VARIATIONS IN MULTIPLIERS AND RELATED ECONOMIC RATIOS FOR RECREATION AND TOURISM IMPACT ANALYSIS

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ABSTRACT

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Economic impact analysis estimates the changes in economic activity within a region resulting from some action. Managers and decision-makers can justify tourism's economic significance by tracing the effects of tourist spending on sales, income and jobs in a region. Economic multipliers can be used to capture the secondary effects of tourist spending on a region's economy.

Despite the growing use of economic multipliers in recreation and tourism impact studies, limited guidance is available for choosing multipliers suitable for a given application. This study describes regional variations in economic multipliers for tourism-related sectors, identifies key factors associated with these variations, and evaluates procedures for predicting tourism multipliers for a given region. One hundred and fourteen regions varying in size and economic development were selected. Input-output models were estimated for each region using the IMPLAN system and multipliers for tourism sectors were extracted for analysis.

Multipliers were compared across sectors and regions. The Coefficients of Variation for most multipliers were between 5 and 20 percent across the 114 regions. All tourism multipliers are positively correlated with the natural log of population except for job multipliers, which are negatively correlated. The natural

log of population was identified as the best predictor of tourism multipliers, explaining 50 to 80 percent of the variation. Regions were formed into four groups with distinct multipliers. A multiplier lookup table was developed with guidance for choosing sector-specific multipliers for a given type of region. The regression models and lookup procedures were evaluated and compared. Errors from using generic multipliers are generally within 2 to 9 percent, similar to the errors from using regression models.

The results of the study will be used to refine procedures for estimating the economic impacts of recreation and tourism, including the National Park Service's Money Generation Model.

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Chapter 1

INTRODUCTION

Economic impact analysis is carried out by both public and private agencies to evaluate the economic effects of proposed projects or existing facilities and programs. For many government agencies, there is a strong demand for economic analysis at the national, state, and local levels (Jackson et al., 1992). Planners and decision-makers can utilize the information to evaluate facilities and programs and to justify the importance of a project to the local community (Loomis and Walsh, 1997-p 242).

Economic impacts of recreation and tourism activity are generally made by first estimating visitor spending and then applying a regional economic model to trace the effects of this spending on the local economy. Many early studies of tourism's economic effects stopped with estimates of consumer or visitor spending, as input-output and related economic models were too expensive and complex for most recreation and tourism analysts. Some early studies employed economic base models to estimate an overall "tourism multiplier" (Archer and Owen, 1971; Archer, 1973). With the advent of microcomputer based economic modeling systems like IMPLAN,[1] recreation and tourism studies began to make considerable use of input-output models and to use multipliers derived from these models (Rickman and Schwer, 1995b).

[1] IMpact analysis for PLANning, an I-O modeling system currently maintained by Minnesota IMPLAN Group, Inc.

Multipliers capture the impacts of a given change in final demand (e.g., visitor spending) on sales, income, and jobs in a region. Most importantly, they capture the secondary effects resulting from the circulation of visitor spending within a local region. Armed with a set of multipliers for the local region, tourism analysts can readily compute the economic impacts of a given change in spending.

Growing use of economic multipliers and regional economic models in recreation and tourism has been accompanied by many abuses and misuse. Few tourism analysts and recreation managers have formal training in regional economic methods and most are not very familiar with input-output models or multipliers. Many tourism studies use "off-the-shelf" multipliers or borrow multipliers from previous studies, often without understanding that there are many different kinds of multipliers or that they vary by region, sector, and over time (Archer, 1984; Beattie and Leones, 1993; Holland, 1994). Limited guidance is available for choosing multipliers suitable for a given application.

The purposes of this study, therefore, are to describe variations in economic multipliers for recreation and tourism related sectors and to explain how multipliers vary across regions. If variations in multipliers across regions can be explained and predicted, a simple procedure for selecting multipliers can be developed. This study will propose and evaluate procedures for predicting tourism multipliers that can be used to refine procedures for estimating the economic impacts of recreation and tourism.

Research Objectives

There are three research objectives for this study:

1. To describe variations in tourism multipliers across sectors and regions of varying economic development.
2. To identify key factors that explain variations in these multipliers.
3. To propose and evaluate procedures for predicting tourism multipliers for a given region.

Variations in economic multipliers for tourism related sectors will be thoroughly examined to better understand the multiplier effects for regions of different population, geographical sizes, and economic development. This study will also develop a procedure that can provide recreation managers and tourism analysts, especially for those who are non-economists, a means for estimating economic impacts. The rest of this chapter will introduce economic impact concepts and research relevant to the problem being studied.

An Overview of Economic Impact Analysis

Economic impact analysis (EIA) estimates the changes in economic activity within a region resulting from some action. EIA can produce estimates of the total economic impacts of holding a sport event, closing a power plant, passing an environmental bill, relocating a military base, opening an amusement park, and other actions that will influence a region's economy. There are two components to an economic impact analysis; to directly convert the action into

monetary values such as sales, income, and jobs, and to estimate the secondary effects that are associated with the action (Pleeter, 1980 p-7).

Economic impact analysis traces changes in economic activity through the economy to measure the cumulative economic effects of an action. For example, visitors who purchase goods and services in a region will directly contribute to businesses such as hotels, restaurants, and retail stores. These businesses will pass the money to their employees as wages and salaries and their employees will spend the money they receive to purchase goods and services from other businesses in the region. These businesses in turn make additional purchases in the region, thereby creating a chain effect. The cumulative result is the total economic impacts of visitors' spending in the region (Frechtling, 1994b).

Economic impact analysis helps policy analysts and decision makers to evaluate current and proposed projects by providing estimates that are measurable and comparable. Tourism industries need support from the local community, as tourism activities affect the entire community. Recreation and tourism development are regarded as attractive investments because they can lure new businesses and visitors to the region. Quantifying tourism's economic significance helps build support among the business community, government officials, and the general public. Economic impact analysis provides tangible estimates of tourism's economic contributions to the region's economy. These economic contributions often result in public policies or decisions that are favorable to tourism development (Clawson & Knetsch, 1966-p 230; Stynes, 1999a).

Activities associated with tourism and recreation involve monetary transactions. These activities include visitor spending on trips and durable goods, expenditures on development and construction of tourism and recreation facilities, and operational costs of these facilities and programs. Both public and private agencies are interested in the economic impacts of tourism and recreation for the following two reasons. First, economic impact analysis answers the fundamental questions raised by government legislators, regional developers, and the general public— "What monetary benefits will tourism bring to the community?" "How much income and how many jobs are supported by visitor spending?" Second, EIA is important in terms of decision making for evaluating a new or existing project and allocating budget funds. The information gathered by an EIA can be used to determine the relative benefits and costs of alternative tourism and recreation development strategies (Hastings and Brucker, 1993; Archer, 1982). EIA's can also help to assess the degree of dependence of the local economy on tourism and the potential economic growth from tourism (Stynes, 1999a; Frechtling, 1994a).

Definitions of Economic Multipliers

Economic impacts may be categorized into direct, indirect, and induced effects. The summation of indirect and induced effects is also called "secondary effect." Multipliers capture the size of the secondary effects, usually expressed as a ratio of total effects to direct effects (Miller and Blair, 1985-p 101). The larger the multiplier, the greater the impact a dollar of visitor spending will have

on the region's economy. For example, the sales multiplier for the lodging sector was 1.74 for the State of Florida in 1996. This means that a visitor spending $100 on lodging will have a total effects of $174 in sales within the state; that is, $100 received by the hotel as direct sales effects and another $74 received by other related industries in the region as secondary effects.

Direct effects are changes in the industries associated directly with visitor spending. In the previous example, $100 spent on lodging in the region will directly increase sales in the hotel sector. This is the direct sales effect of the visitor spending. The hotel will also hire employees and pay wages and salaries, which are the direct job and income effects.

Indirect and *induced* effects are the secondary effects resulting from the initial visitor spending. *Indirect effects* are sales, income, or jobs resulting from various rounds of the purchases the hotel made to other "backward-linked" industries in the region. For example, a hotel buys linen supply and utilities from other industries to deliver the services to its customers. The linen supply industry, on the other hand, also buys raw materials and equipment such as cotton and machinery from other industries. The sales of these backward-linked industries and the associated income and jobs generated from these sales are *indirect effects*.

Induced effects are the sales, income, or jobs resulting form household spending of income earned as a result of visitor spending- either directly or indirectly. The employees of hotels, linen suppliers, utility companies, etc., for instance, will spend their wages and salaries in the region and generate new

rounds of sales, income, and jobs. Several iterations (rounds) may occur before dollars from indirect and induced effects leak entirely from the region. As a result, money spent by visitors will impact not only tourism industries, but also related industries in the region.

The Type I multipliers capture only the indirect effects, while the Type II multipliers include both indirect and induced effects (Richardson, 1972-p 23; Minnesota IMPLAN Group, 2000). Multipliers may be expressed in terms of sales, income, value added or jobs, the most frequently used measures of economic impacts (Bull, 1995; Miller and Blair, 1985).

Economic multipliers are expressed as a ratio of the total effects relative to the direct effects. For instance, an income multiplier is the ratio of total income effects (direct, indirect, and induced) to the direct income effects. This type of multiplier has been called a "ratio multiplier" (Baaijens, et al., 1998; Archer, 1984), "direct-effect multiplier" (U. S. Department of Commerce Bureau of Economic Analysis [USDC BEA], 1997; 1992), or simply "multiplier" (Minnesota IMPLAN Group, 2000). Ratio multipliers, like these, should be used as indicators of a region's economic self-sufficiency and should not be applied to visitor spending (or direct sales effects) without proper justification (Propst, 1991). Ratio type multipliers do not directly convert sales from visitor spending into income or jobs in the region and can be confusing to people who are not familiar with multipliers (Archer, 1984; Frechtling and Horvath, 1999).

