

**FLIGHT TRANSPORTATION LABORATORY
REPORT R 81-3**

**ESTIMATION OF THE
ECONOMIC RELATIONSHIP OF AN AIRPORT
TO THE REGIONAL ECONOMY:
A CRITICAL ANALYSIS**

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OF
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ABSTRACT

In the past decade many major U.S. airports have encountered extensive opposition to plans for future growth and expansion from environmentalists and community groups who cite the noise and air pollution created and the use of increasingly scarce land resources. In an effort to counterbalance these criticisms and highlight the regional benefits the airport provides, several airport authorities have completed economic impact studies which attempt to define the airport's role in the regional economy.

In reviewing the airport economic impact studies which have been completed in the past twenty years, it is obvious that a wide range of methodologies have been developed to accomplish the common task of estimating the different elements of airport economic impact. This thesis provides an overview and critical evaluation of the techniques used in past studies to define what is the airport economic impact and how is the impact estimated in the absence of primary data. Three major economic impact categories, primary, direct and induced, provide the framework for analysis. An economic impact case study of Boston's Logan International Airport is presented to provide insight into problems common to all airport economic impact studies and the solutions to these problems in a specific situation. The need for and direction of future research to clarify and define the quantification of the airport/community economic relationships is also recognized and discussed.

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1.0 CHAPTER 1 INTRODUCTION

1.1 PROBLEM DEFINITION

Airport systems and the regions they serve have a strong interactive relationship. The air transport services provided at an airport are an integral component in the economic makeup of a community, while the needs of the community for these services provides the *raison d'être* for the airport. At the heart of this relationship is a strong economic bond in which the airport supplies economic benefits to the region. Primarily, the transportation services offered at an airport, namely the movement of passengers and freight, fulfill the needs of and provides an economic stimulus to the region. Directly, the airport is a source of employment and payroll both at the airport itself and within the community. Furthermore, the production of services at the airport requires expenditure for local goods and services which stimulates regional economic activity. Finally, because the airport system generates first round economic activity, secondary and tertiary economic activity is induced through a multiplier or ripple effect.

Thus, the economic relationship of an airport and the regional economy is defined within the broad framework of primary, direct and induced categories. It then follows from this assumption that the economic benefit

which accrues to the region because of the existence of the airport is also defined by this framework. The issue at hand is to determine a set of methodologies which accurately and objectively quantify these economic benefits along the lines of the categories described above.

1.2 SCOPE OF OBJECTIVES

This thesis has three main objectives:

1. A comprehensive review and critical analysis of a selected group of airport economic impact studies. The study selection process is described in Section 1.4
2. Presentation of the research approach and results of the author's economic impact case study of Boston's Logan International Airport.
3. A discussion of theoretical and practical issues which warrant further study.

1.3 DEFINITION AND RELATIONSHIP OF ECONOMIC IMPACT CATEGORIES

The term economic impact as used in this study refers to the economic benefits which accrue to a study region due to the presence of and activity at an airport. Two terms in this definition require further clarification - economic benefits and study region.

Economic benefits is a phrase used to describe the sum total of regional economic activity which can be attributed to an airport's existence. This economic activity is tangible in that it represents employment, payroll and local expenditures for goods and services. Other economic benefits are intangible such as a firm's decision to locate in an airport service region in order to utilize the airport's transportation services. This study mainly deals with those economic benefits which can be objectively measured. The estimation of non-quantifiable items is discussed in Chapter 5.

The second term for clarification is the study region. It is important to define the study region because in all likelihood it will not cover the same area as the airport service region. The airport service region can be described as that area surrounding the airport from which the study airport's passengers and freight have their ground origin and destination. For example, Boston's Logan International Airport service region covers parts of the states of Massachusetts, Rhode Island, New Hampshire, Vermont, and Maine. On the other hand, the study region, as used here,

describes that area surrounding an airport to which flow the vast majority of the economic benefits of the airport. Using the Boston example again, the study region is comprised only of the city of Boston and its suburbs. In the studies which are reviewed in this paper the study region is usually defined by a combination of the greater metropolitan area the airport serves and the geographical distribution of airport employees. It is essential to realize that the study region captures most but not all of an airport's economic benefits and that it is generally a much smaller geographic area than the airport service region.

The economic impact is delineated by the framework of primary, direct and induced categories as outlined in Section 1.1. Brief definitions of each category follow.

Primary The monetary value of the local economic activity stimulated by the useage of airport services. Business firms and individuals which use the services of an airport do so because the airport provides an economic advantage in terms of time or convenience over other transportation modes. In addition, regional travel and tourism is generated because of the availability of air passenger services. Therefore, the economic activity associated with the use of the airport is considered the primary contribution to the region.

Direct the monetary value of the local economic activity generated by servicing passenger traffic, cargo shipment and general avi-

ation at the study airport. This category describes the impact resulting from the production of airport services and like the primary category represents first round economic activity.

Induced the monetary value of the local economic activity generated by the respending of the first round impact monies. In essence, the dollars of primary and direct spending are recycled to create subsequent rounds of local economic activity. The process of respending is not infinite however due to a leakage effect which will be described more fully in Chapter 4.

The delineation of these categories and the order in which they are listed are significant. The primary category is so named because it represents the economic benefits associated with the primary function of an airport, which is to provide passenger and cargo services. Because the primary economic impact involves the use of the fundamental services of an airport, it is listed first in the hierarchy of impact categories. Direct impact is so named because it describes the direct economic contribution of the airport's operational activities. The useage of airport services represented in the primary impact category provides a purpose for the direct airport operational activity and so the direct impact category is listed second. The induced economic impact is placed last in the hierarchy because it describes the additional economic stimulation resulting from the activity in the first two impact categories.

1.4 ANALYSIS APPROACH AND ORGANIZATION

This thesis is organized within the framework of the three major impact categories outlined in Section 1.3. Chapter 2 deals with the primary economic impact of the airport on the regional economy. Chapter 3 covers the direct impact and Chapter 4 the induced impact.

Chapters 2, 3, and 4 are organized along the same general guidelines. First, a detailed definition of the impact category is presented. The major impact category is then subdivided into the individual elements which comprise that category. For example, in Chapter 2 - PRIMARY ECONOMIC IMPACT CATEGORY, air cargo represents an element of the primary impact category.

Each element of a major impact category is defined and critically analyzed with regards to the methodology used in other research studies. The alternative methodologies are critiqued for their theoretical validity and the practical merits and pitfalls of their approach. For each applicable element in a general impact category, the research approach and results of the Boston case study are presented. Primary data collection techniques and readily available sources of secondary information are then discussed in the context of the Boston case study.

Chapter 5 discusses suggestions for additional research to further define the meaning of and refine the techniques for estimating the economic

impact of the airport on the regional economy. Practical problems and theoretical issues are explored to provide a starting point for further study.

1.5 ECONOMIC IMPACT STUDY SELECTION PROCESS

Four studies were chosen for review and critical analysis.¹

1. The Economic Relationship of Air Transportation to the Economy of the New Jersey-New York Metropolitan Area, CEIR, 1960.
2. The Economic Impact of Los Angeles International Airport on it's Market Area, Waldo and Edwards, 1976.
3. Airport Noise Control and Land Use Compatibility Study for Greater Pittsburgh International Airport, Working Paper No. 2, Economic Impact Study, Landrum and Brown, 1981.
4. Community Economic Impact of Los Angeles International Airport, Economics Research Associates, 1980.

¹ See the Bibliography for full author and title listings.

These four studies were chosen because they represent a time span of twenty one years and a wide range of methodologies. These research works are also the four best examples available of uniquely different approaches to the study problem.² The other studies which were included in the literature search but not in the detailed analysis either did not give adequate explanation of their techniques or used a similar approach to one of the four studies chosen. Thus, although the airport economic impact studies reviewed and analyzed here do not represent the spectrum of work on the subject, as a group they do represent a chronological development and a comprehensive compilation of the state of the art techniques.

² See the Bibliography for a complete listing of economic impact studies reviewed.

2.0 CHAPTER 2 PRIMARY ECONOMIC IMPACT CATEGORY

2.1 CATEGORY DEFINITION

This chapter deals with the analysis of different methodologies for measuring the primary economic impact associated with the existence of an airport. Primary economic impact is the monetary value of the local economic activity associated with the useage of airport services. Where the direct impact results from the production of air passenger and cargo services, the primary impact is derived from the demand for these services. A number of items in the primary impact category are intangible and non-quantifiable, such as the decision of a firm to locate near a major metropolitan airport or the value of real estate around the airport. It is reasonable to assume that the existence of the airport influences the local real estate values and the firm's locational decision, but difficult to determine the extent of the influence. Furthermore, the attractiveness of a region as a tourist destination or business center is also affected by the presence of the airport.

The interactive relationship between an airport and the community it serves is both complex and manifested in a variety of ways. The purpose of this chapter is not to define the totality of this relationship, but rather to analyze those items which can be and have been objectively measured.

A more detailed discussion of areas for further research in the primary impact category is presented in Chapter 5.

Several airport economic impact studies reviewed for this thesis have considered what is defined here as primary impact to be the indirect economic impact. The term indirect implies second order or subsidiary economic activity and therefore the use of the term is not justified in defining the impact associated with fundamental airport services.

2.2 ANALYSIS OF THE PRIMARY IMPACT CATEGORY ELEMENTS

The primary impact category has been subdivided into four elements for the purpose of discussion. These elements are: air cargo, air visitors, area resident air travel and the banking industry. The four studies critiqued and analyzed in the various elements are, in the interest of brevity, referred to by authorship only.³

³ For a full listing of the four studies see Section 1.5.

2.2.1 AIR CARGO

This element deals with the primary economic benefit to a study area due to the availability of air cargo services at the study airport. Two conceptual approaches for defining this element have been used to date. The first approach is to identify the characteristics of the air cargo moved through the study airport. Some of the characteristics to be recognized are the value of goods shipped, type of goods shipped and the shipments by air versus other modes. The purpose of this approach is to define and quantify the magnitude of air cargo and thereby highlight its importance to the study region. The second approach goes one step further in attempting to identify employment and payroll attributable to the movement of air cargo. The CEIR and Boston case study are examples of the first approach and the Economics Research Associates study is an example of the second approach. The Waldo & Edwards and Landrum & Brown studies do not address the impact of the air cargo element.

2.2.1.1 CEIR

At the time of the CEIR study in 1960 the air cargo industry was in a rapidly growing stage in its development. Intercontinental, large capacity

jet freighters had only recently come into service and industry was becoming aware of the advantages of shipping by air. Despite the high air freight rates some businesses realized that the higher speed of air freight would allow them to reduce their overall cost of doing business.

With this setting it was a natural choice for CEIR to present the economic impact of air cargo by showing the rapid growth of air cargo vis a vis other shipment modes. Tables were formulated which defined the relative growth rates of air cargo versus other transportation modes and air cargo versus regional growth in employment.⁴ The purpose of these tables was to spotlight the modal shift taking place and the growing interdependence between air cargo and the regional economy

In this study a section was also devoted to the results of some survey work which showed the air freight distribution by weight of major commodity groupings for four freight carrying airlines. The intent here was to identify the major industrial users of air freight.

Finally, a section was presented which detailed accounts of individual firms and how the availability of air freight helped reduce overall costs. Examples are given of how air freight useage has permitted a reduction in inventory and warehousing costs, the incidence of damaged goods, and the time from production to market.

⁴ CEIR, Tables 7-1 and 7-2, p. 70.

In summary, the CEIR report treated the air cargo element by defining the magnitude and importance of air cargo, rather than quantifying any primary economic benefit related to these services.

2.2.1.2 Economics Research Associates

The ERA work is attempt to go beyond the CEIR approach and measure the residual value of air cargo shipments and the employment and payroll associated with it. The underlying assumptions necessary to accomplish this measurement indicate that the final result can only be a rough approximation and more representative of a level of activity than an actual dollar figure or employment count. The authors recognize the inherent weaknesses in their approach when they state:

The indirect benefits measured . . . are predicated on the theory that, in the absence of the airport facilities, goods shipped to out-of-area markets would cease to be produced locally. Thus the value added and associated payroll and employment benefits would be lost to the study area. This is clearly a tenuous concept in that there are alternative airfreight facilities and different modes of transportation available to shippers/consignees.⁵

The basic measurement process in this study revolves around the concept of value added. The term value added can be defined as the difference

⁵ ERA, p. IV-1.

between the value of a good and the cost of the raw materials necessary to produce it. In order to measure the value added component of a particular good for an airport study area the additional worth of the good created while it is in the study area must be estimated. To determine the study area value added residual the consultant required three areas of information:

1. The distribution of all inbound and outbound study airport air freight by commodity groupings. This information was obtained by a survey of airlines which carried air freight. The commodity distribution of thirty percent of the total air freight volume was available through this source and the assumption was made that the remaining seventy percent had the same distribution pattern.
2. The dollar value per shipment pound by commodity groupings. This figure was required in order to calculate the study area value added residual and apply wage and employment per dollar value of shipment ratios. The conversion from pounds to dollars was accomplished by using the U.S. Bureau of the Census publication, U.S. Exports/World Areas by Schedule B Commodity Groupings which provides figures for both total pounds shipped and total value shipped by commodity grouping for each customs district. The unstated assumption is that all cargo, domestic and foreign, has the same pound/value relationship as the export shipments.

3. The ratios of value added to value of shipment for each commodity group and employment per dollar value of shipment. This information was also available from the U.S. Bureau of the Census in a publication entitled Annual Survey of Manufacturers 1976: Industry Profiles.

With the knowledge of the value added/value of shipment ratio the consultant was then able to determine a dollar figure of the economic impact of air cargo. For example, if \$100 million worth of electronics was shipped outbound through the study airport and the value added/value of shipments ratio is 1:5 then the \$20 million is the value added or local economic benefit attributable to the production and shipment of locally produced electronics. By using information on payroll as a percentage of the value of shipments and average salaries by commodity groupings the aggregate payroll and employment may be derived.

The above method works reasonably well when considering outbound freight, but it is not totally adequate when evaluating inbound freight. The value added portion of the inbound freight is derived solely from the wages, profits, rent and overhead resulting from moving the goods into the study region.

