Recommended Regional Economic Impact Procedures for Aviation-Related Projects

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In this paper is presented a stepwise system, in descending order, based on sales, payroll, and employees for measuring the regional economic impact of aviation-related projects. The procedure is based on the Regional Input-Output Modeling System (RIMS II) developed by the U.S. Department of Commerce. Also presented are a brief discussion of the RIMS II methodology, general issues associated with aviation-related economic impact studies, an overview of all major studies using RIMS II multipliers, and recommended procedures for future studies. Every agency, or their lead consultants, that had completed or was conducting a major aviation-related economic study with RIMS II responded to a questionnaire used to gather information for this paper. Every respondent reported overall satisfaction with RIMS II. Input-output analysis is the preferred technique for evaluating regional economic impacts of business activity. Developmental problems associated with input-output analysis have been overcome with the development of RIMS II. Since 1983 the RIMS II multiplier methodology has become the dominant economic impact methodology for evaluating regional aviation impacts. In March 1986, 10 major aviation economic studies encompassing 30 primary commercial service and more than 200 general aviation airports were under way or completed. Because the application of RIMS II multipliers to the aviation industry is so recent, discussion and more precise guidelines on the use of the methodology as applied directly to the aviation industry are needed.

A wide variety of approaches has been employed to determine regional economic impacts of aviation-related activities. These approaches range from use of generalized economic multiplier numbers to input-output analysis. The most highly regarded and technically accurate of these approaches is input-output analysis. For instance, the Federal Aviation Administration (FAA) has stated that "the most reasonable technique (and, according to some authorities the only theoretically valid approach) to derive regional or subregional multipliers appears to be the application of an input-output transaction matrix developed for the local economy" *(1)*. The use of input-output analysis for developing local and regional economic impact studies has been retarded by the high costs associated with developing the transaction matrix, the vast data requirements, and the inappropriateness of using the coefficients developed for one region to calculate the impacts of activity in another region *(1)*. However, all of these objections to using input-output analysis have been overcome with the development of the Regional Input-Output Modeling System (RIMS II) by the Regional Economic Analysis Division of the Bureau of Economic Analysis (BEA), U.S. Department of Commerce *(2)*.

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RIMS II multipliers are intended to show total regional effects on industrial output and personal earnings for any county or group of contiguous counties in the United States and for any of the 531 industrial sectors in the 1977 BEA national input-output tables. Thus the application of RIMS II to the air transportation industrial sector (code 65.0500) and related sectors represents only a small element of RIMS II's total applicability. The first use of RIMS II multipliers in an aviation-related project was the Florida General Aviation Economic Assessment *(3)*. The Florida Department of Transportation considered that economic analysis a great success. Subsequently, in 1984, the Transportation Research Board published a paper *(4)* on the use of RIMS II and the Florida findings.

As the result of continued interest in demonstrating aviation's contribution to local economies and more widespread knowledge of RIMS II, the aviation industry is becoming one of the largest users of RIMS II multipliers. In March 1986, 10 major aviation economic studies encompassing 30 primary air carrier and more than 200 general aviation airports were under way or completed. Thus in a period of 3 years the RIMS II multiplier methodology has become the dominant economic impact methodology for evaluating regional aviation economic impacts. Because the application of RIMS II multipliers to the aviation industry is so recent, discussion and more precise guidelines on the use of the methodology as applied directly to the aviation industry are needed. In this paper four topics are addressed:

- Brief description of the RIMS II methodology,
- General issues associated with aviation-related economic impact procedures,
- Case studies and recommended procedures for the use of RIMS II, and
- Future developments associated with RIMS II.

Case studies and recommended procedures are emphasized most.

RIMS II METHODOLOGY

Economic analysis of aviation projects may be broken into three broad areas: financial analysis, economic efficiency (benefit-cost) analysis, and impact (earnings/employment/sales) analysis. RIMS II is ideally suited for impact analysis. It has no direct link with financial or economic efficiency analyses.

The RIMS II model is based on the 1977 national input-output model's technical coefficients (trade mixes) for 531

industries; however, the most recent year county earnings and income data are used in developing the RIMS II multipliers. Thus RIMS II multipliers are essentially updated to within 1 year of a study. Frequently questions arise about the appropriateness of applying a national model to a specific region and the appropriateness of using trade mixes based on a model approximately 10 years old. RIMS II is a regional model, designed specifically to address economic impacts at the regional level. Trade mixes among industries are based on national data; however, county-specific earnings and income data are used to develop the multipliers. RIMS II multipliers have a high degree of reliability compared with far more expensive full-state input-output studies (2). Although the U.S. economy is dynamic and public opinion appears to be that the economy is volatile, structural changes involving trade mixes occur gradually. When updating RIMS II from the 1972 to the 1977 national input-output model, BEA found that technical coefficients for the vast majority of industries changed only slightly. These modest changes occurred during a period of perceived major national and worldwide economic upheavals.

RIMS II is the most nationally recognized regional input model, and there have been numerous professional papers and presentations that have used it in the field of regional economics. Therefore its use has a certain degree of creditability in the economic professional community. To many people untrained in regional economics, the RIMS II multipliers frequently appear low. For instances, rarely are RIMS II total multipliers (including the initial change in demand) higher than 3.0 or earnings multipliers higher than 0.8. Use of RIMS II's realistic multipliers gives further public creditability because of their apparently low values.