Since both the income earned by households and jobs created in the region are caused by sales (e.g., visitor spending), income and job multipliers are

better expressed as ratios of total income or job to direct sales or spending (Frechtling and Horvath, 1999; Frechtling, 1994b-p 383; Crompton, 1999; Stynes et al., 2000). This type of multiplier has been called a "normal multiplier" (Frechtling and Horvath, 1999; Baaijens, et al., 1998), "final-demand multiplier" (USDC BEA, 1997; 1992; Frechtling and Horvath, 1999), or "Keynesian-type multiplier" (Archer, 1984; Propst, 1995). In this study, this type of multiplier will be termed an *economic multiplier* or simply *multiplier.*

It is also useful to distinguish economic ratios from economic multipliers. Economic ratios convert between various economic measures, while economic multipliers capture the secondary effects (Stynes et al., 2000). For example, the statewide job to sales ratio for Florida for the hotel sector in 1996 was 18 jobs per million dollars in sales. This ratio can be used to convert hotel sales directly to hotel employment. The state Type II job multiplier for the hotel sector in 1996 was 28 jobs per million dollars in sales (IMPLAN estimates). This means that for every $1 million in sales in the lodging industry, 18 direct jobs are created in the hotel sector, and 10 (28 minus 18) jobs are created through secondary effects. These secondary jobs are created in industries that receive the secondary effects.

Multipliers can represent an aggregation of industries or a specific sector. An aggregate tourism multiplier, for example, uses one number to represent the tourism sectors within a region's economy. Visitor spending is applied as a whole to the aggregate multiplier for total effects. For example, economic base models (e.g., Archer's "Tourist Regional Multiplier") estimate an overall

aggregate multiplier for the study region's tourism industries (Archer and Owen, 1971). Sector-specific multipliers provide multipliers for different industry sectors. Visitor spending on different items can be applied to different ratios to capture multiplier effects across sectors. The use of I-O model is the most common way to generate sector-specific multipliers.

Tourism Sectors

Recreation and tourism involves a number of different industries. There is no single "tourism" sector in the Standard Industry Classification (SIC) system (Johnson et al., 1989). The U.S. Travel and Tourism Satellite Accounts have identified 15 tourism-related industries for the U.S. economy. Sales to tourists account for more than 20 percent of the total industry sales for eight of these 15 industries (Okubo and Planting, 1998).

IMPLAN generates multipliers for up to 528 industries in a given region. This study will focus on the four primary tourism sectors that receive the bulk of visitor spending: Hotels and Lodging Places, Eating and Drinking, Amusements and Recreation, and Retail Trade. A complete list of multipliers selected for this study is provided in chapter 3.

Variations in Economic Multipliers

Multipliers vary across regions, sectors, and over time. The Type II job multipliers for the State of Michigan, for instance, ranged from 30 jobs per million dollars in sales for the Local Transportation sector to 50 for the Eating and

Drinking sector (USDC BEA, 1992). A million dollars spent on meals and beverages would therefore create 20 more jobs than the same spending on local transportation.

Multipliers also vary across regions with distinct characteristics. One of the most common errors in tourism impact studies is the applications of state level multipliers to sub-state regions. Multipliers indicate the interdependence of industry sectors within a region's economy and are influenced by the size of the region and population (Tooman, 1997; Baaijens et. al., 1998; Detomasi, 1987; Propst and Gavrilis, 1987; Chang et al., 1999). The size of a multiplier for a given region depends on how the study region is defined and its economic characteristics. Propst et al. (1998), for instance, computed sales multipliers for regions surrounding 108 Corps of Engineers lakes. The Type II sales multipliers for these regions varied from 1.37 (a rural region around Dworshak Lake in Idaho) to 1.88 (Metro-Nashville, TN region around Lake J. Percy Priest).

This study will describe and explain variations in multipliers across sectors and regions. Multipliers can also vary across different economic models and they can change over time. Sources of variations in multipliers are discussed further in Chapter 2.

Approaches to Economic Impact Analysis

The most common approaches for estimating economic impacts of tourism are multiplier methods and input-output (I-O) models. The multiplier

approach uses either aggregate (e.g. MGM model[2]) or sector-specific multipliers (e.g. RIMS II, MGM2[3]) to estimate changes in economic activity due to visitor spending. The I-O approach makes use of an input-output model for the region. For example, IMPLAN estimates multipliers for local areas and also computes impacts of visitor spending. As many recreation and tourism analysts do not have immediate access to input-output models or systems like IMPLAN, the multiplier approach is more common in applied world. The multiplier approach is the focus of this dissertation. When using the multiplier approach, the key issues are selections of suitable multipliers for the given region and proper applications of these multipliers.

The original MGM model recommended a sales multiplier of 2.0 (U.S. Department of Interior National Park Service [USDI NPS], 1990). Some MGM applications employed state level multipliers from RIMS II that were "adapted" to local areas. RIMS II is an I-O model that is maintained the Bureau of Economic Analysis (BEA). BEA has published state level multipliers in its 1992 publication for 39 sectors and illustrated how to apply them to a typical tourism application (USDC BEA, 1992). BEA's example illustrates the proper handling of retail purchases by applying multipliers for the retail trade sector to the margins on goods purchased at retail stores. Tourism analysts using aggregate multipliers

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[2] The National Park Service's Money Generation Model is a simple one-page pencil and paper worksheet for estimating economic impacts of visitor spending using aggregate multipliers. A detailed discussion of this model is in chapter 2.

[3] MGM2 is an update of the National Park Service's Money Generation Model. MGM2 was built as an electronic spreadsheet that automates many routine calculations and provides a wide array of options. The multiplier lookup procedure proposed in this study has been used in the MGM2. The MGM2 software and manual can be found at http://www.prr.msu.edu/mgm2/MGM2web.htm.

have tended to apply them to all spending, even if the goods bought by tourists are not locally made.

The most readily available (published) multipliers tend to be for state level regions. While multipliers may be purchased for local regions from BEA (RIMS II), IMPLAN, REMI and other sources, most recreation and tourism organizations are either unaware of these sources or lack the funds to acquire their own multipliers. Hence, state level multipliers have been widely applied to local regions, usually yielding inflated estimates of impacts. Perhaps the greatest source of multipliers is simply borrowing them from past studies. This practice has tended to reinforce the misconception that there is a single "tourism multiplier" and has established 2.0 as the most popular figure (Beattie and Leones, 1993).

Misuse and Abuses of Economic Multipliers

The third research objective entails the development of procedures for selecting tourism multipliers for a given region. Such systems can help to reduce errors that are commonly made in selecting and applying multipliers in tourism applications. A brief review of the most common problems provides some guidance for a multiplier selection system.

1. Using state level multipliers for local applications. This is indicative of a more general problem of choosing multipliers that do not represent the region of interest. This problem stems from less familiarity with economic methods and

concepts among tourism analysts and a lack of understanding on how multipliers vary across regions and sectors. The most common abuse noted by researchers is the applications of national or state level tourism multipliers to sub-state regions (Archer and Owen, 1971; Archer, 1984).

2. Applying aggregate multipliers. Because the total sales, jobs and income to direct sales ratios vary from sector to sector, the same amount of money spent in different sectors can result in very different impacts. For example, $100 spent on hotels and $100 spent on souvenirs will have different impacts to the local economy. Since the value of an aggregate multiplier depends on the distribution visitor spending, applying aggregate multipliers that are estimated from one application to another will not capture the variations in multiplier effects across sectors.

3. Failure to margin retail purchases. It is common to see analysts apply multipliers to spending that will not be captured by local businesses, such as spending on goods that are not locally made. Since the multipliers are ratios of total effects to the direct sales effects, they should only be applied to sales that will accrue to the local region (Archer, 1984; Stynes, 1999a).

4. Incorrect application of multipliers, such as confusing sales and income multipliers, and ratio vs. Keynesian versions. Researchers have pointed out that on many occasions, inappropriate multipliers were used (i.e., use sales multipliers to compute income effects) due to ignorance or a lack of understanding of multipliers (Archer, 1984, Propst and Gavrilis, 1987; Propst, 1995).

An Application for Tourism and Recreation Impact Study

Recreation and tourism analysts need to understand how multipliers vary across regions, and have an approach that can simplify the procedures for estimating economic impacts while providing accurate and detailed information. A lack of accuracy and guidance on choosing multipliers for a given region was one major weakness cited by Duffield et al. in reviewing the National Park Service's Money Generation Model (Duffield et al., 1997; Stynes and Propst, 1999).

This study will develop and evaluate procedures for choosing multipliers for tourism applications. The approach is to simplify procedures for choosing appropriate multipliers for a given region, without sacrificing accuracy of the economic impact estimates.

The multiplier analysis is part of the revisions to the National Park Service's Money Generation Model (Stynes et. al., 2000). The results of this study will also be used in a Michigan Tourism Impact Model (Stynes and Chang, 2000), and the Recreation Economic Assessment System for the U.S. Army Corps of Engineers (Chang et al., 2001).

Chapter 2

LITERATURE REVIEW

This chapter reviews research on economic multipliers and their applications in tourism and recreation studies. The chapter is divided into five sections. The first two sections discuss regional economic methods and applications in general, while the last three sections focus particularly on applications to recreation and tourism. The first section reviews the two most common methods for estimating economic multipliers- economic base and input-output models. The second section discusses systems for estimating multipliers and focuses particularly on the IMPLAN system, as this is the source of all multipliers used in this dissertation. Section three reviews previous studies that have examined variations in multipliers across regions, sectors and time. Section four summarizes the most common approaches for conducting economic impact analysis of recreation and tourism and section five reviews common errors and abuses in applying multipliers within recreation and tourism studies.

Techniques for Estimating Economic Multipliers

Two commonly used techniques for estimating economic multipliers are economic base models and input-output methods (Eadington and Redman, 1991; Richardson, 1985; Pleeter, 1980). This section will introduce both approaches and show how multipliers are derived from them.

Economic Base Models

Economic base models divide economic sectors into basic and non-basic sectors. The basic sector consists of all firms that serve markets outside the region (exports). The non-basic sector, on the other hand, consists of the firms that serve markets inside the region (non-exports). Income of the region can be partitioned into basic and non-basic components:

$$Y = B + NB$$

where

Y = total income

B = basic income

NB = non-basic income

The economic base multiplier (M) is expressed as the ratio of total income (Y) to basic income (B).

$$M = Y / B$$

It can also be defined as:

$$M = \frac{1}{1 - e}$$

where

e = propensity to purchase locally

The equivalence of the two definitions can be shown as follows:

$$M = 1 / (1 - e)$$

M = Y / B	Substitute B with (Y-NB)
M = Y / (Y - NB)	Substitute NB with e×Y
M = Y / (Y - e×Y)	Factor out Y

One major task for using the economic base model is to identify exports (*B*) so the non-basic (*NB*) sector can be estimated. Once *NB* is known, the propensity to purchase locally (*e*) can be estimated from $NB = e \times Y$ (non-basic sector represents local consumption and is assumed as a function of total income) (Tiebout, 1962; Richardson, 1985; Hinojosa and Rios, 1991; Kendall and Pigozzi, 1994).