The consultants' work in quantifying the indirect economic benefit associated with the use of air cargo services is an important step in moving beyond the simple listing by commodity and modal distribution which had been done previously. The primary economic impact estimates for this

element presented in the ERA study are on the two digit Standard Industry Classification (SIC) level and should be interpreted as orders of magnitude rather than hard dollar figures. Although this approach is a significant first step, two areas could be pursued to refine the approximation. The first refinement involves testing or modifying the underlying assumption, as noted by the authors, that outbound finished goods and inbound raw materials or goods for distribution have the same relationship to the total value added as all other finished goods and raw materials in a particular industry classification.⁶ In other words, locally produced raw materials, products for local consumption and labor, all bear the same relationship to the total value added as the shipments sent and received by air. A thorough analysis of the components in the manufacturing production process is necessary to test this assumption.

The second and related item for refinement is the sensitivity of the final results to the types and volume of commodities shipped by air. An industrial firm may choose one month to ship a product by air to meet a deadline, while the following month shipping by a slower transportation mode. It is important to remember that transportation cost is a component of the total cost of goods sold and the firm seeking to minimize overall costs, whenever possible, will choose the transportation mode which helps achieve this end. The modal decision is dependent on market conditions, relative transportation costs and a host of other factors and therefore the makeup by commodity type of the total air cargo moved through an airport

⁶ ERA, p IV-6.

is sensitive to this decision. An area for further research would be to identify the factors in the modal choice decision making process in relation to the value added component of products shipped.

2.2.1.3 Boston Case Study

In an effort to uncover some of the characteristics of the users of air freight services at the study airport a survey of 255 Boston area corporations was done.⁷ The overall response rate for the survey was twenty percent, although the response rate on the gross revenue question was much lower. Descriptive information was available for thirty firms and their survey responses are tabulated in Tables 2-1 and 2-2.

Several noteworthy items surfaced from the results of this survey. For example, sixty percent of the respondents indicated that the air cargo services offered at Logan Airport were "essential to company operations." Survey tabulations also revealed that, in all industry classifications, the percentage of freight moved by air was lower for inbound shipments than for outbound.

⁷ For an example of the survey form see the Appendix.

Since raw materials usually comprise the bulk of inbound manufacturing freight shipments and are lower in value than finished goods, they would tend to travel by a less expensive transportation mode. These raw materials are then processed into finished goods for shipment outbound and air freight now becomes a cost effective alternative for these higher value goods. The difference between the inbound and the outbound percentages by air is therefore an indication of local economic activity that has been generated. This fact is further highlighted when comparing the inbound and outbound value per shipment pound figures in Table 2-2. Although these estimates may not be precise in some cases due to a small sample size, they do indicate a marked increase in value per pound of outbound over inbound shipments. In very general terms this increase reflects the value added to the raw materials while in the airport study area and the economic activity which results from this process may be cautiously considered a primary economic benefit of the study airport. The cautious consideration is because a causal relationship is established by this statement which links the existence of the manufacturing process in the airport study area to the existence of the airport.

TABLE 2-1

Logan Airport
Air Freight Users Survey Tabulation

INDUSTRY CLASSIFICATION	RESPONDENTS	EMPLOYEES	ANNUAL PAYROLL (millions)
Electronics	14	65,481	1,040
Photographic Materials	2	14,700	570
Instruments	2	1,311	20
Research	2	1,438	10
Medical Equipment	2	3,500	63
General Manufacturing	8	12,088	153

INDUSTRY CLASSIFICATION	INBOUND FREIGHT LBS. (000)		% BY AIR
	All Modes	Air	
Electronics	281,011	30,022	10.7
Photographic materials	62,116	5,455	8.8
Instruments	1,492	684	45.8
Research	15	14	93.3
Medical Equipment	2,550	150	5.9
General Manufacturing	65,160	475	.007

INDUSTRY CLASSIFICATION	OUTBOUND FREIGHT LBS. (000)		% BY AIR
	All modes	Air	
Electronics	242,737	56,860	23.4
Photographic Materials	68,914	21,534	31.0
Instruments	2,016	520	25.8
Research	541	540	99.8
Medical Equipment	5,100	915	17.9
General Manufacturing	61,325	921	1.5

Source: M.I.T. Flight Transportation Laboratory

NOTES

1. Employment estimation for a few firms was required and based on an average salary multiplier for firms in the same industry classification.

TABLE 2-2
LOGAN AIRPORT
AIR FREIGHT VALUE PER POUND TABULATIONS

INDUSTRY CLASSIFICATION	SURVEY RESPONDENT LBS (000) (1)	
	Inbound	Outbound
Electronics	27,827.5	52,213.0
Photographic Materials	5,300.0	21,354.0
Instrument	40.0	205.0
Research	14.0	540.0
Medical Equipment	100.0	315.0
General Manufacturing	475.0	921.0

INDUSTRY CLASSIFICATION	VALUE \$ (000)		VALUE/LB \$	
	Inbound	Outbound	Inbound	Outbound
Electronics	498,492	1,444,731	17.91	27.67
Photographic Materials	31,000	284,032	5.85	13.30
Instrument	2,000	12,000	5.00	58.54
Research	112	2,741	8.00	5.08
Medical Equipment	15,000	340,000	150.00	1079.36
General Manufacturing	8,525	65,465	17.95	71.08

Source: I.T. Flight Transportation Laboratory
NOTES

- In some cases the freight pound totals do not match those found in Table 2-1. The reason for this is that shipment value information was not available for all respondents.

The tabulations of the survey results are intended to give an indication of the magnitude of the local economic activity which relies on the airport services, rather than attempting to establish a relationship between the activity and the airport. For this reason in Table 2-2 the total estimated value of air cargo shipped through Logan Airport in 1980 is presented. There is little doubt that the existence of convenient air freight services stimulates regional economic activity, but further research is required to accurately define the extent of this stimulation.

2.2.2 AREA RESIDENT AIR TRAVEL

The availability of air passenger travel service is an important component in the operation of many business firms. Manufacturing firms, which rely on air cargo services as discussed in Section 2.2.1, also depend on the airport to move their salesmen into the field and as a means of transportation to out-of-area operations. In addition, professional service companies, such as consultants, insurance and finance firms, consider air passenger travel as an essential business tool. The problem here then becomes one of translating the study area business firms dependence on the airport services into an economic benefit which accrues to the regional economy. Only two studies discussed in this thesis attempted to quantify this economic relationship - the Economics Research Associates and Boston Case studies.

2.2.2.1 Economics Research Associates

The ERA study analyzed one aspect of area resident air travel - the business travel of the study area professional service firms. The assumption made was that these firms rely on the airport passenger services to serve out-of-area customers to the extent that this out-of-area activity would cease to exist without the airport. The regional economic benefits are then defined as "the level of employment, payroll and other value added components which is supported by, or exists because of, the local firm's out-of-area business activities."⁸

Having established this assumption, the consultant estimates the number of business trips by professional service firms originating in the airport study area. This calculation was derived from a Los Angeles Times 1978 LAX Air Passenger Survey which detailed trip purpose distribution. Applying an average ticket value to the number of trips produced the professional service firms air travel expenditures.

Interviews with five local area firms indicated that air travel expense averaged four percent of the firms total operating budget, which is related to out-of area business and so the consultant was able to calculate the aggregate out-of-area operating budget.⁹ Using an estimate of the

⁸ ERA, P. IV-8.

⁹ ERA, p. IV-9.

payroll percentage of this operating budget and an average salary per employee figure, the professional service firm out-of-area related payroll and employment was calculated. This payroll and employment is then considered a primary economic impact of the study airport.

The ERA study presents a crude first attempt at quantifying the economic impact associated with area resident air travel. The consultants themselves are the first to point out the limitations and difficulties in their approach. The question then becomes not the accuracy of the estimations derived, but the veracity of the underlying assumption that a firm develops out-of-area business because of the existence of the airport. Would the professional service firm move out of the airport study area if the airport suddenly ceased to exist or would they choose a secondary mode of transportation? What about the other area business firms which are not as dependent on the passenger services of the airport? These are quite obviously speculative questions, which cannot be readily answered without an extensive data base of survey information and further conceptual development of the problem, but they do point out the difficulty in quantifying this particular element of primary economic impact. Discussion on areas for further research in this area is presented in Chapter 5.

2.2.2.2 Boston Case Study

The conceptual approach taken in this case study was simply to define the magnitude of the area resident air travel element. The reasoning behind this approach was that defining the size and therefore the relative importance of the useage of air passenger services was an acceptable way to describe the impact of this element. Furthermore, time and resources were not available to conduct a more expanded research effort.

One way to describe the magnitude of area resident air travel is to estimate the total expenditure by area residents for air travel via Logan Airport. The Air Traffic Conference (ATC), an arm of the Air Transport Association, provided airline ticket sales by travel agencies on a zip code basis. After determining the zip codes for the five county study area a total travel agency ticket sales of \$444.33 million was calculated. The ATC estimates that fifty five percent of the value of airline tickets are sold by travel agents. From this information it is then possible to estimate the total airline ticket sales to study area residents at \$807.87 million.

A second source of information was planned to be the tabulations of a survey conducted by the author of fifty five member firms of the Boston chapter of the Passenger Traffic Association.¹⁰ These companies represented a cross section of study area business firms. The intent was to use the survey results to establish revenue/employee/air travel business trip relationships for the respondents and then make aggregate level pred-

¹⁰ For an example of the survey see the Appendix.

ictions of the annual number of air travel business trips by industry classification. Unfortunately, the response rate for the survey was not significant enough to establish relationships on which to base an estimation. Telephone interviews with the some of the companies surveyed indicated that, in general, air travel trips and expenditures were not considered as a separate item but instead were part of a category which included travel by other modes as well as meals and lodging while traveling. The breakout of data pertinent to the survey was considered too time consuming by the companies surveyed and hence the survey achieved a low response rate and the estimation effort was abandoned.

2.2.3 AIR VISITORS

In the framework of this study an air visitor is defined as a non-resident, who arrived via the study airport, with a destination in the airport study region. The primary economic impact of the air visitor derives from their local expenditures for food, lodging, entertainment, retail purchases, transportation, etc. These expenditures, which represent new dollars brought into the study area, translate into local employment, business income and tax revenues.

Defining air visitor economic impact is normally done on the basis of secondary sources of research information. Estimating the number of air vis-

itors, their number of days in the area, their trip purpose, their spending patterns and the air visitor industry employment and payroll are usually beyond the scope of the primary research effort of an airport economic impact study. Likely sources of information on air visitors can be found at the airport authority, the tourist bureau, the state department of commerce, hotel associations, or local universities.

2.2.3.1 Waldo & Edwards

The consultants in this study completed a thorough analysis of the air visitor economic impact. The primary source of information was the latest study airport local origin/destination survey which delineated:

- percentage of total passengers who were non-residents
- trip purpose
- length of stay in the study area
- number travelling in the party
- local spending pattern distribution

From this data the authors were able to calculate the number of visitors by trip purpose, number of visitor days, average daily expenditure by trip purpose and the aggregate air visitor expenditures. Total expenditures were broken down by type of expenditure for each trip purpose.

By using an estimate of the number of hotel rooms required for air visitors and a hotel employee productivity indice, the number of hotel/motel employees attributable to air visitors is calculated. The hotel/motel industry air visitor related payroll was then estimated using average annual wage figures and the employment derived from the method described above. In a similar fashion (ie. productivity indices and average salaries), the employment and payroll of other air visitor industry activities was estimated.

Finally, the consultants assessed the amount of tax revenues accruing to the airport study area as a result of air visitor economic activity. A local area bank study provided an estimate of the percentage of total air visitor expenditures which represented tax and another estimate yielded the amount state tax returned to the area where it was collected. Also discussed was a six percent room occupancy tax. The purpose in providing air visitor tax revenue data is to highlight a valuable source of government revenue which does not require an equivalent outlay in government services. Air visitors as a group require very few government services in comparison to the area resident taxpayer and yet the air visitor makes a significant tax contribution.

The Waldo & Edwards approach to calculating air visitor economic activity is conceptually sound and straightforward. The estimates are reasonable given the extensive primary data base. The consultants were fortunate that such a vast amount of information was available on the air visitor and the air visitor industry. This is not always the case for many major met-

ropolitan areas. The only drawback to this particular study is that much of the primary data was gathered long before the consultant's study year. For example, the passenger local origin/destination survey, on which the majority of the authors' estimations were based, was completed nine years prior to the study year. The authors by using non-current data have made the assumption that the characteristics of the air visitor have remained constant and only the number of visitors and the wage and price levels have changed. Although this could be a reasonable assumption, the credibility of the study could have been improved by using more current information.

2.2.3.2 Economics Research Associates

This study took essentially the same approach as that described for Waldo & Edwards except that they did not attempt to estimate the air visitor industry employment and payroll. A passenger local origin/destination survey completed one year prior to the study year provided a basis for all estimations. The consultant considered air visitor expenditures as an element in the direct economic impact category.

One additional item in this element which this study dealt with was the airline crew layover expenditures. By using estimates of the number of airline crew layovers, the average layover period and the layover

reimbursements, the total crew expenditure was derived. The necessary assumption was that the airline crews spent locally the amount they were reimbursed for the layover. In the long run this is probably a reasonable assumption to make.

2.2.3.3 Boston Case Study

Several sources of air visitor data were available for this study. The first source was a survey-based study on travel and tourism in Massachusetts for 1979 by the University of Massachusetts at Amherst. In this report visitor days and expenditures by trip purpose as well as tourist industry direct employment, payroll and tax receipts was available on the county level. For example, the authors estimate that in 1979 for the five county airport study area there were 40,629 jobs, \$169,139,000 in payroll and \$36,859,000 in tax receipts directly attributable to travel and tourism.¹¹ Unfortunately, the study does not distinguish the arrival mode of transportation and so it is not possible to apportion these impacts to the air visitors. However, by dividing the total expenditures by the total visitor days for each trip purpose, it was possible to calculate an average

¹¹ Derived from the county tables of Travel and Tourism in Massachusetts, 1979 An Economic Analysis, University of Massachusetts at Amherst.

daily expenditure and then adjust this estimate to a 1980 price level. The average daily expenditure in 1980 is \$41.32 for the pleasure traveller and \$29.25 for the personal traveller. These estimates represent the lower bound in that the level of expenditure for the air visitor is assumed to be higher than the aggregate visitor population mean expenditure level.

