying); telephone interviews of the same station managers; and airport data of the same airlines and probably from the same station managers. This extensive (and expensive) data collection effort was plagued with illogical answers, typographical errors and many an "N/A." Few station managers provided all the information and many provided none—even though we and the clients tried to convince the station managers that the study would benefit them by improving the airport. But few station managers, it turns out, even know such things as the station budget for their station; at some airlines, no one person knows how many people work there; and no one has any idea as to where these employees live. Nevertheless, estimates had to be made. we used airport head-counts of identity badges or parking decal applications to estimate airport employment. This provided an independent variable used to predict other variables such as wages and station budget.

Although we had over seventy airline stations from which to collect data, when the time came to estimate impacts, we had complete data for only thirteen. (N.B., not all airlines serving an airport have employees or station budgets; the fixed base operator handles the necessary functions.) With so little data, we lumped the airports together to increase the degrees of freedom for our models, thus enabling us to try more variables than would have been possible had we treated each airport separately. Settling on a linear model for wages and final demand, we went to press with the following regressions (in which Budget stands for final demand, EMPL stands for number of full-time equivalent employees and DF means degrees of freedom):

Variable	*Coefficient*	*T-Value*
Budget =		
Constant	\$1,167,140	2.53
EMPL	\$20,636	6.05
	R^2 = .80	DF = 11
Wages =		
EMPL	\$22,844	12.13
	R^2 = .90	DF = 12

We had four problems with these models:

1. The large constant meant that we were not recognizing differences between large and small air-

lines. Although we may have reasonably estimated the airline final demand for the airports, we did a very poor job of estimating final demand for any individual airline.

2. As the R^2 of .80 in the first equation indicates, there are other factors explaining the variation beyond those which we specified.

3. Both equations depend on knowing the number of full-time equivalent employees working at each airline. When airlines do not respond to surveys, data on full-time equivalent employees are missing as well. We developed a relationship based on identity badge records to estimate full-time equivalent employees for those airlines which did respond to the surveys. This meant that we had to use an estimate in order to find additional estimates.

4. After estimating final demand for the airline sector, we multiplied it by the RIMS II earnings multiplier[1] to find the total earnings produced by the airlines in the region. Total earnings is the sum of wages and induced earnings. This multiplier shows that the airlines produce more of a region's disposable income than what stems from their employees' wages. Unfortunately, the actual multiplication produced a total earnings less than the wages of the airlines alone, implying that either the final demand estimate was too low, or the airlines produced negative induced earnings. Rejecting the latter hypothesis, we then had to "back out" final demand by dividing our airline wage estimate by the household sector of the earnings multiplier. In short, after all the data collection, and after all the econometric models, we were forced to use the coefficients from the regional input-output model to find final demand. Unfortunately, another round of surveying would be too expensive and too frustrating. We knew there had to be a better way.

III. IMPROVED METHODOLOGY

Obviously, we were missing some very important factors in our estimates of final demand. We went to work. Plotting budget and wages against employment as in Figure 1 revealed that some airlines spend nearly all of their budgets on wages (those with Budget/Wage close to one) while others spend less than ten percent (the one off the chart has a budget over 36 times larger than its wages). Analyzing the ratio of budget to wages introduced a new factor to our efforts: contracting-out. It turns out that all airlines contract-out at least some of their functions, such as security or aircraft cleaning. Others contract-out nearly all of their functions including baggage handling, ticketing and ramp services. For the most part, the airlines use firms such as Allied, ARA and Wackenhut to provide these services. In some cases, however, other airlines perform these functions for their competitors. Information on contracting-out proved easy to find. Not only do experienced airport contract specialists know who performs what services for whom, but this is the one area airlines are willing to disclose. In fact, some airlines even went so far as to name the other carrier involved in the contracting relationship.

We developed a dummy variable called "Contract" which equaled "1" when the airline contracts-out heavily and "0" if it does not. The contracting-out dummy variable enabled us to use another easily obtained variable into use: total activity (enplanements, connections and deplanements). (The variable "Total" equals total activity divided by one thousand.) The results from one airport were favorable. With the use of Contract, we found a strong fit between final demand and Total; wages and employees; and employees and Total.

IV. AIRPORT A

Whereas the original model made Budget a function of EMPL, the contract variable not only revealed a relationship between Budget and Total, but enabled the model to stand up to the RIMS test.

Airport A Final Demand

Variable	*Coefficient*	*T-Value*
Budget =		
Constant	\$2,902,168	3.60
Total	\$7,298	6.51
Contract	−\$2,689,295	−3.90
	R^2 = .931	DF = 10

This model explains differences in final demand between large and small airlines, because Contract provides for a lower constant for the airlines that contract-out, which also happens to be the smaller airlines. This makes sense considering that the larger airlines at an airport have achieved such economies of scale that it pays for them to provide more of their own services. The estimated final demand for Airport A, given a 90 percent confidence interval, lies between \$43 and \$174 million.