The economic base multiplier shows the change in total income in a region as a function of exports. The economic base multiplier will be larger if residents buy more from local producers (larger *e* results in larger *M* in the previous formula). One method for measuring the economic base (*B*) is the Location Quotients (LQ) method (Richardson, 1985). This method assumes the nation is self-contained and the productivity and consumption per employee are the same in the region and in the rest of the country. LQ is also an option in IMPLAN I-O model for constructing social accounts to estimate multipliers. There are several other methods for measuring the economic base, such as survey, judgment, and minimum requirements. Detailed descriptions of these approaches are beyond the scope of this study. Readers can refer to Richardson's "Input-Output and Economic Base Multipliers: Looking Backward and Forward" (1985) for details on this topic.

Input-Output Models

Input-output (I-O) models are based on the pioneering development by Wassily Liontief in the late 30's, for which he later received the 1973 Nobel Prize in Economic Science (Leontief, 1986). The I-O model has been further developed and refined by economists and regional scientists such as Isard, Tiebout, Miernyk, Richardson, Bulmer-Thomas, and Miller and Blair in the 50's to 80's (Richardson, 1985, 1969; Isard, 1975; Isard and Langford, 1971; Hewings, 1985; Miernyk, 1965).

I-O models identify the monetary transactions between an industry and a) other industries (intermediate sales), b) labor, capital payment, rents, etc. (value added), and c) ultimate consumers such as tourists (final demand). The region's economic activities are presented in mathematical matrices called transactions tables. A simplified I-O transactions table for a three-sector region is illustrated in Table 2-1.

In this I-O matrix, each column and each row represents a single industry. Each column shows the amount of input that is used by a single sector. A row shows the amount of output a single sector provides to all other sectors. The three by three matrix in the top left corner of the table represents the intermediate transactions. Industry 1 sells goods and services to other industries in the region (x_{11} to industry 1, x_{12} to industry 2 and x_{13} to industry 3). Industry 1 also buys goods and services from other industries in the region (x_{11} from industry 1, x_{21} from industry 2 and x_{31} from industry 3). Households (C_1) and other institutions

(I_1) purchase goods and services from industry 1 as final demands. Industry 1 also makes payments such as labor (L_1), rents, imports, etc. (V_1) to households and other institutions as value added.

Table 2-1. Basic Input-Output Transactions Table

From \ To		Purchasing sectors 1	2	3	Final Demand households	other institutions	Total Output
Producing sectors	1	x_{11}	x_{12}	x_{13}	C_1	I_1	X_1
	2	x_{21}	x_{22}	x_{23}	C_2	I_2	X_2
	3	x_{31}	x_{32}	x_{31}	C_3	I_3	X_3
Value added	labor	L_1	L_2	L_3	L_C	L_I	L
	other value added	V_1	V_2	V_3	V_C	V_I	V
Total outlays		X_1	X_2	X_3	C	I	X

Source: "Input-Output and Regional Economics" (Richardson, 1972).

The first row of the table can be simplified as a mathematical equation:

$$X_{11} + X_{12} + X_{13} + C_1 + I_1 = X_1$$

where $C_1 + I_1$ equals total final demand.

Since the idea of multiplier analysis is to estimate the changes in total industry output (X) resulting from changes in final demand (Y), it is essential to know the mathematical relationship between X and Y. The above equation can be rewritten as:

$$X_1 - a_{11} * X_1 - a_{12} * X_2 - a_{13} * X_3 = Y$$

where $a_{ij} = X_{ij} / X_j$, the coefficient that specifies the amount of input industry i needs to produce a unit of j. Now the simplified transactions of the three-sector economy can be presented in matrix form as:

$$\begin{bmatrix} X_1 \\ X_1 \\ X_1 \end{bmatrix} - \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix}$$

or

$$\mathbf{X - A X = Y}$$

where **X** and **Y** are vectors of output and final demand and **A** is the matrix of coefficient a_{ij}. By restoring an identity matrix **I** to the equation, it can be written as:

$$\mathbf{X *(I - A) = Y}$$

or

$$\mathbf{X = (I - A)^{-1} Y}$$

where $\mathbf{(I - A)^{-1}}$ is the Leontief inverse matrix. The elements of the matrix represent the purchases from one industry to others in order to produce another unit of output for the final demand. Since multiplying this matrix by a vector of final demand **Y** will produce the output **X**, this matrix also represents the multiplier effects. The multipliers for each sector can be calculated from this matrix. The summation of each column in the matrix is the multiplier for the matching industry of that column.

Comparisons Between I-O and Economic Base Models

I-O methods have become the primary tools for tourism economic impact analysis. The use of I-O models to estimate economic impacts of recreation and tourism has increased considerably in the last couple of decades because of the ability to provide accurate and detailed information as well as the ease of interpreting the results (Stevens and Rose, 1985; Summary, 1987; Fletcher, 1989). One major advantage of the I-O model is that it provides detailed information on direct, indirect and induced effects of visitor spending on all economic measures for different industries in the local economy (Loomis and Walsh, 1997 p-254).

Economic base models, on the other hand, have not received as much attention by regional economists as the I-O models. Richardson claims that,

> "Economic base models have had a long and checkered history, going back to the 1940's and even earlier. They have not been quite academically respectable, and the revival of research on measuring the economic base in the 1970's was unexpected."

However, he also comments that,

> "(economic base models) have staged something of a revival since the late 1960's because of their incorporation in regional econometric models..... they offer a clear link from the national economy to the region within a standard macroeconometric (income determination) framework" (Richardson, 1985).

Multipliers derived from I-O models capture how sectors of the economy are linked together within a region, but to develop I-O models require considerably more data and efforts than to develop economic base models.

Multipliers derived from economic base models, on the other hand, are relatively simple to develop in terms of data gathering and are much less expensive to apply, but these multipliers provide less detailed estimates because of the high level of aggregation. There is usually only one aggregate multiplier for a region (Archer, 1996; Eadington & Redman, 1991; Kottke, 1988; Richardson, 1985; Pleeter, 1980). Economic base models are not as widely used in tourism research. One reason is because tourism is part of many different sectors and it is difficult to allocate tourism-related industries into basic and non-basic sectors. The assumption that all types of export sales have the same multiplier effects and the assumption that all the regional economic growth is attributable to export sales only are also impractical for tourism and recreation applications (Krikelas, 1992).

Archer's "tourist regional multiplier" approach is one of the few applications of economic base models to tourism and recreation. While adapting the economic base approaches, Archer's tourism regional multiplier approach includes two important components for tourism applications- the propensity of consumption by different visitor segments, and shares of tourist spending in different industries (Archer and Owen, 1971; Archer, 1973). Archer's concept of a tourist regional multiplier is that the multiplier not only represents the region's economy for tourism sectors, but also reflects tourists' spending profiles. The tourist regional multiplier approach is equivalent to an aggregation of I-O multipliers when multipliers for different sectors are weighted in proportion to tourist spending they receive (aggregate multipliers).

Microcomputer-Based I-O Systems

I-O models have been used in the past mainly by academic economists. However, because of the ability of advanced microcomputers, I-O models have been packaged as ready-to-use computer software and database (Hastings and Brucker, 1993). Among these ready-to-use I-O models, IMPLAN and RIMS II are the most popular systems for recreation and tourism applications (Rickman and Schwer, 1995a, 1995b; Brucker, Hastings and Latham, 1990). The Bureau of Economic Analysis maintains an I-O model of the entire U.S. economy called RIMS II and can provide sector-specific multipliers for the U.S. or sub-regions. IMPLAN, on the other hand, provides software and database for estimating local models and impacts in a microcomputer Windows™ environment.

Besides RIMS II and IMPLAN, other ready-to-use systems were developed beginning in the mid 80's, e.g., ADOTMATR by Lamphear et al. (1983), RSRI by Stevens et al. (1983), SCHAFFER by Schaffer and Davidson (1985), and GRIMP by West (1983) (Brucker, Hastings and Latham, 1987, 1990; Deller et al., 1993). However, these models have not drawn as much attentions as RIMS II and IMPLAN and are not as widely used.

Another commercially available economic impact model is REMI (Regional Economic Models, Inc.). REMI is an economic simulation model that uses econometric and general equilibrium models to trace the total effects over time of changing economic conditions in a study area. REMI includes some I-O model embedded functions such as the computation of inter-industry relationships, plus

additional functions to forecast effects of future changes. However, economic simulation models involve greater analytic sophistication and cost than I-O models (Weisbrod and Weisbrod, 1997).

IMPLAN (IMpact analysis for PLANning)

IMPLAN is the source of multipliers used in this study. IMPLAN is an input-output modeling system that was originally developed by the US Department of Agriculture Forest Service as a tool to assist the Forest Service in land and resources management planning. IMPLAN began as a mainframe-computer application in the 80's. The Minnesota IMPLAN Group (MIG) began to work on IMPLAN in 1987, and IMPLAN has since migrated from the mainframe version to a DOS application (Olson and Lindall, 1993), and then to the current IMPLAN Pro Windows™ version (Minnesota IMPLAN Group, 2000; Propst, 2000).

Like most non-survey I-O modeling systems, IMPLAN uses the national I-O matrices with regional data to create regional models (Charney and Leones, 1997; Bushnell and Hyle, 1995). IMPLAN generates detailed sector-by-sector reports that can include as many as 528 industry sectors for a given region. IMPLAN's sectoring scheme is based on the Standard Industry Classification (SIC) code system and the Bureau of Economic Analysis I-O sectoring, and for the most part, is similar to a 3 and 4 digit SIC code system (Minnesota IMPLAN Group, 2000).

The original DOS version of IMPLAN (before 1995) calculates Type I and Type III multipliers while the current Windows version calculates Type I, II and Type SAM multipliers. The Type I multipliers capture indirect effects while the Type II, Type III and Type SAM multipliers capture both indirect and induced effects resulting from the changes of final demands.

$$\textit{Type I multiplier} = \frac{\text{direct effects + indirect effects}}{\textit{direct effects}}$$

$$\textit{Type II (Type III, Type SAM) multiplier} = \frac{\textit{direct effects + indirect effects + induced effects}}{\textit{direct effects}}$$

IMPLAN Pro 2.0 generates Type SAM multipliers to capture the total effects. The SAM framework tracks both market and non-market flows. The non-market flows are transactions between non-industrial institutions such as households to government, government to households and so on. These flows are called inter-institutional transfers (Alward and Lindall, 1996). Since total personal income is income from all sources, including employment income and transfer payments that are based on both place of work and place of residence, some of this income may not be related to personal consumption expenditures in the region. The SAM multiplier approach enables the model to account for commuting, social security tax payments, household income tax payments and savings and hence adjusts the Type II multipliers for income that is not normally

respent immediately within the region, such as commuting workers who live outside the region and retirement benefits (Minnesota IMPLAN Group, 2000). The Type SAM multipliers are more conservative than the traditional Type II multipliers for tourism and recreation applications as the induced effects are smaller and are likely more realistic for tourism and recreation applications (Stynes et. al., 2000).