A more accurate average daily expenditure for the business and convention air visitor was obtained from the Greater Boston Convention and Tourist Bureau, which participated in a 1979 study by the National Association of Conventions on convention delegates in Boston. From this survey-based work came the estimate that, for those conventioners arriving by air, their average daily expenditure was \$73.08. It was assumed that this was a more accurate convention expenditure estimate than that derived in the University of Massachusetts because it was calculated only with air arrivals versus arrivals by all transportation modes. The estimate derived from the convention study was also assumed to be a reasonable representation of the level of business air visitor expenditures. The inflation adjusted average daily expenditure for the business and convention air visitors in 1980 is then calculated to be \$80.42.

It was then necessary to estimate the number of 1980 air visitors by trip purpose and their average length of stay in the study area. An air passenger survey conducted in 1979 by Cambridge Systematics, Inc. for the Massport provided information on the percentage of departing passengers who were not residents of the study area. The assumption was then made

that the arrival resident/non-resident ratio was the same. The survey also provided information on local area trip purpose and average length of stay. From all of this information it was then possible to derive the air visitor expenditures by trip purpose and an aggregate total air visitor expenditure. The results, presented in Table 2-3, should be interpreted cautiously keeping in mind that, as in the air cargo element, the figures represent an order of magnitude rather than a definitive dollar amount. Since air travellers presumably have a higher daily expenditure level than arrivals by other modes, the pleasure and personal trip purpose categories totals, which were computed with non-specific arrival mode expenditure estimates, represent the lower bound of the actual total expenditures. Thus, as can be seen from the table, the primary economic impact associated with air visitors represents a sizeable input into the regional economy.

2.2.4 BANKING INDUSTRY

The banking industry, which uses air cargo services to transfer funds, was not considered in the air cargo element because it was felt that the characteristics of banking operations warranted separate consideration. The Boston case study was the only study reviewed here which considered the impact of the airport on the banking community.

2.2.4.1 Boston Case Study

TABLE 2-3

BOSTON CASE STUDY AIR VISITOR EXPENDITURES (1980)

Annual Logan Airport Passengers	14,722,363
Arriving Passengers (1)	7,361,182
Arriving Non-resident Passengers (2)	4,063,372

Non-resident Passenger Trip Purpose Distribution

Business	58.54%
Pleasure	26.57%
Personal	14.89%

	100.00%

Trip Purpose	BUSINESS(3)	PLEASURE	PERSONAL	TOTAL
Air Visitors	2,378,698	1,079,638	605,036	4,063,372
Visitor Days (4)	7,240,757	3,286,417	1,841,730	12,368,904
Average Daily Expenditure(5)	\$80.42	\$41.32	\$29.25	-----
Total(\$)	\$582,301,678	135,794,750	53,870,603	771,967,031

SOURCES: Massport 1980 Air Traffic Statistics; Greater Boston Convention and Tourist Bureau; Massport/CSI Air Passenger Survey General Tabulations, April 1980; Travel and Tourism in Massachusetts, 1979 An Economic Analysis, University of Massachusetts at Amherst. Notes

1. Assumes that fifty percent of total passengers are arrivals.
2. An estimated 55.2% of departing passengers are non-residents. Assumes the same distribution for arrivals.
3. This category includes convention delegates.
4. Average length of stay for non-residents is 3.044 days.
5. Business average daily expenditure assumed to be the same as the estimated expenditure for air arrival convention delegates. Pleasure and personal average daily expenditure computed from all arrival modes visitor population.

The Boston area banking community depends on the availability of Logan Airport air cargo services to transfer funds in and out of the immediate area. Funds are moved around the country in the form of bank to bank cash letters and cancelled checks. The banks depend on the faster speed of air transport versus surface modes to reduce the amount of time in which the funds are unavailable for investment or other purposes. For example, if a Boston bank had \$10 million in cancelled checks drawn on banks in Tuscon, the Boston bank could not use those funds until they were processed by the Tuscon banks. Transfer by air in this case may take 24 hours or less, but if a surface mode is used the transfer would take much longer and the bank has lost the availability of these funds for this longer time period.

The methodology used to determine the indirect economic impact of this element was to estimate the interest represented by the delay in transfer of funds which would occur if Logan Airport services were unavailable. An official at the Federal Reserve Bank of Boston estimates that \$1.5 billion in bank funds flow through Logan Airport on a daily basis. In the hypothetical situation where Logan Airport was not available for the transfer of funds there would be an average twenty four delay in the transfer of these funds nationwide. This one day delay is computed on a volume and distance basis with the greatest volume going to the closest points. If based strictly on time to all destinations, the average delay would be much higher. Assuming the banks value these funds at the 1980 average prime rate of 15%, a one day delay in the transfer of \$1.5 billion represents \$616,000 daily in interest or \$225 million annually.

In addition, corporate customers, via the banks, rely on the timeliness of lock box operations to maintain their cash balances. A lock box operation involves the use of the airport postal facility to receive, process and directly deposit the accounts receivable of major corporations. The use of the lock box operation and the time advantage it offers businesses allows them to convert accounts receivable to bank deposits at a much faster rate than the conventional process. The lock box operation itself depends on the availability of air mail service. In a 1976 night curfew study of Logan Airport the First National Bank of Boston indicated it would not be economically viable for them to offer lock box service if air mail flights were curtailed.

2.3 SUMMARY

Since the indirect economic impact category encompasses a wide range of possible activities associated with the existence of the airport, it was not possible to discuss each one. The intent here was to critically analyze what had been and could be done to quantify the impact of this category. The Boston case study results are summarized in Table 2-4.

TABLE 2-4
 Boston Case Study
 Primary Impact Category Summary

Annual Freight Volume (lbs)	396,518,570
Estimated Annual Freight Shipment Value	\$8,822,538,200
Annual Airline Ticket Sales to Area Residents	\$807,870,000
Annual Air Visitor Expenditures	\$771,967,031
Daily Bank Funds Transferred via Logan	\$1,500,000,000
One Day Interest	\$616,000
Annual Interest	\$225,000,000

NOTES

1. Derived from Tables 2-1, 2-2, and 2-3.

3.0 CHAPTER 3 DIRECT ECONOMIC IMPACT CATEGORY

3.1 CATEGORY DEFINITION

This chapter is concerned with alternative methodologies for measuring the direct economic impact associated with the activity at an airport. This category represents the primary or first round of economic impact resulting from the production of airport services. Different approaches used in other research studies for measuring the monetary value of this activity are analyzed and critiqued. The methodology and results of the author's own case study of Boston's Logan International Airport are then presented.

3.2 ANALYSIS OF DIRECT IMPACT CATEGORY ELEMENTS

The direct impact category has been subdivided into six elements for the purpose of discussion. These six elements are: airline disbursements, airport concessionaires, government agencies, air freight, ground trans-

¹² For a list of the four studies see Section 1.5

portation and travel agents. The four studies mentioned in Chapter 1 are reviewed and analyzed with respect to each of the elements. In the interest of brevity the four studies will be referred to by authorship only.¹²

3.2.1 AIRLINE DISBURSEMENTS

3.2.1.1 CEIR

This study represents the earliest of the four studies under review having been done under contract for the Port Authority of New York in 1960. The consultants developed an extensive amount of primary data through mail questionnaires, personal and telephone interviews. In all, some 403 responses were tabulated for airlines, non-airline airport tenants, freight forwarders, government agencies, travel agencies and a host of others. From this data the consultant estimated annual average employment, payroll, revenues and local purchases for all airport tenants.¹³ Local purchases were further broken down into such categories as petroleum products, aviation equipment, insurance, utilities, etc.¹⁴

¹³ CEIR, Table 4-1, p.34.

¹⁴ CEIR, Table 4-3, p.38.

The results of this study and the level of detail are impressive. Other than the statement that 403 surveys were conducted the consultants did not explain how they arrived at the results. A sample survey form and explanation of the estimation techniques for non-respondents was not included in the only published report available today. Furthermore, petroleum products purchases, which accounted for 31.9% of all local purchases was credited as a contribution to the local economy.¹⁵ In reality, only a small percentage of the petroleum purchase cost remains in the local area economy in the form of flowage fees, administrative and handling costs. The bulk of the purchase cost soon leaves the local area and returns to the petroleum manufacturer. The CEIR report, although lacking any substantial explanation of methodology, does represent a good example of a study with an extensive primary data base.

3.2.1.2 Waldo and Edwards.

The 1976 Waldo and Edwards study of Los Angeles International Airport is the second in their series of studies of this airport. The first study was conducted in 1971 and the 1976 study is an updating of the primary data developed in the earlier effort.

¹⁵ IBID

In the 1971 study the consultant did an extensive survey of the air carriers in terms of the number of employees and average annual earnings in each job category. Also in the 1971 report, employee productivity figures were generated in the form of enplaned passengers per employee. Using the CAB Form 41 data, which reports individual carriers employment and payroll for each job category as well as system wide passenger enplanements, the consultant derived an annual system-wide employee productivity indice for the domestic carriers serving Los Angeles (LAX). The relative change in employee productivity was then plotted for the years 1971 through 1975.¹⁶ Using an estimate of the 1976 passenger enplanements at LAX the consultant then worked backwards to obtain the estimated number of airline employees. The airline payroll was estimated by taking the 1971 estimated payroll and applying the system wide percentage annual increases as calculated from the CAB Form 41 data.

The updating of earlier survey results with national level data has its merits and pitfalls. On the positive side, it is a simple and straightforward technique. Time consuming surveys and processing of primary data are not required. Most of the information necessary to update the earlier work is readily available in public documents. On the negative side, the results may have significant errors. These errors could be caused by any of three factors. First, if there were any errors in estimating the total population of air carrier employment and payroll from the 1971 survey results, then updating these figures using annual

¹⁶ 1975 was the latest available annual data at the time of the study

productivity changes only compounds the original errors. Secondly, the use of systemwide passenger enplanements and productivity implicitly assumes that LAX is representative of the entire system. The authors provide no supporting evidence for this assumption.

The third factor which could create errors is the fundamental assumption that passenger enplanements per employee is a valid measure of productivity changes over time. For example, the consultants state that while employment increased only 6% from 1971 to 1976, passenger enplanements increased 25.4% for the same time period.¹⁷ The difference in rates of change is attributed to increased employee productivity. Without discounting for factors such as temporal changes in stage lengths, aircraft size, and airline operating characteristics at LAX vis a vis the rest of the nation, the use of nationwide enplanements per employee indices could result in an inaccurate reflection of the LAX airline employee productivity and hence the number of employees.

The other area of airline disbursements which the authors addressed is the purchase of goods and services within the local economy. Expenditures by the airlines were not broken out, but instead the total airport tenants for 1971 was updated. The method of update was to estimate the local expenditures per originating revenue passenger in 1971 and then apply the changes in the wholesale price index to arrive at a figure for 1976. The results, as in the employment and payroll categories, are again

¹⁷ Waldo and Edwards, p.35.

subject to the national local/bias and the compounding of original study estimates.

3.2.1.3 Economics Research Associates

As in the case of the CEIR study the Economics Research Associates (ERA) study of Los Angeles International Airport in 1980 relied heavily on the development of primary data through survey questionnaires and telephone interviews.¹⁸ The consultants in this study however developed a number of different innovative estimation techniques. In this study, although the airline survey response was only 35%, the respondents represented 87% of passengers and 70% of the freight handled at the airport.¹⁹ Estimates were made for the non-respondents using the information and market share of the respondents. The consultants recognized the following categories of airline disbursements:

1. PAYROLL Estimation for the total air carrier population was done on the basis of the payroll, revenue and employment relationships of the survey respondents and then assuming this relationship holds for the non-respondents.

¹⁸ For an example of the survey used see the Appendix.

¹⁹ ERA, Table II-1, p. II-9.

2. EMPLOYEE BENEFITS This number was estimated to be an additional 25% of the payroll.
3. FLIGHT FEES The number arrived at represents funds paid to the Los Angeles Department of Airports.
4. ADVERTISING An estimate was generated using company-wide average advertising expenditure per passenger of the airlines serving LAX. This system wide average was then applied to the percentage of total LAX passengers residing in the study area to arrive at a local advertising expenditure estimate. Since the local advertising expenditure for the airlines was unknown the technique used would seem to be a reasonable approach to making an estimate.
5. FUEL The consultants were able to obtain the annual jet fuel flowage figure and from this they to estimated the annual airline fuel expenditure. Furthermore, they estimated that only 12% of the fuel expenditure remains in the local economy as maintenance and administrative costs.
6. INFLIGHT MEALS The catering costs were derived from the survey results.
7. INTERRUPTED PASSENGER SERVICE/COMMERCIAL ACCOMODATION EXPENDITURE These numbers were also derived from the surveys.

8. OTHER SERVICES AND SUPPLIES Expenditures in this category included items such as security, utilities, office supplies and local insurance expenses. The total was estimated from the surveys.
9. BUILDING AND EQUIPMENT RENTALS The bulk of this figure was paid to the Department of Airports.
10. LOCAL DEPRECIATION This number was developed for those items of capital equipment which were locally purchased and for all local facilities. Even though depreciation is not a cash expense the authors felt that it was a "reasonable method of translating airline capital expenditure into an average level of economic impact."²⁰
11. LOCAL TAXES Only local property taxes were included in this estimation. The technique for estimating this number was not explained and was not derived from the surveys.

The ERA work represents a very thorough study based on an extensive primary data base. The estimation techniques and the level of detail of airline disbursements is noteworthy. The inclusion of local depreciation is a valuable and legitimate method for estimating the impact of capital expenditure. On the other hand, the consultants included the total fuel expenditure number in the bottom line direct impact number even though

²⁰ ERA, p. II-8.

they had already recognized that only a small percentage of the total remained in the local area.

3.2.1.4 Landrum and Brown

The Landrum and Brown study in 1980 of the Pittsburgh Airport was based on the development of their own primary data with verification of some data using an earlier study which had been conducted. Generally speaking, the techniques for estimating the employment, payroll and expenditures was the same for all types of airport tenants.

Employment was estimated by comparing the results of a survey conducted six months prior with the consultant's own survey. The employment by type of airport tenant estimated in the earlier study was the number used unless the responses from the authors' own survey indicated a higher number for a particular tenant type. The resulting mix of estimations by tenant type were then combined to arrive at a total airport employment number.