Airport A Wages

Variable	*Coefficient*	*T-Value*
Wages =		
EMPL	\$28,105	16.84
	R^2 = .914	DF = 9

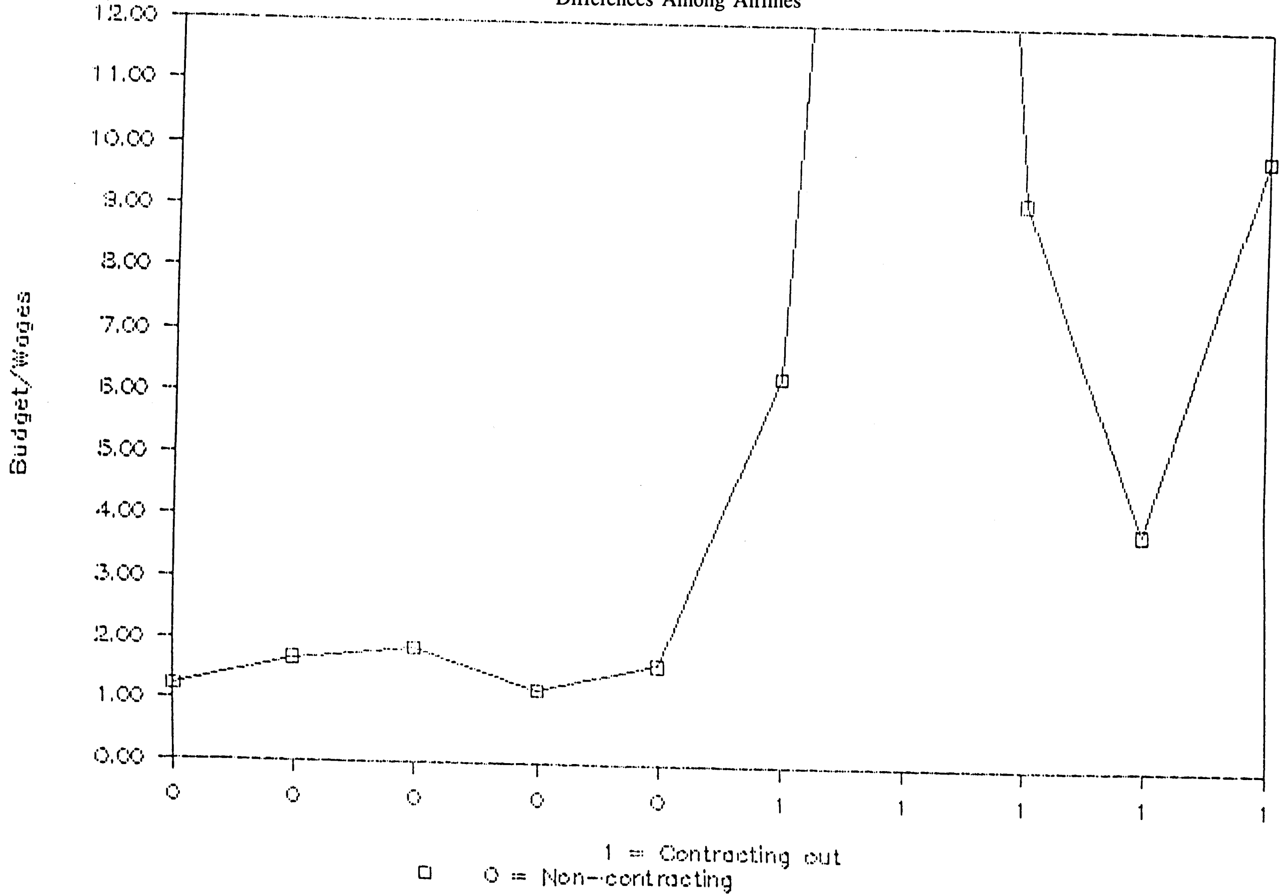
This equation means that given a 90 percent confidence interval, the average wage of an airline station employee lies between \$25,050 and \$31,160 with a mean of \$28,105.

Airport A Full-time Equivalent Employees

Variable	*Coefficient*	*T-Value*
Employees =		
Constant	103.285	6.23
Total	0.102	4.72
Contract	−110.377	−7.63
	R^2 = .952	DF = 12

This equation means that given a 90 percent confidence interval, and assuming an airline has 1,000,000 enplanements and deplanements (Total = 1,000), without contracting the airline will require between 137 and 274 full-time employees and with contracting it will require between 0 and 189 employees. Obviously, the employment at each actual airline will depend on the amount of services it contracts out. Looking at the means of both intervals (206 for non-contracting and 94.5 for contracting)

FIGURE 1. BUDGET VS. WAGES
Differences Among Airlines



emphasizes the difference contracting-out creates. The wide confidence intervals are a function of the low degrees of freedom and the variation among airlines over how much they contract-out. Moreover, airlines must staff to fit time periods that meet human needs. Even with part-timers, airlines cannot vary their workforces to meet continuous flows of passengers. An evaluation of flight schedules would provide information on the frequency and timing of flights as well as the number of hours the airline has its station open. This might explain some of the variation in staffing given contracting status. Again, as in all studies, a little work begets more.