Social accounts have to be constructed in IMPLAN before economic multipliers can be computed. Social accounts are the trade flows that specify the transfers of goods and services between the region and the rest of the world. There are several possible assumptions regarding imports, exports, and the propensity that the final demand can be met locally with the generation of social accounts. IMPLAN Pro provides three options for constructing social accounts (Minnesota IMPLAN Group, 2000-p 141):

1. Regional Purchase Coefficients (RPC's)[4]. This approach uses an econometric equation to predict the percentage of goods that are purchased locally based on a region's characteristics.
2. Supply/Demand Pooling. This approach assumes everything that can be purchased locally will be purchased locally. This approach will maximize the multipliers since it assumes consumers will not buy imports unless the local supply cannot meet the local demand.

[4] See "IMPLAN RPC's" (Minnesota IMPLAN Group, 2001) for details on how RPC's are used in IMPLAN models. See "Use of IMPLAN to Estimate Economic Impacts Stemming from Outdoor Recreation Expenditures in the Upper Lake State" (Pederson, 1990) for details on how RPC's will affect the estimates of economic multipliers using IMPLAN.

3. Location Quotients (LQ). This approach measures an industry's relative concentration compared to a base area. LQ assumes that the commodity will be purchased more locally if more production exists in the region (relative to the national average).

IMPLAN allows users to modify production functions, regional purchase coefficients and other base trade flows that can alter the estimates of multipliers. Like other I-O modeling systems, IMPLAN is based on five key assumptions (Minnesota IMPLAN Group, 2000-p 103):

1. "Constant returns to scale. This means the production functions are considered linear; if additional output is required, all inputs increase proportionally.
2. No supply constraints, supplies are unlimited. An industry has unlimited access to raw materials.
3. A fixed commodity input structure implies that price changes do not cause a firm to buy substitute goods.
4. Homogenous sector output: An industry won't increase the output of one product without proportionally increasing the output of all its other products.
5. Industry technology assumption assumes that an industry uses the same technology to produce all its products. An industry has a primary product and all other products are byproducts of the primary product."

IMPLAN calculates economic ratios and multipliers for output (sales), income, value added, and jobs. IMPLAN's industry output data at the national level is from the BEA's output series and the Annual Survey of Manufacturers. The Bureau of Labor Statistics (BLS) growth model is also used in cases where the census or survey data are not available. IMPLAN uses the national output per worker multiplied by state or county employment to get the total industry

output in the region. The regional industry output is then adjusted based on how the value added to employment ratios in the region deviate from the national averages (Minnesota IMPLAN Group, 2000-p 255).

IMPLAN's job effects (employment) include wage and salary employees and self-employed jobs in the region. They are not full-time equivalents, but count any full-time or part-time job as one job. The employment data comes from three sources: The U.S. Department of Labor's ES-202 data, the U.S. Department of Census' County Business Patterns (CBP), and BEA's Regional Economic Information System (REIS). IMPLAN's employment multiplier report illustrates the structure of IMPLAN's multiplier reports. IMPLAN's job multiplier report includes direct, indirect, induced and total effects based on $1 million of sales in the matching industry (Table 2-2).

Table 2-2. Sample IMPLAN Multiplier Report- Employment (1996, US)

Sector	Direct effects[a]	Indirect effects[a]	Induced effects[a]	Total effects[a]	Type I multiplier[b]	Type SAM multiplier[c]
463 Hotels And Lodging Places	17.22	7.65	9.77	34.64	1.44	2.01
454 Eating and Drinking	28.93	7.73	9.79	46.45	1.27	1.61
488 Amusement And Recreation	26.44	7.15	9.48	43.07	1.27	1.63
432 Manufacturing	9.34	8.18	8.72	26.23	1.88	2.81

a. Per million dollars of output.

b. Type I multiplier = (Direct effects + Indirect effects) / Direct Effects

c. Type SAM multiplier = (Direct effects + Indirect effects + Induced effects) / Direct Effects

Ratio multipliers are reported in the two multiplier columns. The numbers in the "Total Effects" column are *economic multipliers* in this study (ratios of total

job to direct sales), while the numbers in the "Direct Effects" column represent economic ratios (direct job to direct sales). The numbers in the "Type I Multiplier" and "Type SAM Multiplier" columns are the ratio type multipliers.

IMPLAN's value added data consists of four components, employee compensation, proprietor income, other property income, and indirect business taxes. The first two components are also called personal income (or labor income) in the IMPLAN Windows™ version. Value added data are controlled to match the National Income and Produce Accounts (NIPA) published by BEA. The sources of IMPLAN's value added data are the same as the employment data. However, if income information is not disclosed at the county level, the state level income per worker ratios are used. IMPLAN's income and value added multiplier reports are similar to the employment multiplier reports.

Variations in Economic Multipliers

Based on a review of previous recreation and tourism studies, the type II sales multiplier is the most frequently reported multiplier and IMPLAN is the most widely used system. In tourism studies Type II sales multipliers vary from 1.2 to 2.4 for local areas and is normally larger than 2.4 for state and national regions (Table 2.3). The national tourism sales multiplier for the U.S. in 1996 was 2.95 from the Corps of Engineers marina slip renter trip spending study (Chang et al., 2000). Tourism sales multipliers for state or local areas should be smaller.

Table 2-3. Sample Tourism and Recreation Economic Impact Studies

Author (Date)	Study region	Activity	Sources of Multipliers	Multiplier Values[a]	Notes
Economic Base Model/ Aggregate Multiplier Approach					
Archer and Owen (1971)	Rural area (Anglesey, an island off northwestern Wales)	Tourist spending	Archer's Tourist Regional Multipliers	Income = 0.25	Ratio of total income effects to visitor spending is reported.
Gartner and Holecek (1983)	Metro area (Detroit, MI)	Michigan Boat and Fishing Show visitor spending	Borrowed	Income = 2.0	
Gunderson and Kreag (1991)	State (Minnesota)	Recreational fishing spending	Professional judgment	Sales= 1.3 – 1.8	The authors suggest a range of multipliers rather than one number.
Sector-Specific Multiplier Approach					
Gazel (1998)	States (WI & IL)	Casino gambling	RIMS II	Sales = 1.46 – 2.40 (for WI) Sales = 2.11 – 2.44 (for IL)	Multiplier ranges represent values across sectors.
Travel Industry Association (2000)	U.S. and States	Tourist spending	RIMS II	*National:* Sales = 2.4 Income = 0.72 Jobs = 36.6	Only national multipliers are reported.

Table 2-3. (cont'd)

Author (Date)	Study region	Activity	Sources of Multipliers	Multiplier Values[a]	Notes
Sector-Specific Multiplier Approach					
Frechtling & Horvath (1999)	Metro area (Washington, D.C)	Tourist spending	RIMS II	Sales = 1.25 – 1.40 Income = 0.1 – 0.24 Jobs = 3.6 – 17.9	Multiplier ranges represent values across sectors.
I-O Model					
Fletcher (1989)	Selected countries, cities, and regions	Tourist spending	Various reports and publications	Income = 0.19 – 1.96	
Chang et al., (2000)	U.S.	CE marina slip renters' boating trip spending	IMPLAN	Sales = 2.95 Income = 1.38 Jobs = 37	
Stynes and Rutz (1995)	Three county rural area in KY	Spending by Mammoth Cave National Park visitors	IMPLAN (DOS version with Type III multipliers)	Sales = 1.93 Income = 1.94 Jobs = 1.46	Ratio multipliers are reported.
Bergstrom et al., (1990)	Regions (rural) surrounding 5 Georgia State Parks	Tourist spending	IMPLAN (earlier version with 1982 data)	Sales = 1.48 – 1.97 Income = 1.55 – 2.14 Jobs = 1.21 – 1.52	Ratio multipliers are reported.
English et al., (1996)	Three counties in South Florida	Tourist spending	IMPLAN	Sales = 1.6 – 2.3 Income = 1.6 – 2.2 Jobs = 1.6 – 1.9	Ratio multipliers are reported.

Table 2-3. (cont'd)

Author (Date)	Study region	Activity	Sources of Multipliers	Multiplier Values[a]	Notes
I-O Model					
Propst et al., (1998)	Counties surrounding Corps of Engineers Projects	Visitor spending	IMPLAN (revised Type III multipliers)	Sales = 1.37– 1.99 Income = 0.66 – 1.11 Jobs = 28 – 62	The authors adjusted the induced effects downward.
Crompton (1999)	Seven U.S. metro cities	Sports tournaments and special events	IMPLAN	Sales = 1.78 – 2.41 Income = 0.65 – 0.90 Jobs = 33.8 – 49.4	
USDI, Fish and Wildlife Service (1998)	50 states and the U.S.	Wildlife watching	IMPLAN	*National:* Sales = 2.92 Income = 0.83 Jobs = 34.6 *State:* Sales = 1.37 – 1.78	
Archer and Fletcher (1996)	Seychelles	Tourist spending	Archer's I-O model/ primary data	Income = 0.88 Jobs = 15.8	Jobs multiplier is per 1 million SEYRs. One US dollar = 5.4 SEYRs.

a. Multiplier range represents values across regions unless otherwise specified in notes. All multipliers reported are Type II unless stated in notes.

Economic multipliers reported in these studies demonstrate considerable variations across regions, sectors and sources. Three studies cited here use an aggregate multiplier. Archer and Owen's "Tourist Regional Multiplier" was estimated with the authors' own economic model, one study uses the "so-called" standard multiplier of 2.0 and one is based on professional judgment.