The RIMS II multipliers permit examination of the comparative impacts of aviation activity expenditures on any industrial sector, including the air transportation sector. As part of RIMS II, BEA through 1985 provided earnings multipliers, direct coefficients, and total multipliers. The earnings multipliers are the most important because they allow the calculation of earnings (income) and employment impacts, which are the best measures of economic value added from aviation-related activities. Total multipliers allow the calculation of changes in final demand and are analogous to output or sales multipliers. Direct coefficients allow the calculation of the sales impact of a change in final demand (e.g., $1 million) on any other industry.

In summary, there are three major advantages to applying RIMS II to aviation-related economic impact studies. First is creditability. RIMS II is the most nationally recognized economic impact model. Second is accuracy. RIMS II has been found to be quite reliable and is a highly disaggregated system both spatially and industrially. Third is cost. RIMS II multipliers are relatively inexpensive. Thus RIMS II is an excellent economic impact model; however, two limitations exist. First, RIMS II is a static model not a dynamic model. Consequently, the impact estimates generated by the system indicate the overall change that is likely to occur but not the timing of such a change. Second, the airline industry is aggregated with other aviation-related industries, which may not account for the substantially different economic impacts of the airline industry and the other aviation-related industries.

As applied to the aviation industry, the generalized RIMS II impact methodology developed by the author consists of seven major steps:

1. Determine the scope of analysis desired,
2. Determine the regional area or areas to be analyzed,
3. Determine the RIMS II code number for each economic activity to be analyzed,
4. Obtain economic data (usually sales or salary data from primary sources) on each economic activity to be analyzed,
5. Analyze and verify economic input data,
6. Apply RIMS II multipliers, and
7. Report economic impacts.

GENERAL ISSUES ASSOCIATED WITH AVIATION-RELATED ECONOMIC IMPACT STUDIES

Three general issues associated with aviation-related economic impact studies are discussed in this section:

1. The aviation industry's self-interest in promoting high economic benefits;
2. The use of generalized, high, unscientifically derived economic multipliers; and
3. Analysis conducted by analysts without a combined knowledge of aviation and regional economics.

The driving force of many aviation-related economic impact studies is associated with promotional, marketing, or public relations purposes, not technical impact analysis. These aviation studies are used to promote the economic benefits of airports, and thus sponsoring agencies have a self-interest in the results. Such self-interest may inadvertently result in the overstating of airports' or aviation's contributions to regional economies. Two areas in which aviation's contribution to regional economies are frequently exaggerated are the inclusion of indirect benefits (without proper documentation of assumptions) and the use of high economic multipliers.

Many aviation-related economic impact studies include air tourist expenditures and resulting multiplier impacts as benefits. Clearly airports and the aviation industry play a vital role in tourism. However, the actual driving force of the air tourist industry is consumer activity during the trip, such as visiting relatives or tourist attractions, not the trip itself or the airport where the trip originates or terminates. Airports, like highways and utilities, are part of a region's infrastructure. Tourists arriving by air also usually use a region's highways and utilities. There is virtually no more logic to assigning all air tourist expenditures in a region to the aviation industry than to the region's highway or utility industries. An analysis of the impacts of tourists arriving by air is appropriate to include in an aviation-related economic impact study if those impacts are clearly associated with tourists arriving by air and not combined with economic impacts directly associated with aviation-related expenditures. The two types of benefits should not be combined because air tourist expenditures are only indirectly linked to the aviation industry and double counting of benefits is likely to occur.

Poorly constructed economic multipliers are in widespread use throughout the United States. A change in final demand (e.g., $1 million in new sales) results in the respending of that money throughout a region. The respending of money results in economic multiplier impacts. Regional output or sales multipliers greater than 3.0 (inclusive of initial expenditure) are immediately suspect to most trained regional economists as are

earnings or income multipliers greater than 1.0. Furthermore, economic multipliers vary substantially among industries and regions, and the use of common multipliers raises questions of technical accuracy.

The value added from economic activity is the primary benefit to regional economies. The economic concept of value added consists of payroll, proprietor's income, and taxes, of which payroll is usually the most significant. Reporting of earnings (income) or jobs is far more relevant in economic impact studies than are output (sales) values. Sales merely represent monetary transfers, not economic worth to a region. Although earnings values are more relevant to economic impact studies, sales values are frequently stressed (or at least given equal weight) because dollar values and economic multipliers are significantly higher for sales than for earnings.

The single most important technical discipline for an aviation-related economic impact study is regional economics. However, knowledge of aviation characteristics is also important because of unique aspects of the aviation industry. Unfortunately, seldom are those two technical backgrounds closely linked. This paper contains specific guidelines for conducting aviation-related economic studies; however, for a comprehensive study, a team consisting of a regional economist and a person knowledgeable about the aviation industry is desirable.

CASE STUDIES AND RECOMMENDED PROCEDURES

Major aviation-related economic studies are defined in this paper as encompassing a primary commercial service airport or a statewide system of general aviation (GA) airports. Major studies that have used RIMS II multipliers as their foundation are given in Table 1. Care should be exercised in reviewing consultant budgets in Table 1 because they represent significantly different project scopes and client agency involvement.