Payroll was arrived at by calculating average salaries for the survey respondents by business type and multiplying by the number of employees estimated in the category. This technique should provide a reasonably accurate estimate of the total payroll if the response rate for each busi-

ness type is high enough to allow a good confidence interval around the estimate.

Using the earlier employee study as a benchmark, Landrum and Brown developed a weight factor technique to estimate expenditures for goods and services by tenant type. For example, the previous study calculated airline employment at 4,445, while the consultants' survey results accounted for 4000 employees. The weight factor is then simply 4,445 divided by 4,000 or 1.11125.²¹ The weight factor is then multiplied with the expenditures accounted for in the consultants' returned surveys to arrive at a total expenditure by tenant type. This technique implies that employment level is an accurate indice of a firm's expenditure level for materials and service. Unless an effort is made to account for the relative labor intensity of the firms being considered, this implication may lead to inaccurate results. By analyzing the tenants by type of business, the authors partly succeed in differentiating the capital and labor intensive firms. Nevertheless, some estimation errors are likely to occur when using employment as a basis for measuring expenditure for goods and services.

²¹ Landrum and Brown, p.B-4.

3.2.1.5 Boston Case Study

Four primary sources of data were used for the airline disbursements element in the Boston case study. The first source was the records of the Massport Authority which operates Logan International Airport. From these records information was available on landing fees, tenant payments for commissions and rentals, and traffic activity statistics. The second primary input came from the CAB statistics for Logan on enplaned passengers and mail/cargo tons by certificated carrier.

The third data source was an employer and employee survey conducted in 1979 by Cambridge Systematics Inc. for the Massport. This study, although primarily concerned with the airport ground access issue, provided information on the number of employees by airport tenant and the geographical and socioeconomic distribution of these employees. The information was stored in a computer file and subsequently transferred to the M.I.T computer facility for cross-tabulation and storage.

The final source of primary information was an airline survey conducted in conjunction with the Boston Aviation Council. The survey response rates are tabulated in Table 3-1. Although the survey response rate was only 35%, 95% of the employees, 91% of the enplaned passengers and 72% of the cargo and mail carried is represented by the respondents. A second survey process was completed with the air carriers from which tax and

Table 3-1

Boston Case Study Airline Survey Response

AIRLINE CATEGORY	CATEGORY TOTAL	COMPLETED SURVEY	RESPONSE RATE (%)	EMPLOYEES ACCOUNTED FOR (%) (1)
Foreign	8	2	25	17
Trunk	8	7	88	99
Regional	4	4	100	100
Commuter	11	0	0	0
Other (2)	5	0	0	0
TOTAL	37	13	35	95

NOTES

1. Total employment estimated from all primary data sources.
2. Category includes supplemental and cargo operators.

TABLE 3-2

Logan Airport Airline Employment and Payroll (1980)

AIRLINE CATEGORY	EMPLOYMENT	PAYROLL (\$)
Foreign(1)	264	5,216,804
Trunk(1)	6,624	173,164,610
Regional(2)	1,245	40,754,816
Commuter(3)	53	795,000
Other(4)	116	2,320,000
Off airport	128	3,108,302
TOTAL	8,430	225,359,532

NOTES

1. Employment was estimated using survey results and the Massport/CSI survey. Payroll was derived by calculating the average salary per employee for all respondents in the category and multiplying times the estimated employment.
2. No estimation required with a 100% survey response.
3. Employment was estimated from the Massport/CSI survey and telephone interviews. Average salary was estimated at \$15,000.
4. Category includes supplemental and cargo. Employment was estimated from the Massport/CSI survey. Average salary was estimated at \$20,000.

TABLE 3-3

Logan Airport Airline Expenditures (1980)

CATEGORY	EXPENDITURE(\$)
Material(1)	6,389,904
Equipment(1)	2,199,822
Advertising(1)	8,009,036
Commercial lodging(2)	5,507,555
Limousine service(2)	450,450
Catering(2)	18,640,351
Fuel(3)	23,750,000
Landing fees(4)	17,593,302
Facilities rental(5)	-----
State and Local Taxes(6)	16,099,720
TOTAL	98,640,140

NOTES

1. Survey respondents represented 66% of all enplaned passengers in 1979. Estimated total derived by dividing the survey response expenditure category total by the enplaned passenger representation of survey respondents.
2. Same technique as described in note 1 except commuter, supplemental and all cargo excluded.
3. Estimated total is the local residual of the fuel expenditure. For a further explanation see the text.
4. Source: Massport Authority
5. Number was not listed because the only information available is on an airport wide basis. The total figure is included in the summation of the direct impact category.
6. State taxes included were use, income, franchise and employee withholding. State sales tax was not included. City tax was on personal property. Estimation of the aggregate airline local and state taxes paid was done on the basis of enplaned passengers as described in note 1, with the exception of employee withholding which was done on the basis of employment.

advertising expenditure was obtained. The response for this survey was significant enough to make estimations for the non-respondents.

The results of the Boston case study in the airline disbursements element are shown in Tables 3-2 and 3-3.

Two important assumptions were required to make estimations in areas where primary data was not available. They are as follows:

1. The enplaned passenger or cargo tonnage is an accurate gauge of the level of expenditure of an air carrier. Since the enplaned passenger or cargo ton is the only common unit of production on a station basis, which is readily available, it was felt that the number of passengers enplaned would give an approximation of the level of operational activity and hence expenditures.
2. The local residual of the fuel purchase cost is estimated at 12%. The jet fuel flowage figures were obtained from Massport and multiplied with the average jet fuel price per gallon to obtain a total fuel expenditure of \$198 million dollars. As discussed earlier, the bulk of this expenditure does not impact the local economy and so a local residual impact was calculated.

3.2.2 CONCESSIONAIRES

3.2.2.1 CEIR

The methodology used for this element was the same as described in the CEiR airline disbursements element.

3.2.2.2 Waldo and Edwards

As in the case of airline disbursements the consultant used national figures to update an earlier study. The number of enplaning passengers per concessionaire employee was determined as a productivity indice in the original 1972 study. Annual change in productivity was calculated using U.S. Bureau of Labor Statistics on service industry employment and the results of other economic impact studies. Payroll was updated using U.S. retail trade employee earnings average annual increases. Expenditures were determined on an airport wide basis as described in the section

on airline disbursements. The critique of this national data estimation technique is also provided in that section.

3.2.2.3 Economics Research Associates

In the concessionaire element ERA produced extensive primary data from surveys and telephone interviews with a survey response rate of 89%.²² The authors requested information on revenues, expenditures, payroll, employee benefits and number of full and part time employees. Estimations for non-respondent payroll and employment were based on the payroll, employment and revenue relationships of the respondents. Those firms providing services directly to the airlines were not counted in this element since their impact was already included implicitly in the airline disbursement element.

The consultants decided to use revenues rather than expenditures to describe the economic impact of the concessionaires. Non-respondent revenues were calculated from the revenue based lease agreements with the Department of Airports.

²² An example of the concessionaire survey form may be found in the Appendix.

The use of revenues in the concessionaire element and expenditures in the airline disbursement element points to an implied assumption. Since the difference between revenues and expenditures is profit (or loss), the authors are assuming that the profit of the concessionaires impacts the local economy while the profit of the airlines does not. This judgement makes good sense since one would expect the profit of a locally owned and operated firm to be plowed principally back into the local economy. On the other hand, there is no reason to believe that the profit of an airline, which is not locally based, would be realized as an impact on the local area. Of course there is the possibility that an airline is locally based or a concessionaire is part of a national chain with headquarters elsewhere, but as a rule of thumb it is reasonable to assume that the profit of an airline has no significant local impact. Another more mundane reason that the authors may have chosen not to include airline profits is that the data may have been difficult to acquire.

3.2.2.4 Landrum and Brown

The calculation of the impact of this element is discussed in the airline disbursements section - Section 2.2.1.4.

3.2.2.5 Boston Case Study

The primary source of information for this element was originally intended to be survey responses.²³ Thirty three surveys were mailed to non-airline airport tenant firms. The low response rate and the number of partially completed survey returns indicated the need for a secondary source of information. The 1979 Massport/CSI employer survey served as a starting point for calculating employment by firm. The numbers from this study were used only after verification that the tenant still existed in 1980 and all attempts at written and telephone surveys had not yielded a more current count. The net result was that the 1979 employment figure was used for 50% of the 42 concessionaires. Since current data was available for those firms which accounted for most of the employees, it was assumed that random changes in the other tenant employment would cancel out and the total concessionaire employment estimate would be reasonably accurate.

Payroll for non-respondents was calculated using a hierarchy of two methods. The first method was to divide the concessionaires into categories according to the nature of their business, such as restaurants, caterers, security services and hotel. If a significant number of responses were in a category then non-respondent payroll was estimated by multiplying the

²³ For an example of the non-airline tenant survey see the Appendix.

estimated employment times the average salary of the respondents in that category. If a category did not have a significant number of responses then the secondary method was to multiply the non-respondent estimated employment with an average salary by firm classification obtained from the Massachusetts Department of Employment Security. These salaries are averaged for all firms at the four digit SIC level and only for the county in which the airport is located. The average salary statistics were for 1979 and updated to 1980 using a wage inflation index. The end result was concessionaire employment of 2,146 and a payroll of \$26,898,996.

The survey results were not substantial enough to evaluate the expenditures for this element. Further efforts to obtain these figures was not successful in the time allotted for the case study. A secondary source of information pursued in this area were the tenant leasing arrangements with the Massport. This source proved to be inadequate for two reasons. First, not all the tenant leases were revenue based and secondly multiple layers of leasing agreements were identified for some tenants. For example, the South Terminal Corporation leases the entire South terminal complex from the Massport and then sublets to the tenants. In those cases of sub-leasing, lease agreement specifications were considered proprietary information and not available.

Since a number of the concessionaires existed solely to service the airlines (caterers, aviation services, etc) their expenditure impact would already be considered under the airline disbursement element so the absence of an expenditure number for this element is mitigated. What was learned in

this case study about obtaining airport non-airline tenant information was that the total cooperation of the airport authority and extensive follow-up of initial survey efforts is essential.

3.2.3 GOVERNMENT AGENCIES

3.2.3.1 CEIR, Waldo and Edwards, and Landrum and Brown.

The methodologies used in the estimation of this element are essentially the same as those described in the respective sections of the airline disbursement and concessionaire elements.

3.2.3.2 Economics Research Associates

The consultant used the survey method and estimation techniques described earlier in Sections 2.2.1.3 and 2.2.2.3 for payroll and employment. Since government agencies normally operate on a non-profit basis, the annual operating budget less payroll was used in lieu of revenues or

expenditures in this element. With the exception of the U.S. Postal Service, which has an LAX budget, those government agencies, which had interests in the local area in addition to the airport, had their operating budgets apportioned on the basis of their association with the airport. For example, the National Transportation Safety Board Los Angeles regional office was asked to identify what percentage of their budget was, directly or indirectly, related to activity at the study airport. In this fashion the operating budgets of the following government agencies, several of which were not physically located at the airport, were apportioned with respect to the airport.²⁴

- U.S. Coast Guard
- Federal Drug Enforcement Administration
- FAA Los Angeles Center (Palmdale)
- FAA Flight Standards District Office
- Inter-agency Motor Pool
- Public Health Department

In the case of the Department of Airports, which operates several airports in Los Angeles, an allocated share of the common overhead functions in terms of employment, payroll and budget was attributed to LAX on the basis of the airport's proportion of the total Department of Airports operating budget. This, of course, was in addition to the Lax operating budget.

²⁴ ERA, Table III-6, p.III-26.

The Airport Development Aid Program (ADAP) funds going to LAX were also included in the government element of the direct impact category. An annualized average amount for the previous five years was used to estimate the study year ADAP funds.

Economics Research Associates utilized a common sense straightforward technique, which heretofore had not been used, to calculate the impact of government agencies not physically located at the airport, but which nonetheless contributed to the operation of the airport. The method of apportioning operating budget, although simple in theory, may have required considerable time and effort and been subject to the judgement and estimation errors of the persons interviewed. Nevertheless, it represents a sound approach. The inclusion of ADAP funds also was new with this study and is a legitimate entry in the direct impact category.

3.2.3.3 Boston Case Study

The survey results for the government agencies provided payroll information for an estimated 85% of the government employees. The estimation method for the non-respondents to arrive at aggregate payroll and employment is similar to that described in Section 2.2.2.5. Total government agency employment at the airport was 1,183 with an annual payroll of \$30,288,476. The only reliable expenditure or budget data available for

the government agencies was the revenue of Massport. The imprecise wording on the non-airport tenant survey combined with the low rate of response for the expenditure question precluded the development of accurate figures for other government agencies. In order to avoid double counting, the airline landing fees and car rental commissions, which are counted as expenditures in the airline disbursement and ground transportation sections respectively, are not counted in the Massport revenues as listed in the summary of total direct impact in Table 3-6.

3.2.4 AIR FREIGHT

3.2.4.1 CEIR

In this study the consultant recognizes the freight forwarders as a distinct group and calculates employment, payroll, revenues and local purchases.²⁵ The methodology to obtain these numbers is absent from the authors' published available work.

²⁵ CEIR, Table 4-1, p.34.

3.2.4.2 Waldo & Edwards and Landrum & Brown

These studies give no indication that freight forwarders were considered in the direct impact category. Waldo and Edwards show only two freight firms in their list of concessionaires and other airport businesses.²⁶ Landrum and Brown show an "other" category in their listing of tenant types which may or may not include the freight forwarders.²⁷ Although it is not essential to identify the freight forwarders as a distinct tenant type it is a worthwhile exercise since the characteristics of their business do not readily match any other business type at the airport.

3.2.4.3 Economics Research Associates

Payroll and employment estimation for the freight forwarders was done using the same technique as mentioned in their other direct impact elements.

²⁶ Waldo & Edwards, p.34.

²⁷ Landrum and Brown.

²⁸ ERA, p. III-16

The authors undertook an extensive analysis to determine the revenues directly attributable to the movement of air cargo. The variety of services offered by the freight forwarder industry is recognized to include: local cartage, freight forwarding functions, consolidation, and small and large shipment specialization.²⁸ On the basis of interviews with local freight specialists the surface transportation modal distribution is identified. The categories of surface transportation firms are cargo agents (with sub-categories of full service forwarders and drayage only), shipper/consignee and common carrier.²⁹ A percentage of the total cargo is then attributed to each category.