Many studies have used RIMS II multipliers. Most of the studies reviewed here estimate state-level impacts or adjust state-level multipliers to local areas. Mak (1989), for example, applied RIMS II multipliers to tourist spending in each of the 50 states and the District of Columbia to estimate economic impacts of tourism spending (Mak, 1989). Frechtling and Horvath extended the analysis to Washington D.C., where the RIMS II sales multipliers ranged from 1.24 for the Local Transportation sector to 1.38 for the Hotel and Lodging Places sector. Total job to sales ratios in this study ranged from 17 to 7 for these two sectors, respectively (Frechtling and Horvath, 1999). RIMS II sales multipliers for tourism sectors at the state level are generally around 2.0.

Input-output models are applied more at sub-state regions compared to the multiplier approaches because the availability of data. The Type II sales multipliers estimated from IMPLAN varied from 1.37 for regions surrounding CE recreation projects (Propst et al., 1998) to 2.3 for Dade County in Florida (English et al., 1996). Note that some earlier estimates with IMPLAN tend to be larger, with regional sales multiplier approaching 2.0 at sub-state level (Stynes and Rutz, 1995). This is due to the upward bias IMPLAN has with induced effect

estimates for its Type III multipliers. This problem will be discussed later in this chapter.

Fletcher compiled income multipliers estimated from I-O models for 30 countries, cities, and regions around the world. The ranges of these multipliers varied from 0.19 for the City of Winchester, UK to 1.96 for Turkey. When he ranked these multipliers in order he found that the multipliers are larger for regions with larger and more developed economies (Fletcher, 1989).

Research has shown that multipliers are influenced by the geographic size, population, and economic development of the region (Tooman, 1997; Detomasi, 1987; Propst and Gavrilis, 1987; Fletcher, 1989; Becker, 1997; Olfert and Stabler, 1994). Baaijens et al. took income multipliers from 11 studies and estimated regression models by using population, area size, number of tourist arrivals, and other regional characteristics to predict income multipliers. They found that there is a positive relationship between the natural log of population and the tourist income multiplier (Baaijens et. al., 1998). Chang et al. found similar results using regional characteristics to predict sales multipliers for regions surrounding 50 Corps of Engineers Lakes. They concluded that sales multipliers could be best predicted by using a combination of area size and a logarithmic variable representing the region's economic activity (Chang et al., 1999).

Variations Across Economic Models and Changes Over Time

Although this study focuses on variations in multipliers across sectors and regions, multipliers can also vary between different models and can change over time. Borgen and Cooke (1990) compared the output multipliers of the 1977 RIMS model with the earlier version of IMPLAN (1982) for the State of Idaho. They found that the IMPLAN Type III multipliers were consistently lower than the RIMS II Type II multipliers in 29 out of 35 comparable industry sectors. The RIMS II multipliers were greater than IMPLAN's by an average of 7 percent, with differences ranging from 2 to 34 percent. The six sectors where IMPLAN multipliers were higher than RIMS II are hotels/lodging and amusements, eating and drinking places, retail trade, wholesale trade, insurance, and rubber and leather products. All but one of these six sectors are service oriented and are labor intensive. Brucker et al. (1990) compared five Input-Output models to estimate economic impacts of seven economic scenarios from petroleum refining in Texas to poultry processing in North Carolina. While RIMS II output estimates were greater than IMPLAN for six of seven scenarios, IMPLAN income and employment estimates were higher on six of seven scenarios.

Multipliers estimated with the IMPLAN DOS version were compared with RIMS II and REMI (Regional Economic Models Inc.) models by Rickman and Schwer (1995a, 1995b). They compared output and employment multipliers for Clark County, Nevada for the nine largest sectors in this county. Their findings indicate that the IMPLAN Type III multipliers are generally larger than the other two model's Type II multipliers in these selected sectors. Note that as Clark

County is a highly recreation and tourism oriented region (Las Vegas), most of the selected sectors (hotel, amusement and recreation, eating and drinking, etc.) are highly labor intensive and would have lower than average wages and salary.

Researchers have concluded that the IMPLAN method for generating Type III multipliers overestimates multipliers in industries with lower than average wages and underestimates multipliers in higher paying sectors (Chang, 1999; Charney and Leones, 1997). IMPLAN's Type III multiplier approach assumes that income per job and household respending of this income does not vary across industry sectors. Tourism-related sectors generally pay below average wages and salaries due in part to the number of seasonal and part-time employees. The IMPLAN Type III multipliers are therefore overestimated for these sectors. Newer versions of IMPLAN (Windows versions, after 1995) generate Type II and Type SAM multipliers that are more comparable to the RIMS II Type II multipliers. Tourism analysts should use caution when comparing economic impacts of recreation and tourism from different versions of IMPLAN systems, and be aware of the upward bias in the IMPLAN Type III multipliers for tourism sectors (Chang, 1999).

Multipliers may also change over time because of price changes or structural changes in the economy (e.g., new industries move in to the region). Since sales, income, and value added multipliers are expressed as ratios of money to money, these multipliers may not change significantly over time (Loomis and Walsh, 1997). Job multipliers, when expressed as a ratio of number of job to direct sales, will be affected by changes in general price levels. The

IMPLAN manual suggests that users price adjust spending to the year of the model and multipliers.

Another approach is to price adjust job multipliers over time to match the year of the spending data (Propst et al., 1998; Stynes et al., 2000). This approach assumes that when there is no major change in the region's economic structures, multipliers will be reasonably stable. The sales and income multipliers won't change significantly and the job to sales ratios will change based on changes in general price levels over time.

Approaches to Estimating the Economic Impacts of Recreation and Tourism

The National Park Service's Money Generation Model (MGM), Bureau of Economic Analysis's RIMS II system, and Minnesota IMPLAN Group's IMPLAN I-O modeling systems are reviewed in this chapter. The MGM is a simple approach to estimating impacts of visitor spending while the other two are complete I-O modeling systems.

Money Generation Model – Aggregate Multipliers

The National Park Service's Money Generation Model is a simple one-page pencil and paper worksheet for estimating sales, tax (and income), and jobs effects of park visitor spending. This model first uses total visitation, average spending per visit, and the percentage of visitors from outside the region to estimate total non-resident visitor spending in the region. Total visitor spending is then applied to an aggregate sales multiplier to estimate total sales effects.

The MGM estimates total sales effects first, and then converts total sales to total tax and job effects. Note that the spending data used in MGM was the average per person per day rates for lodging and meals (USDI NPS, 1990). The MGM worksheet illustrates how to apply aggregate multipliers (Table 2-4).[5]

Table 2-4. Sample Worksheet for Money Generation Model for a Rural Area National Park in the Rocky Mountain Region

A. Sales Benefits from Tourism			
1	Estimated non-local percent of park use		50%
2	Total recreation visits		1,457,100
3	Average daily expenditures per person	$	66.47
4	Calculate direct sales (1) X (2) X (3)	$	48,426,719
5	Enter estimated sales multiplier (Type II) (range 1.2 – 2.8, average 2.0)		2.00
6	Calculate total sales benefits (4) X (5)	$	96,853,437
B. Tax Revenue Benefits from Tourism			
1	Estimated total sales from A.6	$	96,853,437
2	Enter combined state and local retail sales tax rate		7%
3	Calculate increased sales tax revenue (1) X (2)	$	6,779,741
4	Estimated total sales from A.6	$	96,853,437
5	Enter the taxable income ratio (range .20-.60, average 30%)		25%
6	Enter combined state and local income tax rate		17%
7	Calculate income tax revenue (1) x (5) x (6)	$	4,116,271
8	Compute total tax revenue (3) + (7)	$	10,896,012
C. Job Benefits from Tourism			
1	Estimated total sales from A.6 (in millions)		96.85
2	Estimate job to sales ratio (range is 10-50 jobs per million in sales, average = 30)		30
3	Calculate new jobs created by tourism (1) X (2)		2,906

Source: "Money Generation Model," USDI National Park Service (1990)

[5] For step-by-step instruction for the MGM worksheet, refer to "Money Generation Model" (USDI, National Park Service, 1990), or "Approaches to Estimating the Economic Impacts of Tourism; Some Examples," (Stynes, 1999b).

The MGM worksheet requires estimates of three aggregate multipliers: a Type II sales multiplier to compute secondary sales effects, a "taxable income ratio" to estimate income from sales, and an employment multiplier to estimate jobs from total sales. These multipliers appear on Line A5, B5 and C2 of the MGM worksheet (Table 2-4). A significant problem in applying the MGM model is choosing values of these three multipliers for a given region. National Park Service personnel are generally not familiar with economic multipliers and do not have access to I-O models or multipliers for their regions (Duffield et al., 1997; Stynes and Propst, 1999).

To implement the MGM model, the National Park Service made use of published sate level multipliers from RIMS II. In some cases these multipliers were "adapted" to local areas using judgment. In other cases state level multipliers were used in local applications. As RIMS II does not report multipliers for tourist spending, an average of two multipliers for the Hotel and Lodging Places and Eating and Drinking was used (Duffield et al., 1997).

RIMS II – Sector-Specific Multipliers

Sector-specific multipliers enable the impact analysis to capture variations in spending in different sectors. The Bureau of Economic Analysis's "Regional Multipliers: A User Handbook for the Regional Input-output Modeling System" demonstrates how to apply published sector-specific multipliers in an economic

impact analysis (USDC BEA, 1992).[6] The publication includes RIMS II (Regional Input-output Modeling System) 1989 output, income and employment multipliers for 39 industry sectors for each of the 50 states in the United Sates. State multipliers after 1989 and multipliers for sub-state regions are not available in published form but can be purchased from the BEA.

Table 2-5 is a sample table of RIMS II multipliers for the State of Michigan from the 1992 handbook. The multipliers are reported in two forms- as a ratio of total effects to direct sales effect (termed "final demand multipliers") and as a ratio of total effects to direct sales (termed "direct-effect multipliers").

Visitor spending on different items can be applied to multipliers for different sectors using this approach. Total economic impacts can be more accurately captured with the sector-specific multipliers since spending on different items will result in different impacts on the region's economy. For example, one million dollars spent by visitors on lodging would have different impacts on the region compared to the same amount of money spent on souvenirs. Applying one aggregate multiplier would not capture this difference since the $1 million would be applied to the same multiplier. However, when using sector-specific multipliers, as in BEA's RIMS II approach, the estimated secondary effects are across all industries rather than for any specific industry (Table 2-5).

[6] See "Regional Multipliers: A User Handbook for the Regional Input-output Modeling System," (USDC BEA, 1992), or "Approaches to Estimating the Economic Impacts of Tourism; Some Examples," (Stynes, 1999b) for step-by-step instructions for applying RIMS II multipliers.