To develop the table, questionnaires were sent to the sponsoring agencies or their lead consultants, or both. The list of major studies was derived from the author's knowledge and contacts with BEA, sponsoring agencies, and their lead aviation economic consultants. Representatives of every agency or its lead consultants responded to the questionnaire or discussed their projects with the author.

One section of the questionnaire requested respondents to evaluate the use of RIMS II in their projects in terms of (a) applicability to project, (b) reasonable cost, (c) confidence in accuracy, (d) ease of use, and (e) overall satisfaction. Possible responses were excellent, good, fair, or poor. Responses to the questionnaire are given in Table 2. It is noteworthy that nearly all responses were in the good to excellent range and that there was a high degree of overall satisfaction with RIMS II.

The 10 major aviation economic studies are used as the basis for a discussion of RIMS II methodology steps and recommended procedures.

Determining the Scope of Analysis

Aviation-related economic impact studies need to clearly define what economic activities are to be included. A difficulty in evaluating economic impact analyses is multiple use of technical terms, specifically direct, indirect, and induced impacts. There are fundamental differences in these terms as used in most regional economic analyses and aviation-related economic studies, and even within aviation-related economic studies. BEA uses the terms "initial" changes in final demand, "direct" impacts on industries delivering output for the change in final demand, and "indirect" impacts resulting from production required to produce industries' direct requirements and regional production required to meet consumer demand *(14)*. This author, however, recommends the following groupings of terms that better reflect the terminology currently used in aviation-related regional economic studies.

1. Direct on-site, induced on-site, and total on-site economic impacts;
2. Direct off-site, induced off-site, and total off-site economic impacts;
3. Indirect tourist, induced tourist, and total tourist economic impacts; and
4. Indirect on-site, induced on-site, and total on-site economic impacts.

Direct economic impacts refer to the initial change in final demand (generally from business sales). Induced economic impacts refer to subsequent rounds of economic activity (the multiplier effect) resulting from the initial change in demand. Total economic impacts refer to the summation of direct (or indirect, whichever is relevant) and induced economic impacts. On-site and off-site refer to whether the direct economic impact occurred at an airport. Indirect economic impacts refer to the initial change in final demand as a result of other activities indirectly related to airports, such as expenditures by tourists and nonaviation-related business at airports.

The scope of a project may include one or more of these four economic groupings. It is recommended that each grouping be treated separately. Furthermore, great care must be taken before adding the results of the groupings because there is a high probability of double counting and irrelevancy between groupings. Analysts should also note the substantially different meaning of terms used in the aviation community and the more general regional economic professional community.

A project's scope should clearly state which of the four economic groupings will be included. If the economic impact study is of an airport, then a decision needs to be made about whether to include all activities at the airport or only those closely linked to the aviation industry. For on-site activities, many studies in Table 1 dealt only with on-site aviation-related businesses; on-site businesses not dependent on airport activity were excluded or addressed in significantly less detail. The other major type of aviation-related study is evaluation of aviation-related impacts, not simply airport-related impacts. The Pittsburgh analysis *(10)* is believed to be the most comprehensive regional aviation industry (off-airport-site) economic impact study. Examples of off-site aviation-related activities include such directly related activities as airplane manufacturing and less directly related activities such as travel agencies and hotels and motels, a percentage of whose sales is included in the analysis.

Many aviation-related economic impact studies include air tourist expenditures and resulting impacts as a benefit of airports. As was said earlier, inclusion of these indirect economic benefits is proper only if the assumptions made are clearly

TABLE 1 MAJOR AVIATION ECONOMIC STUDIES USING RIMS II MULTIPLIERS

Study Area	Date Completed (actual or scheduled)	Airports Analyzed		Scope				Primary Purpose of Study	Consultant Budget ($)
		Primary Commercial Service	Other (detailed/ indirectly)	On-Site Aviation Related	On-Site Nonaviation Related	Off-Site Aviation Related	Tourism		
Florida (GA) *(3)*	1983		9/85±	X	X	X		Technical	50,000
Jacksonville *(5)*	1984	JAX	2/0	X	X			Marketing	10,000
West Virginia (GA) *(6)*	1984	CRW	0/36	X	X	X	X	Technical/ marketing	75,000
Colorado (GA) *(7)*	1985	DRO	17/66	X	X			Marketing	50,000
Anchorage *(8)*	1985	ANC	0/0	X		X	X	Technical	50,000
Washington, D.C. *(9)*	1986	BWI, DCA, IAD	0/0	X		X		Technical/ marketing	55,000
Pittsburgh *(10)*	1986	PIT	16/0	X	X	X	X	Technical/ marketing	55,000
Roanoke *(11)*	1986	ROA	0/0	X	X			Marketing	0
Virginia *(12)*	1986	DAN, PHF, CHO, LYH, RIC, ORF, HSP, SHD	40±/35±	X		X	X		115,000
Florida *(13)*	1986	MCO, MIA, TPA, MLB, PNS, TLH	20/105±	X	X		X	Marketing	70,000

NOTE: JAX = Jacksonville, Florida; CRW = Charleston, West Virginia; DRO = Durango, Colorado; ANC = Anchorage, Alaska; BWI = Baltimore, Maryland; DCA = Washington, D.C., National; IAD = Washington, D.C., Dulles; PIT = Pittsburgh, Pennsylvania; ROA = Roanoke, Virginia; DAN = Danville, Virginia; PHF = Newport News, Hampton Roads, Williamsburg, Virginia; CHO = Charlottesville, Virginia; LYH = Lynchburg, Virginia; RIC = Richmond, Williamsburg, Virginia; ORF = Norfolk, Virginia Beach, Williamsburg, Virginia; HSP = Hot Springs, Virginia; SHD = Shenandoah Valley Airport, Virginia; MCO = Orlando, Florida, International; MIA = Miami, Florida; TPA = Tampa, Saint Petersburg, Florida; MLB = Melbourne, Florida; PNS = Pensacola, Florida; TLH = Tallahassee, Florida.