Since the revenue per pound of air freight is dependent on the shipment size, the consultant segments the air freight shipments into small (under 100 pounds) and large (over 100 pounds) shipment sizes. A Federal Express study has shown that 70-75% of all air cargo shipments weigh less than 100 pounds and local interviews determined that 40 pounds was the average small shipment size and 640 pounds was the average large shipment size. Using this information the consultants were able to estimate the pounds shipped in each shipment size group by each type of freight forwarder operation.

The estimated revenue per pound for each shipment size group was multiplied times the number of pounds in that group and the group totals were combined to arrive at the total revenue impact of air freight. It was then

²⁸ ERA, p. III-17

necessary to determine what portion of that revenue accrued to the local economy since the airline and destination freight forwarder were included in the revenue per freight pound calculations. Interviews with local airline freight officials and freight forwarders established that 23% of the total freight revenue accrued to the full service freight forwarder and 15% to the drayage only firm.³⁰

The methodology described above, although requiring a number of assumptions and estimations, is a technically sound and comprehensive approach for describing the magnitude of air freight local revenue in the absence of primary data. Since most freight forwarder firms consider their revenue figures as proprietary information, the ERA technique provides an acceptable and practical alternative.

3.2.4.4 Boston Case Study

Four primary means for estimating employment for the air freight forwarders were used in the Boston study:

1. Telephone surveys.
2. MIT/Boston Aviation Council non-airline airport tenant survey.
3. 1980 Massport freight forwarder survey.

³⁰ ERA, p. III-19.

4. 1979 Massport/CSI employer survey.

If these four sources produced conflicting employment figures the most recent survey was chosen to be the correct number. Comparing the results of the four surveys highlighted the fact that there was a high turnover rate in firms and that over half of the 48 air freight forwarder firms identified employed 10 people or less.

Payroll was determined by calculating an average salary for the respondents and assuming this salary was accurate for the non-respondents. Payroll information was available for 38% of the employees and the average salary was verified with information from the Massachusetts Department of Employment Security. The air freight element yielded an estimated 898 employees and with an aggregate payroll of \$19,764,386.

Air freight forwarder expenditures for non-respondents was determined on the basis of the number of employees. Since the air freight forwarder business is labor intensive, it was felt that the employment/expenditure relationship of the survey respondents would yield a reasonably accurate estimate for the non-respondents. Using the expenditure per employee indice, the aggregate air freight forwarder expenditures was estimated to be \$14,096,195.

3.2.5 GROUND TRANSPORTATION

3.2.5.1 CEIR, Waldo & Edwards and Landrum & Brown

CEIR handles ground transportation in the same fashion as in the other direct impact elements - extensive surveys and no published estimation methodology. Waldo & Edwards and Landrum & Brown do not address the issue of ground transportation and it is not known if the impact of this element was possibly imbedded elsewhere.

3.2.5.2 Economics Research Associates

This study discusses four ground transportation modes and the methodology used to arrive at their impact.

1. TAXI The Los Angeles Department of Airports charges an outbound trip fee to each passenger carrying taxi leaving the airport and therefore the number of annual outbound trips is recorded. The air-

port authority estimates that an additional 15% of the outbound taxis bypass the fee collection system. From this information the consultant estimated the number of outbound trips. Discussions with the taxi cab industry revealed that there was approximately one inbound trip for each two outbound airport trips. The total number of taxi trips was then calculated and multiplied times an average fare. To this number a \$1 gratuity per trip was added to arrive at the total airport related taxi revenue.

2. CAR RENTAL AGENCIES Payroll and employment were estimated by previously described survey and aggregation techniques. Total revenue was derived from the airport authority revenue based lease agreements.
3. BUS The airport authority provided statistics on the annual passengers using the bus transportation mode. An average fare was calculated and multiplied times the number of passengers to arrive at the total bus revenue.
4. LIMOUSINE The Southern California Livery Operators Association had information on the average daily number of limousines in the area and estimated that each limousine made one airport trip per day. Using an average fare plus gratuities figure it was then a simple matter to calculate the airport related revenues.

It must be recognized that the potential for double counting exists here because transportation expenditures are also included in the air visitor element of the primary impact category. Although the consultant recognizes the double counting problem, no action is taken to correct it.

3.2.5.3 Boston Case Study

Four elements of the ground transportation element were studied:

1. CAR RENTAL AGENCIES Payroll and employment estimation was done as outlined in Section 2.2.2.5. Five car rental agencies operate at Logan and responses were received from three of them. Aggregate employment was estimated at 494 with a payroll of \$5,597,346. The response rate for this category of non-airline airport tenant was significant enough to make a reasonable estimation of the car rental firms aggregate expenditures. Total expenditures for the group were calculated using the employment, payroll and expenditure relationships of the respondents and amounted to \$23,855,705. This figure includes commissions paid to the airport authority.
2. TAXI The Massport Authority provided the number of outbound taxi trips. The number was readily available because the Massport levies a surcharge on each outbound passenger carrying taxi. Discussion

TABLE 3-4

Boston Taxi Industry Airport Related Trip and Revenue Data

TOTAL TRIPS		TRIP DESTINATION	
-----		-----	
Dispatched outbound (a)	738,863	Downtown Boston (c)	1,086,129
Estimated inbound (b)	812,749	Other points	465,483
-----		-----	
TOTAL	1,551,612	TOTAL	1,551.612

TRIP REVENUE (\$) (d)	

Downtown Boston	5,973,707
Other points	3,956,609
Trip gratuity (@ \$1 per trip)	1,551,612

TOTAL	11,481,928

Notes

- a. Source: Massport.
- b. Source: Taxi News Digest. Inbound equals outbound plus 10 percent.
- c. Trip destination split is 70 percent to downtown Boston and 30 percent to other points.
- d. Average fare to downtown Boston is \$5.50. Average fare to other points is \$8.50.

with an official of the Taxi News Digest yielded an estimation that the number of inbound trips roughly equalled the number of outbound number of outbound trips plus 10%. Destination data and average fares were also provided by this source. The information is summarized in Table 2-4.

3. PUBLIC TRANSPORTATION The primary means of public transit is the MBTA subway system which has an airport station. It was assumed that all fares processed through this station were attributable to the airport. MBTA officials estimated that \$162,000 in fares were collected in connection with this station.
4. CROSS-HARBOR TUNNELS The primary access road from the city of Boston to the airport involves a set of cross harbor tunnels. The statistician for the Massachusetts Turnpike Authority, which operates the tunnels, stated that 27.4 million vehicles annually pass through the tunnel resulting in \$8 million in tolls. Furthermore, the Turnpike Authority conducted a study which showed that 46 percent of the vehicles transiting the tunnel had the airport as their origin or destination. This leads to the conclusion that \$3.68 million in tunnel tolls is directly attributable to the existence of the airport.

3.2.6 TRAVEL AGENCIES

3.2.6.1 CEIR and Landrum & Brown

The same technique described earlier in this chapter for CEIR is used here as well. The Landrum & Brown study does not address the travel agency impact.

3.2.6.2 Waldo & Edwards

The consultant relies on the results of a 1972 study conducted on the travel agency industry to generate current data. The method for estimating the number of travel agent employees directly attributable to the study airport activity was a labor productivity indice. In the 1972 study, the consultant estimated that 70 percent of local travel agency business was related to the activity at LAX. With an esti-

³¹ Waldo and Edwards, p. 40.

mation of the number of local area travel agent employees and the number of resident originating passengers the authors calculated the 1972 travel agent productivity at 1300 air passengers per employee.³¹ The assumption is then made that this productivity level has remained constant until the current 1976 study year.

For the current year the authors make the assumption that 50 percent of the revenue passenger traffic is departing and that 75 percent of these passengers have a study area origin. A passenger local origin/destination survey provided the estimate that 46.4 percent of the local originating passengers were residents of the study area. By applying the 1972 travel agent productivity figure to the number of 1976 departing resident revenue passengers the current travel agent employment is derived. The 1972 average annual salary was updated using changes in retail trade employees earnings and an aggregate payroll was estimated.

This methodology is flawed for two reasons. First, the results are an estimate of an estimate done four years earlier and thus far removed from any current primary source of data. Secondly, the assumption that travel agent productivity has remained constant over time is unfounded. The ratio of direct booking versus travel agent booking may have changed or the travel agent productivity may have increased due to the introduction of remote terminal reservations systems. The Waldo & Edwards technique in this element can best be

described as the "quick and dirty" approach which is reasonable only when time and/or resources are a factor.

3.2.6.3 Economics Research Associates

The consultants completed an estimation of travel agency revenues but did not consider the employment or payroll impact. Two methods for estimating revenues were established.

In the first method, the number of study area revenue passengers as calculated from a Los Angeles Times origin/destination survey is used as a starting point. Discussion with several local travel agencies yielded an average ticket value of \$300 and so a study area generated ticket revenue was derived. Based on the national figures of the Air Transport Association (ATA) the travel agency share of this revenue was calculated to be 55 percent. By applying the travel agent commission figure of 8 percent, the residual travel agent revenue is derived.

The second method for arriving at travel agent revenues was to multiply the estimated number of study area travel agencies with the annual gross ticket sales per agency as estimated by the ATA. The

travel agent commission is again taken to be the local residual revenue.

The two methods yielded results which were within two percent of each other so the consultant took the midpoint of these numbers as the estimated revenue.³² Interviews with local travel agents revealed that approximately 80 percent of their gross revenues were accounted for by airline ticket sales with the remaining 20 percent in the form of other travel arrangements. The authors, on the basis of this distribution, added 20 percent to their local residual revenue to arrive at a local travel agent impact.

Since both estimation techniques are theoretically sound, the use of a two method bracketing approach lends credence to the consultants' final figure. The travel agent revenue associated with sales other than airline ticket sales would be better related to the primary impact category, not included in the direct category as done here.

3.2.6.4 Boston Case Study

³² ERA, p. III-12.

In the Boston case study, the conceptual approach chosen was the estimation of the net travel agent revenues directly associated with the study airport services. The Air Traffic Conference, an arm of the ATA, provided information on study area travel agent gross air-line ticket revenue on a postal zip code basis. After determining all the zip codes in the study area, an aggregate travel agent gross air-line ticket revenue figure of \$444.33 million was determined. Using the Air Traffic Conference estimated 1980 travel agent commission figure of 8.9% yielded a net travel agent revenue of \$39.55 million, which was considered the airport's direct impact on the regional travel agency industry.

3.3 DIRECT IMPACT CATEGORY SUMMATION AND DISTRIBUTION

An important aspect of an airport economic impact study is how the results are summarized and the effects then distributed within the study region. Potential double counting of impacts is highlighted when a summary table with a total impact figure is presented. Distribution of employment, payroll and other expenditures is done using a variety of techniques as will be shown in this section. Payroll distribution in terms of how the dollars are spent is important in that it relates the direct impact of the airport to the other industries in the study area, such as housing, retail trade, medical care, etc.

3.3.1 CEIR

A summary table for employees, payroll, revenue and local purchases is presented as discussed in Section 2.2.1.1 by type of airport tenant.³³ The consultant undertook a distribution of two items of the direct impact category - employment and payroll. Employment, both on and off airport property, was distributed geographically on a county level for the study region.³⁴ The method of distribution was not discussed, but given the extensive amount of survey information the authors gathered, it can be postulated that it was done on the basis of the distribution of the survey respondents. If the survey results captured a significant portion of the employees then a distribution on this basis is reasonable.

As with employment, payroll was also distributed on the county level. Payroll distribution was also done in terms of how the payroll dollar was spent. In neither case was the methodology for apportionment explained.

³³ CEIR, Table 4-1, p. 34.

³⁴ CEIR, Table 4-8, p. 43.

3.3.2 WALDO & EDWARDS

The consultant did not recognize direct and primary categories as defined here, but instead provided a summary table of primary and induced impact.³⁵ The primary impact included the elements of the direct impact category as discussed in this chapter plus air visitor expenditures, which is considered an primary element in this thesis. No geographical distribution of employment, payroll and expenditures or payroll spending distribution was done.

3.3.3 ECONOMICS RESEARCH ASSOCIATES

Summations were provided for gross revenue, employment and payroll.³⁶ The authors chose to present a gross revenue direct impact listing and summation and then to refine the figures in terms of the local residual economic impact. The fuel purchase, which has a minimal impact on the local economy, is listed in total in direct impact

³⁵ Waldo & Edwards, Tables 5.5-1 and 5.5-2, pp. 62 and 64.

³⁶ ERA, Tables III-7 and III-8, pp. III-28 and III-30.

summary table and the 12% residual is listed later in the work. The refinement process for the revenues is called "value added."

Geographical distribution of the direct impact is done for the local residual or "value added" impact.³⁷ The method of apportionment is airport employee residence on the assumption that since payroll accounts for 70% of the value added impact it was reasonable to distribute the aggregate impact along the same lines. Zip code information was available for forty percent of the direct impact employees. Apportionment was done for employment, payroll and value added revenue impact by county and in concentric circles with the airport as the center.

3.3.4 LANDRUM & BROWN

The consultant provided a summary table for airport wide direct expenditures in terms of type of expenditure (materials, fuel, advertising, etc.), rather than by the element method used in this thesis.

³⁸ Using the distribution of the survey respondents, total expenditures were then apportioned on the township level.

³⁷ ERA, P. VI-1.

³⁸ Landrum & Brown, Table III-1, p. III-2.

The distribution of employees proved to be difficult for two reasons. First, the response rate of the consultants' own survey was quite low and secondly their results did not match the results of a distribution done with an earlier survey. Discrepancies as high as twenty percent existed in terms of the percentage of total airport employees for certain townships. The authors chose to average the differences between the two studies to determine the apportionment of employment. Payroll was distributed by calculating an average salary by community and multiplying times the estimated employment by community.

The consultants approach for apportionment is flawed in certain respects. The technique of averaging the percentage distributions of two studies to determine the correct distribution can lead to substantial errors. With differences as high a 20% in a township proportion of the total employment it is likely that one or the other of the studies is in error and averaging only serves to compound the error. A better approach would have been to base the distribution on the study with the higher response rate. If neither study had significant confidence limits then the apportionment should not have been undertaken.