Table 2-5. RIMS II State Multipliers for Michigan—Output Earnings, and Employment by Industry Aggregation

Sector	Final-demand multipliers			Direct-effect multipliers	
	Output[a]	Earnings[b]	Jobs[c]	Earnings[d]	Jobs[e]
Agriculture, forestry, and fisheries:					
Agricultural products and agricultural, forestry, and fishery services	1.7833	0.4433	35.1	2.0227	1.5571
Forestry and fishery products	1.3907	0.1655	9.7	4.3015	2.8744
Mining:					
Coal mining	1.0000	0.0000	0.0	0.0000	0.0000
Crude petroleum and natural gas	1.4477	0.1922	7.4	1.954	2.4041
Miscellaneous mining	2.1005	0.6123	23.1	2.0412	2.4836
Construction:					
New construction	2.1913	0.7068	30.2	2.262	2.4017
Maintenance and repair construction	2.1249	0.7839	31.7	1.816	2.0795
Manufacturing:					
Food and kindred products and tobacco	1.8095	0.3463	5.6	2.7893	3.5207
Textile mill products	1.8086	0.4338	17.2	2.1632	2.4775
Apparel	1.9003	0.5207	19.6	2.0166	2.5570
Paper and allied products	2.0230	0.4627	17.3	2.4461	2.9950
Printing and publishing	2.0890	0.6313	27.2	1.9957	2.1020
Chemicals and petroleum refining	1.8646	0.3814	13.5	2.6099	3.6920
Rubber and leather products	2.0897	0.5349	23.1	2.1968	2.1780
Lumber and wood products and furniture	2.1002	0.6155	25.1	2.2339	2.4543
Stone, clay, and glass products	2.0487	0.5704	21.4	2.1583	2.6170
Primary metal industries	2.1519	0.6099	21.7	2.3001	2.9811
Fabricated metal products	2.3508	0.7035	26.3	2.4326	2.8572
Machinery, except electrical	2.1657	0.7215	26.1	2.02	2.5140
Electric and electronic equipment	2.1782	0.6437	24.7	2.2883	2.6060
Motor vehicles and equipment	2.4770	0.5631	19.3	3.8872	6.4247
Transportation equipment except motor vehicles	2.1356	0.6068	22.2	2.3016	2.8092
Instruments and related products	1.9835	0.6288	25.1	1.9363	2.1917
Miscellaneous manufacturing industries	2.0648	0.5597	24.5	2.3398	2.3571

Table 2-5. (cont'd)

Sector	Final-demand multipliers			Direct-effect multipliers	
	Output[a]	Earnings[b]	Jobs[c]	Earnings[d]	Jobs[e]
Transportation and public utilities:					
Transportation	1.8959	0.7181	28.8	1.6852	1.9438
Communication	1.5725	0.4777	18.1	1.6155	2.0005
Electric, gas, water, and sanitary services	1.5810	0.2116	7.5	2.5793	3.6638
Wholesale and retail trade:					
Wholesale trade	1.7576	0.6537	24.2	1.5886	2.0117
Retail trade	1.9514	0.7817	48.7	1.6056	1.4420
Finance, insurance, and real estate:					
Finance	1.9620	0.7142	31.4	1.8422	2.0065
Insurance	2.2135	0.8286	33.8	2.002	2.3495
Real estate	1.2046	0.0793	3.7	5.4688	4.6981
Services:					
Hotels and lodging places and amusements	1.8605	0.5745	38.3	1.849	1.5260
Personal services	1.8953	0.7571	50.0	1.5949	1.3903
Business services	1.9725	0.8518	36.5	1.6153	1.7696
Eating and drinking places	1.9395	0.5800	49.9	1.8537	1.3398
Health services	2.0127	0.9067	39.2	1.5110	1.6294
Miscellaneous services	2.0881	0.7281	42.0	1.8223	1.5856
Households	1.0659	0.3317	17.5	.....	.....

a. Each entry in this column represents the total dollar change in output that occurs in all row industries for each additional dollar of output delivered to final demand by the industry corresponding to each entry.

b. Each entry in this column represents the total dollar change in earnings of households employed by all row industries for each additional dollar of output delivered to final demand by the industry corresponding to each entry.

c. Each entry in this column represents the total dollar change in number of jobs in all row industries for each additional dollar of output delivered to final demand by the industry corresponding to each entry.

d. Each entry in this column represents the total dollar change in earnings of households employed by all row industries for each additional dollar of earnings paid directly to households employed by the industry corresponding to each entry.

e. Each entry in this column represents the total change in number of jobs in all row industries for each additional job in the industry corresponding to each entry.

Source: "Regional Multipliers: A User Handbook for the Regional Input-output Modeling System," (USDC Bureau of Economic Analysis, 1992).

Table 2-6 illustrates sample visitor spending impacts estimated using sector-specific multipliers. Total visitor spending by visitors is listed for each category in column two. All spending on local services like lodging and recreation will accrue as direct sales (column 3). Purchases of goods are divided into retail margins and producer prices. Only the retail margins and the local production portion of the goods will be captured by the region's economy as direct sales in column three. The direct sales estimated from visitor spending for each category are then applied to multipliers for the matching sectors in column four to estimate the total sales effects (column five).

Table 2-6. Sample Visitor Impacts Estimated Using RIMS II Multipliers

Sector	Visitor Spending (000's)	Direct Sales[a] (000's)	Sales Multiplier[d]	Total Sales Effects (000's)
Eating and Drinking	$500	$500	1.94	$970
Hotels And Lodging Places	$400	$400	1.86	$744
Amusement And Recreation	$100	$100	1.88	$186
Groceries (local supplies)	$50	$40[b]	1.80	$72
Groceries (imports)	$450	-	-	-
Retail Trade	-	$100[c]	1.95	$195
Total	$1,500	$1,150	1.88[e]	$2,167

a. Direct sales are the local production portion of visitor spending and retail margins.
b. Total spending on locally produced groceries less retail margins.
c. Retail margins of purchase on groceries. A 20% retail margin is used and applied to the $50 spending on local produced and the $450 spending on imported groceries.
d. From Column 2, Table 2-5.
e. Computed as the ratio of total sales ($2,167) to direct sales ($1,150).

IMPLAN – I-O Modeling System

I-O models analyze the flow of monetary transactions from one industry to another and from the consumer to the producer. The transactions tables used in an I-O model include many industry sectors in the region and show the linkages among industry, households, government, and exports (Bulmer-Thomas, 1982; Minnesota IMPLAN Group, 2000). IMPLAN, for instance, generates a complete set of multipliers for up to 528 industry sectors for a given region at the county level.

I-O models enable the allocation of visitor spending to different industry sectors in a detailed manner. Some ready-to-use I-O models such as IMPLAN also handle the margins and local production issues. In addition to the detailed information provided by I-O models, the I-O approach also provides a number of advantages compared to the other two approaches. The researcher can customize an I-O model and focus on individual industry sectors. For example, analysts can single out the hotel sector and see which other sectors will be affected by spending on lodging and by how much. It also provides direct and secondary effects for individual sectors in which the researcher is interested.

Table 2-7 is a sample economic impact analysis report that was generated using IMPLAN. Economic impacts of Corps of Engineers marina slip renter spending on trips were estimated by applying visitor spending to an I-O model of the U.S. economy. The indirect and induced effects reported in Table 2-7 are the sales effects to individual row industries.

Table 2-7. Sales Effects of CE Marina Slip Renters' Trip Spending to the Nation

	Direct	Indirect	Induced	Total
SALES EFFECTS ($MM)				
Manufacture	302.34	335.67	243.06	881.07
Transportation & Services	33.18	235.56	466.30	735.04
Recreation	39.10	10.00	15.99	65.08
Hotel and Lodging	54.05	6.96	9.30	70.30
Eating and Drinking	176.30	4.41	30.53	211.24
Retail/ Wholesale	188.50	50.32	114.67	353.49
Government	1.84	10.44	18.16	30.44
Total	$795.30	$653.37	$898.00	$2346.67

Source: "Visitor expenditures and economic impacts by marina slip renters associated with the US Army Corps of Engineers" (Chang et al., 2000).

When applying tourism spending to an I-O model, spending must be allocated to production sector (industry) in the I-O model (Propst and Siverts, 1990). For example, visitor spending on groceries involves more than 50 sectors in the IMPLAN system. With a proper "bridging" scheme to match visitor spending to industry sectors in the model, more targeted and potentially meaningful results can be derived. The Micro-Implan Recreation Economic Impact (MI-REC) system was used to bridge the total spending into the appropriate industrial sectors of the I-O model (Stynes and Propst, 1998; Chang et al., 1998). However, this level of detail is only necessary if the goods are locally produced and the production functions vary significantly. If visitors spend only a small percentage of their overall spending on a given item, detailed attention to the corresponding sector will not significantly change the results, unless one is particularly interested in the impact of tourists on a particular industry.

Problems in Applying Multipliers to Tourism Impact Studies

There are four main categories of problems in applying multipliers to tourism impact studies, generalization errors, aggregation errors, incorrect application of multiplier, and failure to margin retail purchases.

Generalization Errors

Generalization errors occur when a multiplier for a region, sector, or time period is applied to another situation that is not the same. Many tourism analysts apply national or state level multipliers to sub-state regions or apply the largest multiplier that is available (Archer and Owen, 1971). Since the economic leakage in a sub-region is substantially higher than a larger region, this practice results in overestimated economic impacts. A similar abuse was also observed by Beattie and Leones (1993) as

> "...the 'all purpose' or 'standard' multiplier. These are multipliers that people pull out of the air because they don't have access to multipliers estimated using a full blown model or because they don't know any better. The most common ones we hear, are output multipliers of 3 or 3.5. These are large for state economies and even more so for county and city economies."

Burress (1989) notes that numerous Kansas reports quoted multipliers from a study by Heins (1982) contracted by the Institute for Economic and Business Research (IEBR) on the behalf of Kansas Chamber of Commerce and Industry. Although the Heins study was released but not endorsed by IEBR for its implausible methods and results, the multipliers reported in the Heins study

were heavily quoted in Kansas because they were much higher than results from other reports (Burress, 1989). The use of inappropriate multipliers for the tasks, especially to apply multipliers for a larger region to a smaller region, has been one of the most common abuses of economic multipliers (Beattie and Leones, 1993).

The key point for applying borrowed multipliers is whether the borrowed multipliers can adequately reflect the study region's economy (Holland, 1994; Chappelle, 1985). Even for the same economic activity, multipliers still vary across regions, sectors, and times. Borrowing multipliers from other regions without comparing the regional characteristics and proper adjustment can lead to significant errors in estimates.