TABLE 2 EVALUATION OF RIMS II USE

Study Area	Applicability to Project	Reasonable Cost	Confidence in Accuracy	Ease of Use	Overall Satisfaction
Florida (GA) *(3)*	Excellent	Good	Good	Good	Good
Jacksonville *(5)*	Excellent	Excellent	Excellent	Excellent	Excellent
West Virginia (GA) *(6)*	Excellent	Good	Good	Good	Good
Colorado (GA) *(7)*	Excellent	Excellent	Good	Excellent	Good
Anchorage *(8)*	Excellent				Excellent
Washington, D.C. *(9)*	Excellent	Excellent	Fair	Excellent	Good
Pittsburgh *(10)*	Excellent	Excellent	Good	Excellent	Excellent
Roanoke *(11)*	Excellent	Excellent	Fair	Excellent	Good
Virginia *(12)*[a]	–	–	–	–	–
Florida *(13)*	Excellent	Good	Good	Good	Good

[a]This study was not far enough along for researchers to be able to evaluate RIMS II.

presented and the benefits are separated from the benefits that result from direct expenditures. Although they vary significantly in the approach taken to tourist impact, the Pittsburgh *(10)* and the 1986 Florida *(13)* studies are good examples of the proper treatment of tourist impacts in aviation-related economic studies.

Determining Regional Areas To Be Analyzed

The delineation of appropriate regional boundaries is not precise. Factors that should be considered are what airport, group of airports, or industry is being analyzed; regional economic trade areas; possible other uses of the RIMS II multipliers; and the budget available to perform a study. A county is the smallest region to which RIMS II can be applied. RIMS II multipliers may be obtained for a grouping of counties if counties are contiguous.

RIMS II is essentially an economic model and therefore boundaries should be established by economic, not political, considerations. For many studies BEA recommends the use of Metropolitan Statistical Areas (MSAs) delineated by the Census Bureau. Primary air carrier airports usually serve an area larger than an MSA and thus expanded boundaries are justified. On the other hand, general aviation airports frequently serve smaller areas and populations, and, correspondingly, will usually result in smaller impacts per dollar of direct expenditure.

Frequently, there is a desire to determine economic impacts on a subcounty basis in aviation-related economic studies. For instance, impacts on the 5-mi area closest to an airport or on specific municipalities may be desired. RIMS II is not formulated to address those desires. An attempt may be made to use some form of percentage process using RIMS II multipliers as was done in the Washington and Pittsburgh studies *(9, 10)*; however, extreme caution must be used because of varying economic impact areas among industrial sectors (e.g., motel versus construction), location of employees (i.e., the household sector plays a major role in RIMS II multipliers and employee living patterns may be diverse), and other factors. BEA and this author do not recommend the use of economic impact analyses on a subcounty basis.

Indirectly related to determining regional boundaries is the question of what administrative level is most cost-effective in preparing these studies. As implied by the data in Table 1, the

RIMS II methodology is applicable to all aspects of the aviation industry, all sizes and types of airports, and all regions of the United States. Major studies to date indicate that studies using the RIMS II methodology can be conducted or managed at the local, regional, or state level; however, it is this author's opinion that the most cost-effective use of RIMS II is at the state or roughly comparable level (e.g., Metropolitan Washington Council of Governments, Southwestern Pennsylvania Regional Planning Commission). There are advantages to a state's conducting or managing aviation-related economic studies:

- Individual airports or regions can pool their economic resources to collectively perform economic studies at a fraction of the cost of individual studies because of economies of scale;
- Analyses are done in a consistent manner;
- A method of sampling airports that will reduce the number of individual airports to be analyzed can be determined; and
- If the analysis does not use consultants, a state is more likely to be able to form a knowledgeable team consisting of a regional economist and an aviation specialist.

In Florida *(3)*, West Virginia *(6)*, and Colorado *(7)* the RIMS II methodology was applied to general aviation airports throughout the respective states. Selected airports were analyzed and impacts for the statewide system were aggregated. In both the Florida *(3)* and the Colorado *(7)* studies, a high degree of correlation was found between based aircraft and aviation-related sales at airports. This correlation allows a quick estimate of the economic impact of any airport within those states. Also, with a transfer of technical knowledge from the consultant to agency staff about RIMS II, state personnel can conduct detailed studies at any individual airport relatively inexpensively.