3.3.5 BOSTON CASE STUDY

Employment and payroll distribution was completed for the five county study area, but expenditures were not apportioned due to a lack of primary data. The methodology and results for employment and payroll are described below.

EMPLOYMENT Two sources of employee geographical distribution were available for this study. The first was the 1979 Massport/CSI employee study which detailed information on home residence and household income. The second source was the survey conducted in conjunction with the Boston Aviation Council which yielded airline employment and payroll by community. This second source, although reflecting more recent information, was not felt to be representative of the total airport population. The earlier Massport/CSI results were chosen because the distribution in this survey represented both airline and non-airline employees and because residency patterns were not likely to change in the short run. The apportionment could be accomplished down to the city or town level but the county level was chosen for study purposes.

PAYROLL The problem of apportioning payroll was confounded by two factors. First, the Massport/CSI survey requested total household income instead of airport employee income. In order to estimate

the airport payroll in a community it was necessary to assume that the distribution of household income was the same as the distribution of airport employee income. The following formula was used to determine the percentage of total payroll by county:

$$HI(i)/HI = E(i) / E \times AH(i) / E \times AHI$$

ASSUMPTION: $HI(i)/HI = P(i)/P$

where: HI=total household income.
 E=total airport employment.
 P=total airport payroll.
 AHI=average household income.
 (i)=the ith county.

The second problem with the interpretation of the survey results stemmed from the fact that the household income question allowed responses only in \$5000 brackets with the final bracket being \$30,000 and above. Because the distribution above \$30,000 was unknown, it was necessary to determine if the distribution below \$30,000 followed a normal statistical curve. If it could be established that the payroll did follow a normal curve then a mean household income by county could be calculated. Plotting the below \$30,000 household income on probability scale graph paper showed that between 68 and 80% of the curve was being captured and that it did approximate a normal curve. Average household income levels by county were calculated and the percentage of airport payroll by county could then be calculated using the formula given above.

The payroll and employment distribution for the 5 county study area is shown in Table 3-5. Total airport family members are also shown to

give an indication of the number of people the airport payroll helps support. The distribution of the airport payroll by spending patterns given in Table 3-5 to show the direct impact of the airport payroll on other regional industries. Table 3-6 contains a summary of all of the direct impact economic activity described in this chapter.

TABLE 3-5
Boston Study Area Airport Employment and Payroll (1980)

COUNTY	AIRPORT EMPLOYEES	PAYROLL(\$)	TOTAL FAMILY MEMBERS(1)
Essex	2,885	73,243,440	7,847
Middlesex	2,393	53,583,840	6,629
Norfolk	878	19,659,600	2,494
Plymouth	637	16,489,680	1,911
Suffolk	3,275	70,134,480	7,926
TOTAL	10,068	233,111,040	26,807

Payroll Spending Distribution(2)

CATEGORY	EXPENDITURE(\$)
Food	50,188,807
Housing	57,415,249
Transportation	21,329,660
Clothing	12,203,363
Personal care	3,869,643
Medical care	10,326,819
Social Security and disability payments	13,695,274
Income tax	44,547,520
Other	19,534,705
TOTAL	233,111,040

Notes

1. Computed from U.S. government statistics on average family size at the county level.
2. Based on U.S. Department of Labor statistics for Autumn 1980.

TABLE 3-6
Boston Case Study Direct Impact Summary

ELEMENT	EXPENDITURE(\$)
Airline payroll	225,359,532
Airline expenditures	98,640,140
Concessionaire payroll	26,898,996
Government payroll	30,288,476
Massport revenues(1)	44,795,147
Air freight payroll	19,764,386
Air freight expenditures	14,096,195
Car rental agency payroll	5,597,346
Car rental agency expenditures	23,855,705
Taxi revenue	11,481,928
MBTA transit fares	162,000
Mass. Turnpike Authority	3,680,000
Travel agent net revenue	39,550,000

EMPLOYMENT

Airline	8,430
Concessionaire	2,146
Government	1,183
Air freight	898
Car rental agencies	494
TOTAL	13,151

Notes

1. Revenues are exclusive of airline landing fees and car rental commissions. The number also includes building rental revenue which would be considered a tenant expenditure.

4.0 CHAPTER 4 INDUCED ECONOMIC IMPACT CATEGORY

4.1 CATEGORY DEFINITION

Induced economic impact is defined as the additional rounds of economic activity generated in response to the first round primary and direct impact category activity. In other words, the employment and expenditure resulting from the existence of and activity at an airport creates a demand for additional employment and expenditure in other industrial sectors. The most common way to calculate the induced economic impact is through the use of an economic multiplier, which quantifies the additional employment and expenditure resulting from first round economic activity

This chapter gives a brief background in the study of economic base theory and then explores the current methods available to calculate an economic multiplier. In addition to economic base study, two other conceptual approaches, location quotient and input/output, are also available for multiplier analysis. Practical applications of economic multiplier theory will be discussed in the context of five airport economic impact studies.

4.2 ECONOMIC BASE THEORY

The underlying concept of economic base theory is that the direction of a regional economy is determined by the region's status as an exporter to the rest of the world. Regional exports fall into two broad categories. The first category is the physical outflow of goods and services which leaves the region. The second category is the purchase of goods and services, which are indigenous to the region, by visitors to the region. This latter category is considered an export even though the goods and services do not physically leave the region because they are being consumed by non-residents. These export industries provide an economic base for regional growth and hence are considered the basic sector.³⁹

The employment and income growth generated in the basic sector is thus a result of exogenous demand for local goods and services. Furthermore, extensive economic activity is required to support the existence of the basic sector activity. Employees of basic sector industries and their families require the products of the agriculture, housing and transportation industries and the basic industries themselves require locally produced raw materials as well as police, fire,

³⁹ The economic base theory described here is derived from Bendavid, Avrom, Regional Economic Analysis for Practitioners, (New York: Praeger Publishers, 1974), Chapter 6.

utilities and a variety of other services. These supporting activities are classified as the non-basic sector of the regional economy. In theory,

Both sectors, then, are related to exogenous demand, the basic sector directly and the non-basic sector indirectly, through the basic sector. If exogenous demand for the exports of the region increases, the basic sector expands. This, in turn, generates an expansion in the supporting activities of the non-basic sector.⁴⁰

From this concept it then follows that there is a ratio between employment and income in the basic sector versus the non-basic sector. For example, if one job in the basic sector creates a demand for an additional two jobs in the non-basic sector, a ratio of 1:2 in job generation is indicated. An equivalent way to state this ratio is in terms of a base multiplier. Using the above example, since each new basic sector job results in a total of three new jobs (one basic and two non-basic), the base multiplier is three.

Two steps are necessary before an economic base study may be undertaken. First, a unit or units of measurement must be chosen. The most common units of measurement chosen are employment and income because they are readily available in government statistics at even the micro-regional level and the multipliers derived are easily understood and useable in an economic impact study.

⁴⁰ Bendavid, p. 104.

The second preliminary step to an economic base study is the identification of basic and non-basic sectors of the economy. One method to achieve this is a direct survey of industries with regards to their basic/non-basic distribution of employment and income. The survey would have to identify local versus non-local purchases of raw materials and the destination of finished goods. This method is not often used because of the extensive time and resources required to develop comprehensive data. The identification may also be done indirectly using the "assumptions" approach in which assumptions are made as to what general categories of economic activity are basic and non-basic. This approach works reasonably well in small regional economies with very few industries, but may be unsuccessful in complex regional economies with a multi-industrial base. A derivative of the assumptions approach to calculate the induced economic impact was used in the airport economic impact study discussed below.

4.2.1 WALDO & EDWARDS

The research approach in this study for the induced category was a two part process. The first step was to determine the ratio of basic/non-basic activity in each primary and direct impact category element using a derivation of the assumptions approach. With the

basic sector determined the authors then applied employment and income multipliers to determine induced impact.

The following are the consultants' basic/non-basic ratios for each impact element they considered and the rationale for each:

1. AIR CARRIER Ninety four percent of the employment and payroll was considered basic. The basis for this estimation was derived from another estimation that six percent of all study airport air carrier total passengers were boarded at LAX and ninety four percent at all other stations. The underlying assumption is that there is a direct relationship between the number of enplaned passengers and the source of an airline's income flow. In other words, the consultants are saying that, since 94% of the air carriers income (enplaned passengers) is not LAX income, then 94% of the economic activity at LAX in terms of income flow is a product of out of area demand.

This approach is seriously flawed by the assumptions that income flow is representative of basic/non-basic activity and that there is a correlation between income flow and enplaned passengers. The consultant, in effect, is applying the characteristics of the entire network to the particular situation at one station. There is no basis to assume that an airport's percentage of total enplaned passengers is the same percentage as the income derived from the airport study area because the enplaned passenger indice does

not account for place of purchase of the ticket. Take for example the case of the Las Vegas airport, where the proportion of non-residents to total enplaned passengers is very high. Most of these non-residents purchased a round trip ticket in their home cities and are now using the return portion of that ticket. Thus, the income from these tickets never passes through Las Vegas. In the case of Las Vegas, the percentage of enplaned passengers at this station with respect to the whole system will be much higher than the percentage of income derived from that airport service area.

The problem with the Waldo & Edwards approach stems from the fact that income flow is not a good indication of the basic/non-basic ratio and the enplaned passenger indice does not accurately reflect income flow. However, given the authors' propensity to use income flow, a more reasonable method to determine the basic/non-basic ratio is to estimate the percentage of total study airport passengers who are area residents and purchased their tickets locally. The income flow derived from these passengers is then considered the non-basic portion of air carrier income.

2. CONCESSIONAIRES AND GROUND TRANSPORTATION The percentage of the basic sector is assumed to be the same as the percentage of non-resident passengers. Since this method captures the magnitude of exogenous demand it is a reasonable approach.

3. GOVERNMENT AGENCIES, AVIATION SERVICE ORGANIZATIONS and the AIR VISITOR INDUSTRY All of these elements are considered 100% basic and rightfully so since the income which generates activity in these elements is exogenously originated.
4. TRAVEL AGENCIES These are considered 100% non-basic since revenue is derived from local area demand.

After the consultants have determined the percentage of airport related economic activity which is in the basic sector they then apply economic multipliers to arrive at the induced employment, payroll and expenditures. The induced estimates are then combined to the primary and direct impact totals to arrive at a grand total for the airport economic impact. Schematically this is represented as:

(PRIMARY & DIRECT) & INDUCED = TOTAL IMPACT

where

INDUCED = the basic sector portion of the primary and direct times an economic multiplier.

The totals derived from such a formula should be interpreted cautiously since they represent both observed and theoretical employment, payroll and expenditures.

The authors do not explain the derivation of their economic multipliers beyond the statement that they were used in other economic impact studies. The multipliers used were

- Employment - 2.5.⁴¹
- Payroll - 3.0
- Airport tenant expenditures - 2.3
- Air visitor expenditures - 2.5

4.3 LOCATION QUOTIENT ANALYSIS AND APPLICATIONS

Location quotient analysis is a methodology to determine the relative industrial specialization of a region as compared to a reference area, which is typically the state or the nation. This methodology is founded in economic base theory and results in basic/non-basic sector determination and economic multiplier estimation. At the heart of location quotient analysis is the use of a ratio of ratios. The first ratio is employment (or income) for an industry in the region versus employment (or income) in that industry in the reference area. The second ratio is the total regional employment versus the total reference area employment. The location quotient is the result of dividing

⁴¹ An employment multiplier of 2.5 means (1) employee basic and (1.5) employees non-basic. Some studies interpret this as a multiplier of 1.5.

⁴² Derived from Bendavid, p. 94. Income could have been used instead of employment here.

the first ratio by the second. The location quotient is represented by the following formula:⁴²

$$\frac{\frac{X(r)}{Y(r)}}{\frac{X(n)}{Y(n)}} = \text{Location Quotient (LQ)}$$

where

X(r)=employment in industry X in region r.

X(n)=employment in industry X in reference area n.

Y(r)=total employment in region r.

Y(n)=total employment in reference area n.

To illustrate the location quotient method consider the following simple example where:

Regional employment in the electronics industry	500
State employment in the electronics industry	1,000
Total regional employment	25,000
Total state employment	100,000

$$\text{LQ} = \frac{\frac{500}{1,000}}{\frac{25,000}{100,000}} = 2$$

From the location quotient formula it can be seen that if

LQ IS GREATER THAN ONE: The region is an exporter in the study industry vis a vis the reference area.

LQ IS LESS THAN ONE: The region is an importer in the study industry vis a vis the reference area.

LQ EQUALS ONE: The region neither exports or imports in the study industry or the flows balance out vis a vis the reference area.

Thus, by using the location quotient method, it is possible to determine which regional industries are basic (exporters) or non-basic (importers or local market producers).

Location quotient analysis, although straightforward in theory, is fraught with difficulties in practical use which may degrade the final results. First, the choice of the most common units of measurement, employment and income, may bias the results. Employment, as a unit of measure, may not be sensitive enough to differences in productive output due to differences in labor productivity. Income, as a unit of measure, is subject to changes in wage and price levels and more reflective of the standard of living than productive output. Despite these drawbacks employment and income remain the only production indices which have readily available statistics and are suited for use in an economic impact study.

Other problems which arise in the use of location quotient analysis are the assumption of homogeneity between the study region and the reference area and the problem of product mix. Product mix occurs if a region exports in an industry in which it also imports and thus the location quotient will underestimate the exports and thereby overestimate the multiplier.⁴³

In spite of the conceptual and practical difficulties of location quotient analysis, it does represent an easy method for determining the basis of an economic multiplier. A discussion of the use of location quotient analysis in two airport economic impact studies now follows.

4.3.1 SACRAMENTO AIRPORTS STUDY

An economic impact study of Sacramento's two airports was done in 1979 and used a combination of two techniques described here to calculate the induced economic impact.⁴⁴ The basic/non-basic ratio for the airport primary and direct economic activity was derived by the direct survey method. Airport tenants were asked to identify both total and local expenditures. By aggregating the responses, the

⁴³ For a further discussion of the use of location quotient analysis see Isserman, Andrew M.; "The Location Quotient Approach to Estimating Regional Economic Impacts"; Journal of American Institute of Planners, January, 1977.