The biggest complaint against the first attempt was the failure of the final demand model to hold up to the RIMs test. When the regional earnings coefficient of 0.5348 was multiplied by final demand, the subsequent value for induced earnings and wages was less than the actual wages themselves. Using the results of the new methodology produced total earnings of $49 million which is larger than the value for wages which lies somewhere within the 90 percent confidence interval of $39 to $49 million.

Certainly, there are other factors influencing these key variables, but the results of the new models produced a more solid estimate of the economic impacts of airlines. Of course, more data would tighten the boundaries of the confidence intervals, but that is the problem with working with primary data. The next section looks at another airport with the hope of combining data from both to produce an even better model.

V. AIRPORT B

At first glance, the models disappointed us because they let show a large amount of unexplained variation.

Airport B Employment

Variable	*Coefficient*	*T-Value*
EMPL =		
Constant	81.286	1.94
Total	0.169	2.65
Contract	−92.899	−1.83
	R^2 = .627	DF = 8

Although a small airport, with one-third the enplanements of the other, Airport B contains two airlines with hubbing operations. With hub thrown in as an explanatory variable, the variation is explained, but the model becomes entirely dependent on the hub and contract dummy.

Airport B Employment (with Hubs)

Variable	*Coefficient*	*T-Value*
EMPL =		
Constant	83.011	3.90
Total	0.062	1.59
Contract	−80.648	−3.11
Hub	180.567	4.90
	R^2 = .904	DF = 7

Further investigation showed that hub operations create the same imbalances in capital and personnel at small or mid-sized airports as does rush-hour demand on public transit properties. The tremendous onslaught of passengers during a few hours of the morning and evening requires more employees than would the same number of passengers spread throughout the day. Similarly, as a small international airport, Airport B experiences peaking problems when wide-body airplanes load and unload. The need to meet these surges requires a greater workforce than would otherwise be necessary for an airport of the same size given a smoother flow of traffic. Airport A, although a larger airport, has neither hubs nor international carriers. Its airlines are better able to spread their personnel over many arrivals and departures (although peaking would explain some of its variation too). Airport B, on the other hand, has a large proportion (approximately 50 percent) of its total traffic dependent on its two hub airlines.

Airport B Without Hub Airlines

Variable	*Coefficient*	*T-Value*
EMPL		
Constant	46.292	2.05
Total	0.167	3.13
Contract	−57.705	−2.59
	R^2 = .802	DF = 6

Dropping the hub airlines from Airport B produces a much better fit for the model based on the continuous variable total. [Perhaps another study can examine hub airlines at several airports, looking at their total operations as a function of station budget. The hypothesis suggested from this study is that small hubs have a higher cost per enplanement than either large hubs or regular carriers which can better extend their operations over more hours of the day.

VI. GENERALIZING TO THE POPULATION

The difficulty in getting airlines to disclose information causes economic impact studies to suffer from very wide confidence intervals. Airport A produced statistically sound results, but no airport manager or Chamber of Commerce President would ever tell a room full of reporters that the total impact of an airport on a region lay somewhere between $1.5 and $3 billion, given a 90% confidence interval. Confidence intervals do not play well in the press. Moreover, not all airports have as many airlines as airport A, further reducing the degrees of freedom. The dilemma caused by cost versus accuracy calls for an answer which lies in developing a universal model. Unfortunately, it would be foolhardy to suggest that the following equations apply universally, only that they may point in the right direction.

The following equations resulted from combining Airports A and B.

Airports Combined

Variable	*Coefficient*	*T-Value*
Budget =		
Constant	$3,077,129	5.42
Total	$7,071	7.89
Contract	−$2,802,579	−5.50
	R^2 = .936	DF = 13

Wages =		
EMPL	\$28,999	17.39
	R^2 = .969	DF = 13

Employees =		
Constant	68.826	5.31
Total	0.138	6.74
Contract	−80.877	−6.67
	R^2 = .906	DF = 21

All of these equations have high R-squares and T-values. By themselves, they are gratifying, but their importance lies in their ability to predict impacts of a particular airport. (The following 90% confidence intervals use Total of 446 and mean Contract of .583, which are the means for Airports A and B.)

Comparing Employment For A Typical Airline

	Low		*Mean*		*High*
Airport A	22	<	84	<	147
Airport B	−28	<	87	<	202
Combined	33	<	83	<	134

As this comparison shows, combining the two intervals narrows the deviation about the mean, and, consequently, provides a forecasting tool of greater accuracy.

VII. CONCLUSION

Although there is much more that we can learn about the economies of airport stations, this paper reveals that relationships exist between publicly available data and proprietary information, which when properly used, will show the econmic impact of airlines. The actual models shown here are guaranteed to predict impacts at Airports A and B only; other airport impacts may vary. But a practitioner may wish to use these models (for domestic non-hub airlines) for comparision when undertaking an airport econmic impact study.

ENDNOTES

*Economist, Gellman Research Associates, Inc. He gives special thanks to his colleagues Richard Golaszewski and Earl Bomberger for their invaluable help on this paper. Its weaknesses, however, are nobody's fault but his own.

[1] RIMS II is a product of the Bureau of Economic Analysis, U.S. Department of Commerce.