The major airport economic impact studies conducted in the Pittsburgh, Jacksonville, Anchorage, and Roanoke areas clearly indicate that quality studies can be conducted for small to large primary commercial service airports. The Roanoke study *(11)* is especially interesting because it was the only study that did not use consultants, encompassed the smallest regional study area, had a low budget, and was conducted and managed by a planner without RIMS II experience. Local or regional governments desired these regional aviation economic studies and consequently they were funded through local or regional entities. However, there is similar logic for a state or comparable region to perform aviation economic impact studies where there are at least three primary commercial service airports. In the most recent Florida study *(13)*, 6 of the state's 18 primary commercial service airports are to receive detailed analyses, and, on the basis of correlation between enplanements and direct sales, the economic impact for all of the airports will be determined. It is believed that the Florida approach can result in an economic savings of at least two-thirds of the cost of airports conducting their own studies individually and will result in a consistent approach with higher-quality findings.

Determining RIMS II Code Numbers

To use the RIMS II multipliers, each economic activity to be evaluated must be identified and corresponding RIMS II code numbers determined. A listing of on-site businesses is generally available from airport managers. It is usually easy to determine what economic activity each business is engaged in; however, if uncertainty exists the business should be contacted. Accompanying the RIMS II multipliers, BEA routinely provides a table correlating the RIMS II code numbers (National Input-Output Table code numbers) with Standard Industrial Classification (SIC) numbers. Table 3 gives most business activities that will be encountered in aviation-related economic

TABLE 3 AVIATION RIMS II CODE NUMBERS

Business	RIMS II No.
Airport Management	
Administration	650500
Construction	
Runways	110400
Terminals	110202
Warehouses	110203
Airlines	650500
Fixed-based operators	
Aircraft servicing	650500
Aircraft rental	730107
Aerial spraying	400001
Federal facilities	
Air National Guard	780400
Air traffic control	650500
Airways facilities	650500
Armed forces	780400
Customs patrol	650500
Forestry Service	040000
Postal Service	780100
Weather Service	730300
On-site aviation-related	
Advertising	730200
Aircraft manufacturing	600100
Aircraft radio repair	720204
Aircraft sales (retail)	690200
Airport inspection	650701
Airport parking	750003
Airport security	730106
Airport terminal services	650500
Automobile rental	750001
Auxiliary aircraft parts manufacturing	600400
Aviation school	770402
Avionics manufacturing	620100
Avionics repair	730101
Barber shops	720300
Book stores	690200
Building maintenance and cleaning	730102
Coin-operated amusement	760206
Drinking places	740000
Drug stores	690200
Engine and propeller manufacturing	600200
Fire departments	790300
Flight insurance	770403
Florist shops	690200
Flying clubs	770403
Flying instruction	770403
Food services	690100
Freight forwarding	650701
Freight shipping	650701
Gift shops	690200
Hotels and motels	720100
News dealers	690200
Police department	790300
Repair shops	730101
Restaurants	740000
Transit service	650200
Tobacco shops	690200
Travel agents	650702

studies and can be used as a shortcut method for determining RIMS II code numbers.

Obtaining Economic Data

Having the RIMS II model available allows the analyst to devote a larger share of resources to that phase of the study that is most critical, the collection of primary economic data. To date all completed studies using the RIMS II methodology have obtained primary economic data through surveys. Although some of the RIMS II studies *(3, 7)* have devoted significant planning, manpower, project time, and financial resources to the acquisition of economic data, this phase remains the most significant obstacle to successful completion of a quality product.

The development, distribution, and collection of the surveys have varied by study, primarily reflecting consultant preferences. The survey instruments used have been generally adequate. Some were pretested *(3)* and others *(5, 7, 10)* reflected insights gained from previous RIMS II–based aviation studies. The surveys are generally short and can be answered relatively quickly. Some have been administered and collected by trained personnel from the airport manager's office *(5)*, state aviation staff *(3, 7)*, and consultants *(10)*. Other surveys were conducted by mail *(8)*. All featured, to various extents, personal follow-ups either by telephone or in person. Experience has shown that support of the surveys by airport managers is essential.

Survey response rates have been good, ranging from approximately 40 to 100 percent in the Jacksonville study *(5)*. The quality of responses has also been reported as high; however, this author believes that some of the quality of response ratings are exaggerated. From personal experience with well-thought-out, pretested surveys; proper airport manager support; advanced notice of the surveys; and well-trained and motivated survey takers, quality survey responses from on-site tenants cannot be expected to exceed 60 percent without follow-up. It is uncommon to exceed this value because of reluctance or refusal to complete the survey, lack of desire to complete the survey, tenant absence, a nonqualified person completing the survey, unavailability of requested information, or misunderstanding of questions. Only with extensive follow-up and airport management support can an analyst reasonably expect at least 80 percent of the tenants to provide quality information (e.g., 90 percent response rate and 90 percent useful responses) for a major aviation-related economic impact study. The survey effort also frequently consumes 50 to 75 percent of a project's duration.

It is this author's opinion that the major faults with the surveys are that they frequently request too much information, occasionally do not ask the most important question, and seldom indicate the reliability of responses. The RIMS II model, as well as the National Input-Output model, is driven by gross sales data. For most economic activities the most important figure to be obtained from the surveys is sales. It is usually that number (or a percentage associated with aviation economic activity) that is multiplied by RIMS II multipliers. As important as the sales number is, occasionally it is not requested in surveys.