⁴⁴ Redmond, Gary W., Economic Impact of Sacramento Metropolitan and Executive Airports for the Fiscal Year July 1, 1978 Through June 30, 1979, Masters Thesis, California State University at Sacramento, November 1979.

author was able to estimate a weighted average basic/non-basic ratio by tenant type.

Economic multipliers were calculated for employment and income using the location quotient method. The state of California served as the reference area and the percentage of employment and income for 10 major industry classifications was compared at the state and local level. If the percentage of employment (income) for an industry group was higher at the local level than the state then that industry group was considered basic. If an industry group had a lower percentage locally vis a vis the state, it was non-basic or local. By comparing the percentage differences of all 10 industries at the state and local level an aggregate percent basic and non-basic for Sacramento is estimated. By dividing the total employment percentage (100%) by the study area basic percentage, the income and employment multipliers were calculated to be 2.46 and 4.73 respectively.⁴⁵ These multipliers were then applied to the estimated basic sector airport economic activity to arrive at the induced impact.

The estimated economic multipliers and the resulting induced impact in this study represent a gross approximation of the true induced effect. The economic multipliers were developed using macro level industrial classifications and applied to a very specific sector of the economy. In addition to all the difficulties inherent in the use of

⁴⁵ Redmond, Tables 1.1 and 1.2, pp. 8 and 9.

location quotient analysis, the author compounds the problem by applying aggregate level analysis to a local economic activity which comprises only 5% of the total local area income and less than a half of one percent of the total local area employment. There is no basis to assume that this small proportion of the total local economic activity will behave the same as the economy defined at the 10 major industries level. The study results would have been strengthened had the author used a more detailed location quotient analysis which more accurately captured the specific economic activities associated with the airport.

4.3.2 LANDRUM & BROWN

This study used the assumptions approach to divide airport activity into basic and non-basic sectors and location quotient analysis to determine an economic multiplier. The consultant divided the airport economic activity into basic and non-basic on the basis of the resident/non-resident ratio of enplaned passengers. Since seventy percent of the enplaned passengers were not study area residents, then seventy percent of the demand for airport services was assumed

⁴⁶ Landrum & Brown, p. B-15.

to be exogenous to the region. Thus, on the basis of origin of demand, 70/30 is the basic/non-basic ratio for airport activities.⁴⁶

In the absence of a detailed analysis of the economic characteristics of the airport activities this approach provides a reasonable estimation. This approach, however, does not capture the unique qualities of individual tenant types which may exist to exclusively service either basic or non-basic demand.

Using location quotient analysis the authors calculate economic multipliers of 3.0 for employment and 2.6 for payroll and expenditures.⁴⁷ The source for determining these multipliers was the U.S. Department of Commerce publication, County Business Patterns. No discussion was included on the reference area chosen or the level of detail of the analysis.

4.4 INPUT OUTPUT ANALYSIS AND APPLICATIONS

Input output analysis is a sophisticated econometric technique used to describe inter-industrial relationships and is also the most advanced method to date for calculating economic multipliers. At the heart of

⁴⁷ Landrum and Brown, IBID.

input output analysis is the concept that an increase in the production output in one industry causes a demand for production output in other industries. The relationships between industries can be quantified and the equations describing all inter-industrial relationships may be presented in matrix form. By using a matrix, the impact of a change in one industry can be calculated in all other industries. Typical input output analyses have on the order of 500 industrial classifications, which equates to the four digit level using the Standard Industry Classification code

The impact on the entire industrial base of an increase in the production of one industry is an iterative process. For example, consider the simplified case where the manufacturing industries increase production. This production increase results in demand for output in agriculture, construction, retail and employment. The demand for output in these other industries creates a need for more input and another round of economic activity is initiated. This process goes on through subsequently less intense rounds of economic activity until the entire effect of the increased manufacturing production is realized in the economy. If the sum total effect of all the rounds of economic activity in agriculture, for instance, is summed and divided by the

⁴⁸ If a 10 unit increase in manufacturing created a demand for a 15 unit increase in agriculture through all rounds of activity then the multiplier would be 2.5.

original manufacturing input than an economic multiplier of agriculture with respect to manufacturing is determined.⁴⁸

The iterative process is not infinite however due to a "leakage" effect.⁴⁹ The leakage effect is the result of purchases of output outside of the study region, which will not generate outputs in the regional industries. The greater the amount of leakage, the smaller the induced impact in the study region will be. In order to determine the extent of leakage, a regional purchase coefficient must be determined. A regional purchase coefficient is "the proportion of a good or service used to fulfill intermediate and/or final demands in a region that is supplied by the region itself rather than being imported."⁵⁰ A simple method to calculate this coefficient is through the use of location quotient analysis, although more sophisticated techniques are now available.

Due to the extensive amount of detail required to construct input output tables and the large scale computers required to do the multiple iterations of such a complex matrix, the use of input output analysis

⁴⁹ The term leakage and its definition was provided to me by Benjamin H. Stevens of the Regional Science Research Institute.

⁵⁰ Stevens, Benjamin H. et al, On the Estimation of Regional Purchase Coefficients, Export Employment, and Elasticities of Response for Regional Economic Models, Regional Science Research Institute, Discussion Paper Series: No. 114, December 1979.

in airport economic impact studies has been minimal. Furthermore, because the required statistics are normally only available down to the county level, input output analysis is normally done on a national, state or major metropolitan city level. If the airport study area does not match an existing input output analysis region or no input output tables exist for the area, then a significant amount of work is involved in altering the existing analysis or creating a new one.

In those airport study areas where input output tables are available, the process of computing the economic multiplier is straightforward. First, the inputs of employment, goods and services in the primary and direct impact categories which have a local origin must be identified. Employment and expenditure multipliers on an industry classification basis are then applied to these figures to arrive at the induced impact.

The U.S. Department of Commerce, Bureau of Economic Analysis (BEA) has developed the Regional Industrial Multiplier System (RIMS) for selected regions and cities in the country. Other specialized input output tables are normally derivations of a national BEA model. The Regional Science Research Institute in Amherst Massachusetts has been active in improving the performance of current input output tables and developing methodologies for more accurate analyses which have greater versatility in the choice and size of the study region.

4.4.1 ECONOMICS RESEARCH ASSOCIATES

The consultants in this study used the Los Angeles RIMS model to calculate the induced economic impact of the airport. The gross revenues or expenditures in the direct impact category elements were analyzed using the RIMS model to determine the percentage of value added or basic. All elements in the direct category with the exception of government services, ADAP funds and fuel expenditures had a value added percentage of 69%. The fuel, as discussed in 3.2.1.3., had a value added percentage of 12% and the government services and ADAP funds were 100%, reflecting their exogenous origin. In the category of primary impact, the authors developed, with the aid of the RIMS model, a composite value added coefficient for estimating the induced impact for air cargo and area resident air travel elements.

The economic multipliers used to calculate the induced economic impact ranged from a low of 2.7 for government services and area resident air travel to a high of 3.7 for air visitor expenditures. Induced employment and payroll was calculated using area-wide earnings to output and earnings per employee ratios.

This study did not develop the level of detail or accuracy which is available through the RIMS model. By aggregating industry classifications and the survey derived expenditure inputs, the economic multipliers are not as fine tuned as they could be. The authors went

to the trouble of gathering expenditure information at a very detailed level (see the ERA survey forms in Appendix A) and then chose not to use this same level of detail in their analysis of the induced impacts. Nonetheless, this study is the only recent airport economic impact study in which the more sophisticated input output analysis technique is used.

4.4.2 REGIONAL SCIENCE RESEARCH INSTITUTE

The authors of this study conducted an input output analysis of the direct and induced impacts of the New York airports in 1971.⁵¹ The airport tenants were divided into major groupings according to their operating and economic characteristics and the regional purchases by type of purchase by tenant grouping were identified. An input output table developed for Philadelphia and adapted to New York was then used to develop induced regional purchase impact information at the two digit SIC level. This study was more an attempt to show what could be done with input output analysis in airport economic impact

⁵¹ Economic Value of Port Authority Airports to the New York-New Jersey Metropolitan Region: A Preliminary Analysis, (Philadelphia: Regional Science Research Institute), 1972.

studies rather than a comprehensive airport economic impact study. In addition, the techniques used in this 1971 study have since undergone considerable refinement.

4.5 SUMMARY

The methodologies for estimating the induced economic impact and their applications in several airport economic impact studies have been presented in this chapter. The economic base and location quotient methods, although easy to use with readily available data, are fraught with theoretical difficulties which cast doubt on the results derived in using them. Input output analysis, which is a more sophisticated and accurate technique, requires a complex data set which is not always available for an airport study area. Further theoretical and practical development in input output analysis and its more commonplace acceptance should foster its more extensive use in future airport economic impact studies.

5.0 CHAPTER 5 PRACTICAL SUGGESTIONS AND AREAS FOR FURTHER RESEARCH

5.1 INTRODUCTION

Up to this point the purpose of this thesis has been to delineate and analyze the development of airport economic impact studies. Different methodologies for completing a study, including the author's own Boston case study, have been critically appraised. This chapter will deal with some practical suggestions in preparing an airport economic impact study and directions for future research. The organization of the chapter is within the framework of the three economic impact categories discussed.

5.2 PRIMARY ECONOMIC IMPACT CATEGORY

All the airport economic impact studies reviewed, as well as the Boston case study, have only partially succeeded in defining the total primary economic impact of an airport. The fundamental purpose for an airport is to provide a region with passenger and cargo services.

The demand for these services arises from a multitude of sources and for a variety of reasons: a hospital requires an emergency airlift of a rare blood type; a university is sponsoring a conference and the out of town attendees arrive by air; a construction engineer must make a trip to a distant field site; a law firm must have an important contract delivered to a distant city in a few hours. The list of reasons why airport services are required is endless and so the task of quantifying the benefits which results from these services is quite complex.

In addition to the general complexity of demand, the situation at each airport is unique. Las Vegas Airport primarily exists to service the demand of non-residents who come to Las Vegas for gambling and entertainment. The bulk of Atlanta International Airport passengers are connecting to other flights and never leave the airport grounds. Thus, the first step in calculating the primary impact must be to define the major demand sources for airport services. Once these sources have been identified the task of quantifying regional benefits can be tailored to the characteristics of the demand.

The most common sources of demand are regional air visitors, area business air travel and air cargo shipments. Quantifying the air visitor impact has been shown to be straightforward given the proper data. The Economics Research Associates study is the first attempt to delineate the impact of the airport passenger services on area businesses. Further research is required to understand and define the importance of air travel as a business tool. Business air travel

demand should be considered with respect to a firm's alternative choices should airport services not be available (.ie choose an alternative transportation mode, move the business out of the region, or cease operations). If an understanding is gained of how important airport services are in the business firm's locational decision or why air transportation is used, it may then be possible to establish a relationship between the amount of business travel and gross revenues, employment and payroll. The study of air travel demand should be oriented so as to capture the unique characteristics of different classes of business activity as well as such fields as education, medicine and government.

The estimation of the air cargo impact received attention in the Economics Research Associates and Boston case studies. The ERA work developed payroll and employment estimations based on tenuous and untested assumptions, while the Boston case study defined only the economic magnitude of air cargo shipments. Further primary research is required to define the major users of air cargo, the role air cargo plays in the entire industrial process, and the shipper's modal choice decision making process. Any assessment of the air cargo shipment impact must be done with regard to alternative transportation modes. For example, air freight may provide a cost advantage, a time advantage or be the only mode suitable for a particular type of shipment. By gaining a basic understanding of the reasons for using air cargo services it may then be possible to quantify the economic benefit to the users.

5.3 DIRECT IMPACT CATEGORY

If the information on payroll, employment, revenues and expenditures for all airport activities was available, then the calculation of the airport's direct regional impact would be a simple task. The problem arises in obtaining the primary data and making estimations in the areas where information is not available.

From the outset of an airport economic impact study it is essential to have the complete cooperation of the airport authority. Since the airport authority manages the operation of the airport, it is normally the best source of information on traffic statistics, identification of tenants, leasing arrangements and previously completed studies.

After enlisting the aid of the airport authority it is then necessary to accurately identify all direct activity associated with the airport. A major metropolitan airport is likely to have a hundred or more tenants of various sizes and operating characteristics. In order to provide a homogenous base for the estimation of non-respondents, the tenants should be grouped into categories as specifically as possible. If a survey of airport tenants is to be done, it should ideally include, as a minimum, questions on

- Nature of business
- Total gross revenues, expenditures, employment and payroll.

- Geographical distribution of employment and payroll
- Expenditures by type and place of purchase. Type of purchase information should equate to the two digit SIC level for non-airline tenants and CAB Form 41 expenditure classifications for air carriers. Place of purchase information should identify those purchases made within the specified airport study area.
- Average annual capital improvement expenditure.
- All state and local taxes.

Since it is virtually impossible to achieve a 100% response rate on any survey, let alone the one described above, it is clear that some estimation to arrive at aggregate figures will be required. For an estimation to be meaningful it should be based on relationships which are specifically oriented to the tenant type. It would be incorrect to use an average salary of the air carriers to estimate the freight forwarder tenants payroll or the advertising expenditure per car rental employee to estimate a restaurant's advertising budget. Through the common sense application of estimation techniques the gaps in primary data may be filled and the direct economic impact accurately described.

5.4 INDUCED ECONOMIC IMPACT CATEGORY

The calculation of the induced economic impact in airport studies has been tied to developments in the field of multiplier economics. The

economic base and location quotient methods have been frequently used because they are easily understood by non-economists and can be completed with readily available government statistics. However, because these two methods are based on an examination at the aggregate level of industrial activity and require many tenuous assumptions, the results can only be considered a crude approximation of the true induced impact.

Input output analysis involves a much more thorough study of regional inter-industrial relationships and consequently yields a more accurate methodology for determining induced effects. The use of this technique in airport economic impact studies has been limited because of the extensive data requirements and the limited availability of regional input output tables. A significant amount of research is currently underway in the government and private sector to refine input output analysis and increase the availability and flexibility of regional tables.

In many ways a major airport is a microcosm within the larger regional economy. There is economic interaction within the elements of the airport, such as an airline's dependence on aviation service firms, as well as interaction between the entire airport and the regional economy. An area for further research should be to study the unique problems associated with the use of input output analysis in airport economic impact studies. A set of guidelines could be proposed which provide a practical working tool for preparing an airport economic

impact and ensure uniformity in methodology as an aid in comparing the results of different studies.