Aggregation Errors

Aggregation errors occur when applying aggregate multipliers that fail to capture the variations of visitor spending. Visitors spend money on many items, and the money goes to many different sectors. Because economic ratios and multipliers vary from sector to sector, the same amount of money spent in different sectors can result in very different impacts. For example, $1 million spent in restaurants yields 50 jobs while the same amount spent on manufactured goods yields only 25 jobs in Michigan (based on BEA's RIMS II multipliers, see Table 2-5). The use of aggregate multipliers in studies of visitor spending cannot capture these variations.

Misapplication

Using inappropriate multipliers is also a common problem in tourism and recreation studies. There are many kinds of economic multipliers and ratios. On many occasions, inappropriate multipliers have been used due to ignorance or a lack of understanding of multipliers (Archer, 1984, Propst and Gavrilis, 1987). It is not uncommon for the analysts to fail to specify the kind of multiplier being used, to use the wrong multipliers (i.e., use sales multipliers to compute income effects), or to mix the "direct-effect" with the "final-demand" multipliers. For example, the final demand income multiplier is 0.57 for the Hotel and Lodging Places and the Amusement sector for the State of Michigan, while the direct-effect income multiplier is 1.85 (Table 2-5). The final demand income multiplier is based on *direct sales* effects (ratio of total income to direct sales), while the direct-effect income multiplier is based on *direct income* effects (ratio of total income to direct income). A common mistake in applying RIMS II multipliers is to apply the direct-effect income multiplier to the final demand (i.e., visitor spending in lodging) (Frechtling and Horvath, 1999). In this case, the total income will be overestimated by a factor of 3 if the direct effect multiplier is applied to direct sales on lodging.

Failure to Margin Retail Purchases

Another common error in recreation and tourism studies is to apply multipliers to total visitor spending, even though the manufactured goods purchased by visitors are not locally made. The retail prices paid by visitors are

called purchaser prices. The purchaser price includes the producer price (price of good at the factory) and retail, wholesale and transportation margins.

Purchaser Price = Producer Price + Margins (Retail, wholesale and transportation)

If the goods bought by visitors are not made locally, only the retail margin and possibly wholesale and transportation margins will be captured by the local economy as direct sales. For example, $100 worth of souvenirs purchased from a local shop may be broken down into two components: Producer price and margins.

Purchaser Price	=	Producer Price	+	Margins
$100		$60 ($15 local)		$40 ($30 local)

Only the portion of local productions ($15 of the $60 in producer prices) and the local margins ($30 of the $40 in margins) will accrue to the local economy as direct sales.

Direct sales effects = $45 ($15 Local Production + $30 Local Margins)

Since multipliers are ratios of total effects to the direct sales effects, they should only be applied to direct sales that will accrue to the region (Archer, 1984; Stynes, 1998). Therefore, if goods purchased by the visitor are not manufactured in the local region, there will be no direct effect for the manufacturing sector in the region. Only the margins will stay in the region. In

analyzing the economic impacts of tourist spending, all purchases of services will accrue to the local region, but only the local margins (retail and locally operated wholesale and transportation) on goods should be treated as direct effects when the goods are not manufactured in the region.

This chapter has reviewed studies of economic multipliers and their applications in tourism and recreation studies. Economic multipliers vary across industry sectors and regions. Despite the growing use of economic multipliers and regional economic models in recreation and tourism, limited guidance is available for choosing multipliers suitable for a given application. I-O models provide detailed estimates of both direct and secondary effects. However, users must have access to I-O modeling systems such as IMPLAN and have some knowledge of regional economics. Few recreation and tourism analysts have formal training in regional economic methods and most are not very familiar with input-output models or multipliers. Sector-specific multipliers provide a compromise between easy and accuracy for recreation and tourism applications.

Chapter 3

RESEARCH METHODS

The research objectives for this study are to describe variations in economic multipliers for tourism sectors, to identify key factors that explain the variations, and to propose and evaluate procedures for predicting tourism multipliers for a given region. To achieve these objectives, 114 regions varying in size and economic development were selected. Input-output models estimated with IMPLAN were developed for each of these regions and multipliers were extracted. Variations in multipliers were examined by comparing multipliers for recreation and tourism-related sectors across these regions. Regression models were estimated to identify regional characteristics that explain the variations in multipliers. A simple "multiplier lookup" procedure was developed for choosing multipliers for a given region. The lookup and regression approaches for predicting multipliers were both evaluated and compared.

Select Study Regions

One hundred and fourteen regions in five states (California, Colorado, Florida, Michigan and Massachusetts) were selected. These five states were selected mainly based on the availability of data. Michigan State University has purchased the datasets from the Minnesota IMPLAN Group for a project to revise the National Park Service's Money Generation Model (Stynes and Propst, 1999). Regions from these five states include a wide variety of regional characteristics,

which is an essential component for this study. Regions were selected to cover different population sizes, geographical sizes, and degree of economic development. These regions were formed into one of the following four categories:

1. State regions for each of these five states (California, Colorado, Florida, Michigan and Massachusetts) to represent the state level economies.
2. Metropolitan Statistical Areas (MSA's) in these states (about 70 models). The MSA is defined by USDC Bureau of Economic Analysis as "a geographic area consisting of a large population nucleus together with adjacent communities having a high degree of economic and social integration with the nucleus" (USDC BEA, 2001). Each MSA consists of one or several contiguous counties. MSA's are semi-self-sufficient economic units that include places for people to live, work, and consume. They are also called functional economic areas and are recommended to serve as economic impact study regions (Minnesota IMPLAN Group, 2000).
3. Regions surrounding National Parks (30 to 50 mile radiuses) that include gateway cities to National Parks to represent economies of tourism regions (about 20 models, some overlap with regions in category 2).
4. Single or multiple county non-metro regions (about 20 models). Regions that consist of single or multiple counties were formed to

represent low economic development areas. These are regions in rural areas with low populations that are not included in the other three categories.

A complete list of all of the 114 regions selected for this study is given in Appendix A.

Develop I-O Models and Extract Economic Multipliers

Input-output models were built for each of the 114 regions using IMPLAN Pro version 2.0 with the 1996 IMPLAN database (the most current year available at the time). Economic multipliers (using IMPLAN Pro's Type SAM multiplier method) were estimated within IMPLAN. The default Regional Purchase Coefficients approach was used to estimate trade flows for estimating multipliers.

IMPLAN stores all model information including multipliers in a Microsoft Access™ database file. An Excel file with Visual Basic Macros was developed to extract the relevant data from these files. Information that was extracted included the 1996 base year data (industry output, income, value added, and jobs), multipliers (for sales, income, value added, and jobs), regional purchase coefficients (RPC's), and population and area sizes of the study regions.

Table 3-1 summarizes the economic ratios and multipliers that were extracted for this study. Eight different economic ratios and multipliers for four economic measures were extracted. The income data extracted for this study is IMPLAN's personal income (also called labor income). IMPLAN's personal

income consists of *employee compensation* (all income to workers paid by employers) and *proprietor income* (payments received by self-employed individuals as income).

Table 3-1. Economic Multipliers and Ratios Used in this Study

Economic measures / Multipliers	Sales	Income	Value Added (VA)	Jobs
Direct effect ratio	---	$\frac{\text{direct income}}{\text{direct sales}}$	$\frac{\text{direct VA}}{\text{direct sales}}$	$\frac{\text{direct jobs}}{\text{direct sales}}$
Type I multiplier	$\frac{\text{direct + indirect sales}}{\text{direct sales}}$	---	---	---
Type II multiplier	$\frac{\text{total sales}^a}{\text{direct sales}}$	$\frac{\text{total income}^a}{\text{direct sales}}$	$\frac{\text{total VA}^a}{\text{direct sales}}$	$\frac{\text{total jobs}^a}{\text{direct sales}}$

a. Total effects = direct + indirect + induced effects

Choice of Industry Sectors

Multipliers and ratios for 12 tourism-related sectors were selected for this study (Table 3-2). These 12 sectors were selected to match spending categories used in the National Park Service's Money Generation Model 2 (Stynes et. al., 2000). There are ten spending categories in the MGM 2 to identify the kinds of goods and services a typical visitor will buy. Besides multipliers for the ten sectors that match the ten spending categories in MGM 2, multipliers for the retail and wholesale trade sectors were also extracted to accommodate the margins of visitor spending on merchandise (Table 3-2).

Table 3-2. Tourism Sectors and Corresponding Spending Categories

Spending Category	IMPLAN Sector Name	Sector #
Lodging	Hotels and Lodging Places	463
Restaurant or food on-site	Eating and Drinking	454
Recreation and entertainment	Amusement and Recreation	488
Retail margins on goods	Retail Trade	448-453, 455[7]
Whole sale margins on goods	Wholesale Trade	447
All auto expenses other than gas and oil	Auto Repair and Services	479
Local transportation (taxis, buses, etc.)	Local Transportation	434
Gas and oil	Petroleum Refining	210
Sporting goods	Sporting Goods	421
Grocery, or food off-site	Food Processing	103
Clothing	Apparel	124
All other miscellaneous goods	General manufacturing	432

Table 3-3 is an example of the multiplier table for one of the 114 regions. Eight different economic ratios and multipliers plus regional purchase coefficients were extracted for each of the12 industry sectors. All Type II multipliers are ratios of total effects to *direct sales effects*. These Type II multipliers were extracted from the "total effects" columns in IMPLAN's multiplier reports. RPC's represent the proportion of local demand satisfied by local producers. RPC's are applied to the producer prices of goods purchased by visitors to allocate the direct sales effects to the local economy.

[7] There are seven IMPLAN retail trade sectors: 448 Building Materials & Gardening Supplies, 449 General Merchandise Stores, 450 Food Stores, 451 Automotive Dealers & Service Stations, 452 Apparel & Accessory Stores, 453 Furniture & Home Furnishings Stores, and 455 Miscellaneous Retail. The average of these seven sectors was used in this study.