The proper intent of most other survey questions is to reasonably verify the sales figure or to serve as fall-back numbers if a responder will not provide the sales figure or the sales figure is inappropriate. Proprietor's income (profits) equals sales value minus payroll expenditures, taxes, and other expenditures. Asking for profits on a voluntary questionnaire may be disastrous and is not recommended. However, sales will normally equal expenditures plus a reasonable profit margin. In the Colorado study *(7)* a 20 percent profit margin was used as a basis for comparison; if the stated sales were within plus or minus 20 percent of expenditures, the sales figure was used. If the sales figure varied by more than 20 percent, follow-up questions were asked.

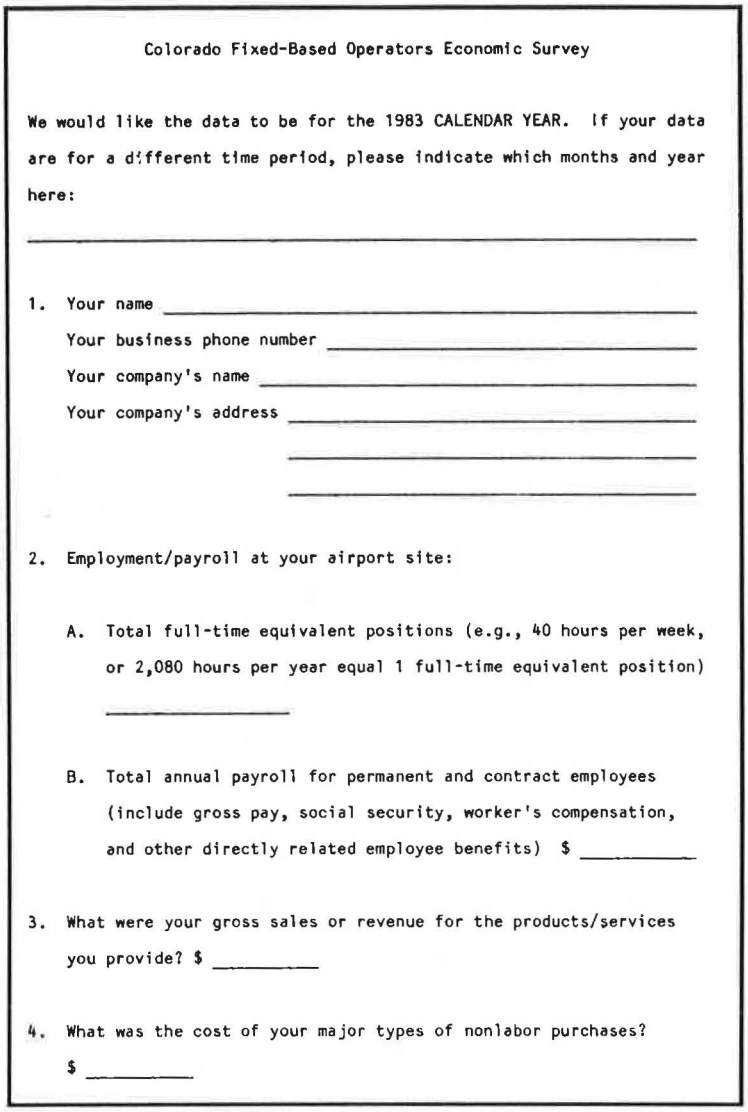
Occasionally a business may be reluctant to supply sales or expenditure values but will supply either employee or payroll information. This employee and payroll information is useful if sales information is unacceptable, and it also serves as a check to verify sales and reliability of payroll expenditures (i.e., average wages may be out of line).

An example of a good survey is shown in Figure 1. It is brief and asks only essential sales, back-up, and follow-up information. If it is accompanied by an introductory letter, the survey form should require little effort or controversy to complete. Using a survey instrument similar to that shown in Figure 1 also allows the analyst to immediately and unobtrusively verify sales values provided. Then he or she may ask immediate follow-up questions if the surveys are personally collected or ask them later by telephone. An example of a good tourist survey instrument is found in the Pittsburgh study *(10)*, and good examples of numerous nontourist surveys are provided in the 1986 Florida study *(13)*.

Although surveys have been the exclusive source of primary economic information, opportunities exist to substantially reduce or eliminate the need for surveys. Eliminating or reducing survey efforts represents the greatest opportunity to reduce project costs. Potential sources of needed economic information include the airport manager's office and state departments of labor and commerce. Some airport managers routinely require tenants to supply information on any or all of the following: sales, employees, and payroll. If of sufficient quality, this information can be used directly.

All businesses with five or more employees are required to supply payroll data for social security. Given the high accuracy of those values, economic surveys would not be needed if the information could be obtained in an acceptable manner. The major concern is statutory prohibition against disclosure of information relating to specific businesses. However, the RIMS II model does not need to be based on individual business information; it requires information only on industrial sectors. Thus the disclosure problem can possibly be overcome by aggregating information on similar businesses. Other problems of using state department of labor information include initial coordination efforts and businesses with multiple locations in an area not being disaggregated by location. For instance, a car rental business may have six locations in a county, one of which is at an airport; however, there is no way to separate the airport location's economic activities. The Florida study *(13)* is to be based largely on state labor information with surveys supplementing that information. The success of the approach and the anticipated cost reductions have yet to be determined.