6.0 CHAPTER 6 SUMMARY

This thesis is intended to serve as both a culminating and a starting point in the study of the relationship between an airport and the regional economy. It is culmination because it presents a comprehensive, critical evaluation of airport economic impact studies to date, as well as the author's own case study. The economic benefits have been defined within the three categories of primary, direct, and induced impacts.

The primary impact, which results from the use of airport services, has been shown to be the most complex part of the airport/community relationship to define. To date only a few major aspects of this impact category, namely air cargo usage, resident air travel, bank funds flow and air visitors, have been quantified.

On the other hand, the assessment of the direct expenditure, employment and payroll has been considerably easier to deal with. The stumbling blocks for calculating the direct impact category are the complete identification of all direct economic activity, acquisition of a significant amount of accurate primary data and reasonable estimation techniques.

Finally, the most common techniques used to estimate the induced economic impact have been discussed and critiqued. This impact category is an attempt to identify the magnitude of the economic activity which is induced by primary and direct category activity. Economic base theory, location quotient analysis and input output analysis provide the means to calculate a multiplier for payroll, employment and expenditures in the primary and direct categories. The induced impact category, much more than the other two categories, is a theoretical estimation of a level of economic activity which should occur as opposed to economic activity which can actually be observed. The induced impact in many studies is oftentimes combined with the known economic benefits in order to provide an impressive total airport economic impact figure.

This thesis is a starting point because it provides a base on which to launch further research efforts. Several alternatives for the directions this research could take and some practical suggestions were presented in Chapter 5.

The costs of an airport to a community, in terms of land use and the environment, will continue to receive considerable attention in the future. An airport economic impact study represents a means to balance these costs by evaluating the airport's important role in the regional economy and as such should serve as an important tool in the airport development decision making process.

7.0 APPENDIX



FLIGHT TRANSPORTATION LABORATORY

NON-AIRLINE TENANT SURVEY

The Flight Transportation Laboratory at M.I.T. in conjunction with the Boston Aviation Council is conducting this survey to develop information concerning aviation's economic impact upon the Boston metropolitan area. An important aspect of this analysis is the determination of the employment of the tenants on the airport property. Each job and payroll dollar at the airport creates a demand for additional employment and income for the community as a whole. The questions listed below are being asked of all airport tenants. Please keep in mind that all information provided will be kept in the strictest confidence and only airport wide totals will be published. Your cooperation in supplying this information will be greatly appreciated so please take a few minutes to complete this form. Any questions please contact Steve Fortune, Massachusetts Institute of Technology, 253-6309 or Kevin Kiley, General Manager, Boston Aviation Council, 567-0358.

1. a. Please give data for calendar or fiscal year 1980. If fiscal year, indicate closing date of fiscal year. _____

b. If 1980 data is not used indicate what year was used and if this data is representative of current operations. _____

2. How many employees does your business or agency have at the airport?

3. What is your total payroll at the airport? \$ _____ Annual

4. What were your expenditures for goods and services (exclusive of payroll)? \$ _____ Annual.

5. If possible please identify your expenditures for goods and services purchased in the Boston area (exclusive of payroll)? \$ _____ Annual.

East Boston \$ _____ Chelsea \$ _____

South Boston \$ _____ Revere \$ _____

6. How much did your firm spend for capital improvements to plant, property and equipment last year? \$ _____ Annual.

NAME OF FIRM: _____

Form Completed by _____

Date _____



FLIGHT TRANSPORTATION LABORATORY

AIR FREIGHT SURVEY

The Flight Transportation Laboratory at M.I.T. in conjunction with the Boston Aviation Council is conducting this survey to develop information concerning aviation's economic impact upon the Boston metropolitan area. An important aspect of this analysis is the determination of the indirect benefits to the users of Logan Airport facilities. The movement of goods through Logan Airport, both inbound and outbound, constitutes a significant portion of this indirect economic benefit. In order to quantitatively identify the economic benefit of the Logan International Airport facility to the Passenger Traffic Association members we would like to ask the following questions. Please keep in mind that all information requested is regarded in the strictest confidence and only industry totals will be published.

1. a. Please give data for calendar or fiscal year 1980. If fiscal year, indicate closing date of fiscal year. _____

b. If 1980 data is not used indicate what year was used and if this data is representative of current operations. _____

c. If your firm has more than one location in the Boston area indicate whether data is for all locations. (Data for all operations in the Boston area is preferable). _____

2. What is the major product or service of your company? _____

3. What are the gross revenues or sales of your company? \$ _____

4. What is the annual payroll for your company? \$ _____

5. Total number of employees for your company? _____

6. How much freight does your firm handle to points outside the Boston area? (Annual data in pounds). Inbound _____ Outbound _____

7. What percentage of the freight in question 6 travels through the Logan Airport facility? Inbound _____% Outbound _____%.

8. What is the total dollar value of freight moved through the Logan Airport facility? Inbound \$ _____ Outbound \$ _____.

9. Please estimate how many employees are directly involved with the inbound and outbound freight moved through the Logan Airport facility. In other words, if the shipments which travelled through Logan stopped, how many employees would be affected? _____.

10. Does your firm deal directly with:

a. an airline _____%

b. an air freight forwarder _____%

c. other _____%

If there is a split between the above methods please indicate that split in terms of percentage by each method.

Air Freight Survey
Page 11

11. How would you classify your company's dependence on the services provided by Logan Airport facility? (circle one)

- a. essential to company operations.
- b. dependent but could use other transportation modes with some loss of efficiency.
- c. dependent but could use other transportation modes with no loss of efficiency.
- d. not essential to company operations.

NAME OF FIRM _____

Completed by _____

Date _____



FLIGHT TRANSPORTATION LABORATORY

PASSENGER TRAFFIC SURVEY

The Flight Transportation Laboratory at M.I.T. in conjunction with the Boston Aviation Council is conducting this survey to develop information concerning aviation's economic impact upon the Boston metropolitan area. An important aspect of this analysis is the determination of the indirect benefits to the users of Logan Airport facilities. The availability of scheduled air service for business travel constitutes a significant portion of this indirect economic benefit. In order to quantitatively identify the economic advantage of the Logan Airport facility to a cross section of firms in the Boston area we would like to ask the following questions. Please keep in mind that all information provided is regarded in the strictest confidence and only industry totals will be published.

1. a. Please give data for calendar or fiscal year 1980. If fiscal year, indicate closing date of fiscal year. _____

b. If 1980 data is not used indicate what year was used and if this data is representative of current operations. _____

c. If your firm has more than one location in the Boston area indicate whether data is for all locations. (Data for all operations in the Boston area is preferable). _____

2. What is the major product or service of your company? _____

3. What are the gross revenues or sales for your company? \$ _____

4. What is the annual payroll for your company? \$ _____

5. Please estimate the annual number of trips to points outside the Boston area by company personnel by all transportation modes. _____

6. Please estimate the annual number of trips to points outside the Boston area by company personnel using the Logan Airport facility. _____

7. If your company has locations outside the Boston area please estimate the number of inbound trips from these locations using:
all transportation modes _____ the Logan Airport facility _____

8. In terms of business travel, how would you classify your company's dependence on the services provided by the Logan Airport facility. (circle one)

- a. Essential to company operations.
- b. Dependent but could use other transportation modes with some loss of efficiency.
- c. Dependent but could use other transportation modes with no loss of efficiency.
- d. Not essential to company operations.

Name of Firm: _____
Form completed by _____
Date _____

Economics Research Associates
 10960 Wilshire Blvd.
 Los Angeles, California 90024
 Phone: 477-9585

CONFIDENTIAL
 INFORMATION

LOS ANGELES
 DEPARTMENT OF AIRPORTS
 ECONOMIC IMPACT STUDY

*Please provide the following information for the most recent fiscal year relative to
 Los Angeles International Airport and Ontario Airport if applicable.*

1. Fiscal Year: _____ Beginning: _____ Ending: _____
2. Company Name: _____
- Address: _____

	<u>LAX</u>	<u>ONT</u>
3. Total Annual Expenditures in Local Area:	_____	_____
4. Total Annual Payroll (exclusive of benefits) in Local Area:	_____	_____
5. Number of Employees:	_____	_____
6. Number of Annual Hotel Room-Nights Generated by Layovers:		
Flight Crews:	_____	_____
Unscheduled Passengers:	_____	_____
Other Airline Personnel:	_____	_____
7. Percent Distribution of Total Revenues Generated Associated With:		
Passenger Movement	_____	_____
Cargo Movement	_____	_____
Total	100%	100%

	<u>Full Time</u>		<u>Part Time</u>	
	<u>LAX</u>	<u>ONT</u>	<u>LAX</u>	<u>ONT</u>
Administration	_____	_____	_____	_____
Sales and Marketing	_____	_____	_____	_____
Flight Kitchen	_____	_____	_____	_____
Commissary	_____	_____	_____	_____
Ticket Office	_____	_____	_____	_____
Freight	_____	_____	_____	_____
Maintenance	_____	_____	_____	_____
Membership Courtesy Lounge	_____	_____	_____	_____
In Flight				
Pilots, Co-Pilots, and Navigators	_____	_____	_____	_____
Cabin Attendants	_____	_____	_____	_____
Passenger Service	_____	_____	_____	_____
Ramp Operations	_____	_____	_____	_____
Reservations	_____	_____	_____	_____
Sky Caps	_____	_____	_____	_____

9. Expenditures for the following items:

CAB Account No.	Description	Annual Amount	
		LAX	ONT
21	General Management Personnel		
23	Pilots and Co-Pilots		
24	Other Flight Personnel		
25	Maintenance Labor		
26	Aircraft and Traffic Handling Personnel		
28	Trainees, Instructors, and Unallocated Shop Personnel		
30	Communications Personnel		
31	Recordkeeping and Statistical Personnel		
32	Lawyers and Law Clerks		
33	Traffic Solicitors		
34	Purchasing Personnel		
35	Other Personnel		
36	Personnel Expenses		
37	Communications Purchased		
38	Light, Heat, Power, and Water		
39	Traffic Commissions		
40	Legal Fees and Expenses		
41	Professional and Technical Fees		
42	General Services Purchased—Associated Companies		
43	General Services Purchased Outside		
44	Landing Fees		
45	Aircraft Fuels and Oils		
46	Maintenance Materials		
47	Rentals		
49	Shop and Service Supplies		
50	Stationery, Printing, and Office Supplies		
51	Passenger Food Expense		
53	Other Supplies		
55	Insurance—General		
56	Insurance—Traffic Liability		
57	Employee Benefits and Pensions		
58	Injuries, Loss and Damage		
60	Advertising		
62	Other Promotional and Publicity Expenses		
63	Interrupted Trip Expenses		
64	Memberships		
65	Corporate and Fiscal Expenses		
67	Clearance, Customs and Duty		
68	Taxes—Payroll		
69	Taxes—Other than Payroll		
71	Other Expenses		
72	Aircraft Overhauls		
75	Depreciation		
77	Uncleared Expense Credit		
78	Direct Maintenance—Flight Equipment		
79	Applied Burden Dr/Cr		

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LOS ANGELES
 DEPARTMENT OF AIRPORTS
 ECONOMIC IMPACT STUDY
 FIXED BASE OPERATOR QUESTIONNAIRE

Please provide the following information for the most recent fiscal year relative to
 Los Angeles International, Ontario, and Van Nuys Airport if applicable

1. Fiscal Year: _____ Beginning: _____ Ending: _____
 2. Company Name: _____
 Address: _____

	LAX	ONT	VNYS
3. Gross Receipts or Sales: ¹	_____	_____	_____
4. Total Wages, Salaries, and Employee Benefits:	_____	_____	_____
5. Distribution of Revenues by Source:			
Sales Commissions	_____ %	_____ %	_____ %
Product Sales	_____	_____	_____
Maintenance and Repair	_____	_____	_____
Avionics	_____	_____	_____
Flight School	_____	_____	_____
Line	_____	_____	_____
Other	_____	_____	_____
Total	100%	100%	100%

6. Distribution of Expenditures by Type:			
Payroll (including benefits)	_____ %	_____ %	_____ %
Subcontractors or Subtenants	_____	_____	_____
Rent	_____	_____	_____
Fuel	_____	_____	_____
Other Services and Supplies	_____	_____	_____
Total	100%	100%	100%

	Full Time			Part Time		
	LAX	ONT	VNYS	LAX	ONT	VNYS
Administration	_____	_____	_____	_____	_____	_____
Sales	_____	_____	_____	_____	_____	_____
Flight School	_____	_____	_____	_____	_____	_____
Maintenance	_____	_____	_____	_____	_____	_____
Avionics	_____	_____	_____	_____	_____	_____
Other (specify)	_____	_____	_____	_____	_____	_____
Total	_____	_____	_____	_____	_____	_____

¹Excluding aircraft sales, but including commissions resulting from such sales.

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**CONFIDENTIAL
 INFORMATION**

**LOS ANGELES
 DEPARTMENT OF AIRPORTS
 ECONOMIC IMPACT STUDY
 AIRPORT SERVICES QUESTIONNAIRE**

Please provide the following information for the most recent fiscal year relative to Los Angeles International Airport and Ontario Airport if applicable.

1. Fiscal Year: _____ Beginning: _____ Ending: _____

2. Company Name: _____
 Address: _____

	<u>LAX</u>	<u>ONT</u>
3. Gross Annual Receipts or Sales Less Returns/Allowances in Local Area:	_____	_____
4. Total Annual Wages, Salaries (excluding benefits):	_____	_____
5. Employee Benefits in Terms of Percent of Annual Payroll:	_____ %	_____ %
6. Estimate the percentage of your total services or goods which is related to airport facilities	_____ %	_____ %
7. Number of Employees – Full Time	_____	_____
– Part Time	_____	_____
8. One means of measuring the importance of the aviation facilities to you is to ask how your business would be affected if these facilities did not exist. <i>Check one:</i>		
a. No effect _____		
b. Some disadvantage, but would not impact our operation _____		
c. Our operations would have to be reduced _____ Percentage Reduction _____ %		
d. We would have to cease operations here _____, or we certainly would not have located here without the airport _____		

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