Numerous pitfalls exist in determining the economic impact of air tourists through surveys. None of the aviation-related economic studies using the RIMS II approach reflect the latest



Colorado Fixed-Based Operators Economic Survey

We would like the data to be for the 1983 CALENDAR YEAR. If your data are for a different time period, please indicate which months and year here:

_____

1. Your name _____
   Your business phone number _____
   Your company's name _____
   Your company's address _____
   _____
   _____

2. Employment/payroll at your airport site:

   A. Total full-time equivalent positions (e.g., 40 hours per week, or 2,080 hours per year equal 1 full-time equivalent position)
   _____

   B. Total annual payroll for permanent and contract employees (include gross pay, social security, worker's compensation, and other directly related employee benefits) $ _____

3. What were your gross sales or revenue for the products/services you provide? $ _____

4. What was the cost of your major types of nonlabor purchases?
   $ _____

FIGURE 1 Example of economic survey.

research on air tourist survey techniques and analysis. This lack of highly sophisticated quality is primarily due to limited study budgets, limited time frames, and the relative importance of air tourist impacts to the overall scope of economic impact studies. Of the RIMS II studies that include indirect impacts of air tourists ascertained through surveys, the most comprehensive is the Pittsburgh study *(10)*.

In recognition of the high costs of tourist surveys and limited project budgets, the Florida study *(13)* approach makes use of Florida Department of Commerce *(15)* data on tourists and total expenditures and U.S. Travel Data Center *(16)* data on the breakdown of those expenditures. RIMS II multipliers can be applied to the values from these sources. If impacts of air tourists are desired, a reasonable estimate of tourists and expenditures is known, and either passenger surveys are not desired or a project budget is restricted, the Florida approach may be a viable option.

Analyzing Economic Input Data

After obtaining the initial economic data, analysts should evaluate the reasonableness of the data. From experience this author believes that for a major study it is desirable to have more than one analyst review and discuss the acceptability and subsequent application of economic data. Ideally the study team should consist of an economist knowledgeable about RIMS II, an aviation specialist, and a person knowledgeable about the business or businesses in question (e.g., survey taker, airport manager representative). Appropriate follow-up questions should be asked until the project team is satisfied that no further follow-up will yield beneficial results.

In general, sales values should be multiplied by RIMS II multipliers to determine economic impacts. The studies identified in Table 1 were properly based on business sales. However, because of specific business activity or lack of survey information, other economic information may be more appropriate. The following stepwise system, in descending order, based on sales, payroll, and employees, is recommended. The project team should evaluate the economic data and decide which process factor is the most appropriate.

1. Sales: For most businesses, this value should be used. Exceptions include airlines and businesses involved in airplane retail sales. When sales are known, the following assumptions can be made:

- Business—aircraft-servicing fixed-based operator (from survey),
- RIMS II code number—650500 (from Table 3),
- Sales—$100,000 (from survey), and
- RIMS II earnings multiplier for RIMS II Code Number 650500—0.6131 (from RIMS II tables; actual value will vary).

The earnings impact calculation is sales times earnings multiplier or $100,000 × 0.6131 = $61,310.

2. Payroll: This classification uses a Type 2 income multiplier to derive the sales for a particular business by applying RIMS II earnings and household direct coefficient multipliers. It should be used for most public enterprises and when sales figures are not provided. When payroll is known, the following assumptions can be made:

- Business—aircraft engine manufacturer (from survey),
- RIMS II code number—600100 (from Table 3),
- Sales—none provided (from survey),
- Payroll—$300,000 (from survey), and
- RIMS II earnings multiplier for RIMS II Code Number 600100—0.7120 (from RIMS II tables; actual value will vary).

The earnings impact calculation (Type 2 income multiplier procedure) includes the following steps:

- Obtain direct coefficient household multiplier for applicable RIMS II code number (600100) from RIMS II tables—0.3676 (actual number will vary),
- Calculate Type 2 income multiplier by dividing RIMS II earnings multiplier (0.7120) by direct coefficient household multiplier (0.3676) = 1.9369, and
- Determine earnings by multiplying payroll ($300,000) by Type 2 income multiplier (1.9369) = $581,070.

3. Employees: This process should be used only when the number of employees is provided or when a business does not complete a survey. Average-earnings-per-job values are applied to the real or estimated number of employees to determine payroll. When the actual or estimated number of employees is known, the following assumptions can be made:

- Business—acrial sprayer (from survey),
- RIMS II code number—400001 (from Table 3),
- Business refused to answer survey,
- Employees (airport manager or other knowledgeable person estimates how many employees work for aerial sprayer)—three, and
- RIMS II earnings multiplier for RIMS II Code Number 010100—0.5662 (from RIMS II tables; actual value will vary).

The earnings impact calculation (Type 2 income multiplier procedures) includes the following:

- Obtain direct coefficient household multiplier for applicable RIMS II code number (400001) from RIMS II tables—0.2619 (actual number will vary),
- Calculate Type 2 income multiplier by dividing RIMS II earnings multiplier (0.5662) by direct coefficient household multiplier (0.2619) = 2.1619,
- Obtain average-earnings-per-job value—$15,000 (actual value to be obtained from state department of commerce),
- Determine payroll by multiplying the estimated number of employees (three) times the average-earnings-per-job value ($15,000) = $45,000, and
- Determine earnings by multiplying payroll ($45,000) by Type 2 income multiplier (2.1619) = $97,286.

Then the procedure in Process 2 is followed.

Two procedural matters should be addressed early in any major aviation-related economic study:

1. How to handle capital improvements and
2. How to handle businesses that were operating during the study but subsequently ceased operations.

Capital investment costs are generally more volatile than sales. For instance, an airport may fund a new runway one year and have relatively minor capital improvements during the next 10 years. Under these circumstances, should these capital investments be spread over a period of years or should they reflect only the year under study? Spreading capital expenditures over time gives a truer picture of the economic impact of an airport or aviation industry for a longer period. However, using only capital improvement costs for the study year is consistent with economic data obtained for the rest of the study. Most aviation-related economic studies did not address this question and subsequently the single-year approach was used. The Colorado study *(7)* was the first to address the question early in the study, and it was decided to average airport capital improvements over the most recent 5-year period.

Most aviation-related economic studies using RIMS II have been conservative in not including any economic impact from firms that went out of business during or after the study year. However, if a business had a relatively moderate to large earnings impact, the study team may desire to estimate that impact. In the Jacksonville study *(5)* a major airline ceased operations late in the study year. The study team subsequently estimated impacts based on the proportion of enplaned passengers of other comparable airlines operating in Jacksonville at the time.

Applying RIMS II Multipliers

With the sales, expenditures, payroll, or employees figures obtained from the previous step, economic impacts of earnings and sales can be readily calculated. Relatively simple computer spreadsheet programs can be developed *(10)* to perform algebraic calculations, group businesses by industrial classification or airport location, or perform other desired functions.

Applying RIMS II multipliers to sales is a straightforward process as shown earlier. Applying RIMS II multipliers when only payroll is given involves calculating a Type 2 income multiplier by dividing the RIMS II earnings multiplier by the direct coefficient household multiplier for the industry. Until 1986 BEA routinely provided direct coefficient multipliers; however, because of business disclosure problems, BEA no longer supplies these numbers for a region. When requesting RIMS II multipliers from BEA, the project manager should discuss with BEA the possibility of obtaining direct coefficients for households or other surrogate values.

Applying RIMS II multipliers to a number of employees involves the further outside step of obtaining average-earnings-per-job or surrogate values for various industries and the region as a whole. The availability of such information varies; the state department of commerce is frequently the major source. Obtaining average-earnings-per-job information should begin early in the project to ensure its availability when the RIMS II multipliers are applied.

Reporting Economic Impacts

Reporting economic impacts primarily reflects the purpose of the study and the implications of the findings. As indicated in Table 1, the purposes of the major aviation-related economic studies were about equally divided between promotional/marketing and technical. However, as stated earlier, greater emphasis should be placed on earnings and employment impacts than on sales impacts. Correctly packaged, the earnings and employment impacts are effective public decision-making tools.

The most attractive and informative color brochure of the RIMS II aviation-related studies is the Colorado study *(7)*. Jacksonville's brief, attractive, one-color brochure *(5)* is a good example of an inexpensive public relations document.

FUTURE DEVELOPMENTS ASSOCIATED WITH RIMS II

In 1986 BEA began supplying RIMS II multipliers in an updated version. BEA has also developed a user handbook for RIMS II *(14)*. Updated RIMS II multipliers are revised total multipliers (overcoming a discrepancy of including the household sector), earnings multipliers, and new employment multipliers. The employment multipliers will make it easier to calculate employee impacts. Direct coefficients are no longer being supplied by BEA and therefore calculation of impacts based on payroll or employees will be more difficult. BEA is also considering further changes in the information provided.

A concern expressed by the earliest users of RIMS II for aviation-related economic studies was the aggregation of much of the aviation industry and related industries. However, since 1985, automobile rental, freight forwarding, and travel agents have had distinct sets of RIMS II multipliers. The remaining large industry that has not been disaggregated is the airline industry. This author currently recommends the use of payroll to determine economic impacts of the airline industry because of perceived inaccuracies of applying relatively high airline sales data to the RIMS II multipliers. Discrepancies in using sales data arise largely because of airports that serve as hubs and the location of main offices. For instance, U.S. Air's ticket sales have significantly different impacts at the Jacksonville airport; the Pittsburgh airport, which is a hub for U.S. Air; and in Washington, D.C., U.S. Air's national headquarters. Under these circumstances payroll is a far better measure to which to apply RIMS multipliers than are sales. BEA has expressed an interest in cooperating with the aviation industry to provide separate multipliers for the airline industry. As more studies are completed, it may become possible to generate such a set of multipliers.

CONCLUSION

RIMS II is ideally suited to evaluating regional economic impacts. Since 1983 the RIMS II multiplier methodology has become the most highly regarded and dominant economic impact methodology used to evaluate regional economic impacts of aviation. It has been used on the complete spectrum of airports from small general aviation facilities to some of the nation's largest primary commercial service airports, from an individual county level to a state level, and from Florida to Alaska. Every agency or its consultants who used RIMS II multipliers reported overall satisfaction.

As with any new methodology, discussions and more precise guidelines on use are needed. It is hoped that this paper and continuing improvements by BEA will assist the aviation community to perform more technically sound and cost-effective economic impact studies.

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