Table 3-3. Michigan Statewide Multipliers – 1996

IMPLAN Sector Name	Sector No.	Direct Effect Ratio			Type II multiplier				Type I	
		Jobs/ $MM Sales	Income/ Sales	Value Added /Sales	Sales	Jobs/ $MM Sales	Income / Sales	Value Added/ Sales	Sales	Model RPC[a]
Hotels and Lodging Places	463	22.79	0.34	0.52	1.70	32.72	0.60	0.96	1.40	44%
Eating and Drinking	454	30.91	0.35	0.49	1.66	38.97	0.57	0.87	1.38	89%
Amusement and Recreation	488	30.72	0.35	0.58	1.65	39.67	0.60	0.98	1.35	66%
Retail Trade	N/A[b]	28.07	0.51	0.80	1.52	35.16	0.70	1.12	1.17	95%
Wholesale Trade	447	8.39	0.41	0.69	1.53	15.68	0.61	1.02	1.23	63%
Auto Repair and Services	479	11.97	0.32	0.50	1.60	19.30	0.53	0.85	1.33	49%
Local Transportation	434	27.09	0.58	0.69	1.61	35.22	0.81	1.06	1.20	45%
Petroleum Refining	210	0.61	0.05	0.14	1.38	3.96	0.14	0.35	1.30	20%
Sporting Goods	421	8.28	0.27	0.52	1.53	14.65	0.47	0.83	1.30	3%
Food Processing	103	5.34	0.15	0.30	1.54	11.84	0.34	0.60	1.37	57%
Apparel	124	11.33	0.33	0.39	1.51	17.80	0.51	0.69	1.25	2%
Manufacturing	432	9.05	0.26	0.45	1.56	15.80	0.46	0.77	1.32	3%

a. Regional purchase coefficient.
b. Retail is an average of seven retail trade sectors.

Local Purchase Coefficients (LPC) are used to estimate the portion of tourist spending that accrues to the local economy as direct sales. LPC's are 100% for visitor spending on services (e.g., Eating and Drinking Places, Recreation and Amusement, etc.) and retail trade, since all these expenditures will accrue to the region.

IMPLAN's RPC's are used to estimate local production for wholesale trade, transportation and all manufacturing sectors. Use of LPC's may be illustrated using visitor spending on gasoline as an example. The national average retail margin on gasoline is 22% and the wholesale margin is 8% (USDC Census bureau, 1998a; 1998b). For each $100 that visitors spend on gasoline, $30 goes to the retail and wholesale sectors as margins and the remaining $70 (the producer price) is allocated to the Petroleum Refining sector. The RPC for the Petroleum Refining sector is 20% for Michigan (Table 3-3). Thus, only 20% of this $70, or $14, will accrue to the Michigan Petroleum Refining sector. The other $54 represents imports to the region and does not accrue as direct sales to the local economy.

Defining a Tourism Multiplier

To explain general finding for the four primary tourism sectors, lodging, eating and drinking, recreation and amusement, and retail trade, a "tourism multiplier" is defined as:

Tourism multiplier = 0.32 X Lodging Multiplier +
0.29 X Eating and Drinking Multiplier +
0.13 X Recreation Multiplier+
0.26 X Retail Trade Multiplier

Tourism multipliers were computed as weighted averages of the multipliers for the four primary tourism sectors. These four tourism sectors

account for more than 80 percent of the sales from a typical visitor spending and are the focuses of this study (Table 3-4). Multipliers for these four tourism sectors were weighted into a tourism multiplier in proportion to the percentage of the direct sales they receive.

Table 3-4. Weights for Combining Multipliers into a Tourism Multiplier

Sector	Percent of Spending	Percent of Direct Sales[a]	Weight = Percent among top four categories
Lodging	22%	27%	32%
Eating and Drinking	21%	25%	29%
Recreation	9%	10%	13%
Retail Trade	-	20%	26%
Local Production	12%	18%	
Imports	36%	-	
Total	100%	100%	100%

Source: "Money Generation Model 2" (Stynes et al., 2000).
a. Spending on goods is divided into retail margins and producer prices. Only the retail margins and the local production portion of the goods are captured by the region's economy as direct sales.

One of the study objectives is to explain how multipliers vary across regions. As multipliers for the primary tourism sectors are highly correlated (pages 69-70), variations may be largely captured by the aggregate tourism multiplier, defined above.

Describe Variations in Multipliers

The first study objective is to describe variations in economic multipliers and ratios across sectors and regions. Descriptive statistics were first computed for the population, area size, and population density across all 114 regions.

Means, medians, minimums, maximums, standard deviations, and coefficients of variations were computed to illustrate the variations in regional characteristics across regions.

Averages of multipliers, ratios, and RPC's among all regions were then computed for the 12 tourism-related sectors. The differences in multipliers and ratios across sectors were compared to evaluate the variations of multipliers across sectors.

Means, medians, minimums, maximums, ranges, standard deviations, and coefficients of variations of multipliers and ratios among all regions were then computed and compared for each sector. These basic descriptive statistics show how multipliers vary across regions. Values of Type II tourism multipliers were also plotted for sales, income, value added, and jobs to illustrate the distributions of multipliers across regions.

Identify Key Factors that Explain Variations in Multipliers

The second study objective is to identify key factors that explain variations in economic multipliers and ratios across regions. Correlation coefficients were first computed for all multipliers and regional characteristics to examine relationships among these variables. Regression models were then estimated to identify the best set of regional characteristics for explaining the variations in multipliers. The factors identified are used to help characterize groups of regions in the next section, and the results of the regression models are used as a benchmark to evaluate the "multiplier lookup" procedure in the next section.

Tourism multipliers for four economic measures, sales, income, value added, and jobs, were used as dependent variables in four regression models. The four linear regression models (ordinary least squares) hypothesized for this study are:

1) Type II Sales Multiplier = $a_0 + a_1R_1 + a_2R_2 + a_3R_3 + a_4R_4 + a_5R_5$

2) Type II Income Multiplier = $a_0 + a_1R_1 + a_2R_2 + a_3R_3 + a_4R_4 + a_5R_5$

3) Type II Value Added Multiplier = $a_0 + a_1R_1 + a_2R_2 + a_3R_3 + a_4R_4 + a_5R_5$

4) Type II Job multiplier = $a_0 + a_1R_1 + a_2R_2 + a_3R_3 + a_4R_4 + a_5R_5$

where

R_1 = Population

R_2 = Area size

R_3 = Population density

R_4 = Natural log of population

R_5 = Natural log of area size

Since one of the research objectives is to develop a tool to simplify the selection of multipliers for recreation and tourism applications, only regional characteristics that are readily available to recreation and tourism managers were tested as independent variables. Based on the literature review, all independent variables were introduced in their original values and as logarithmic values.[8] A stepwise regression procedure was used to help define the best

[8] The natural log of population density was not included since it is a function of the natural log of population and the natural log of area. For any given region, ln(population density) = ln(population) – ln(area).

subset of regional characteristics to explain the variations of multipliers (Hauser, 1974).

The mean absolute percent errors (MAPE) and the maximum of APE's were computed for all four models by comparing the multipliers predicted by regression model to the multipliers estimated by individual I-O model to evaluate the possible range of errors of the regression approach.

$$\text{MAPE} = \frac{\Sigma \left| \text{predicted value - individual multiplier} \right|}{\Sigma \text{ individual multiplier}}$$

Propose and Evaluate Procedures for Predicting Multipliers

The third study objective is to propose and evaluate procedures for predicting multipliers for a given region. Regression models in the previous section provide one approach to predicting multipliers. A "multiplier lookup" procedure that can lead the users to choose multipliers for a given class of region based on the regional characteristics identified in Objective 2 was also developed. Regression models yield continuous predictions of multipliers while a lookup approach will identify a small number of discrete points from which users may select. A regression approach requires measures of the independent variables to make predictions, and allows only quantitative variables. A lookup approach can capture factors that are not easily quantified (e.g., central place theory, similarities between regions, etc.) in a more subjective manner.

Procedures for developing and evaluating the multiplier lookup approach were to 1) group regions with similar multipliers, 2) characterize these groups based on regional characteristics, 3) use the group averages as generic multiplier values for the group, and 4) evaluate the magnitude of errors when generic multipliers are used instead of actual IMPLAN multipliers for each region.

The set of 114 regions were first sorted by the aggregate Type II tourism sales multipliers. Several cut-off points were identified to form the initial groups. The cut-off points were first selected based on the multipliers' distribution examined in Objective 1. The cut-off points were then adjusted to minimize the errors between the individual region's sales multiplier and the group average. Tourism income, value added, and job multipliers for each region were then compared with group averages. Differences were examined and adjustments were made to ensure reasonable homogeneity within each group.

After regions have been classified into different groups, means and variations of the key regional characteristics identified in Objective 2 were also computed for each group. The research hypothesis to be tested is that there are significant differences in the key regional characteristics between groups of regions formed by multipliers. Regions grouped by economic multipliers will also have distinguishable regional characteristics. ANOVA and descriptive statistics were used to measure variations in regional characteristics within and between these groups.

Groups of regions were characterized based on key regional characteristics identified in Objective 2. The idea is to develop simple rules for

selecting which group a given region falls into, where the group average multipliers can be used as generic multipliers for that type of region. For each group of regions that a distinctive set of multipliers can be identified, there are descriptions on the region's characteristics that can serve as a "lookup table."

The "multiplier lookup" procedure was evaluated by computing errors in multipliers estimated by this approach and comparisons with regression models. For each region, IMPLAN generated multipliers were used to test the accuracy of the multiplier lookup procedure and the regression method. To evaluate the multiplier lookup procedure, errors were computed using the multipliers for each individual model and then comparing them with the group multipliers (using the group averages to which the region belonged). The mean absolute percent errors (MAPE) and the maximum APE's were computed for all regions in same group to demonstrate the possible range of errors of this "multiplier lookup" approach.

$$\text{MAPE} = \frac{\Sigma \left| \text{group multiplier} - \text{individual multiplier} \right|}{\Sigma \text{ individual multiplier}}$$

The same comparison was also made between multipliers for each individual model and multipliers estimated from regression models. Both mean and maximum APE's were also computed for the regression model approach for each group of regions. The results for both the "multiplier lookup" procedure and the regression models were examined and compared to evaluate these two approaches.

Chapter 4

RESULTS

Results are presented for each of the three objectives—to describe variations in economic multipliers for recreation and tourism sectors, to identify key factors associated with the variations, and to propose and evaluate procedures for predicting tourism multipliers for a given region.

Objective 1. Describe Variations in Multipliers

The first research objective is to describe how economic multipliers vary across industry sectors and regions of different levels of economic development. Variations in regional characteristics across 114 regions, variations in multipliers across sectors, and variations in multipliers across regions are presented in this section.

Variations in Regional Characteristics Across Regions

The average population for all 114 regions was 1.3 million and the median was about 300,000. The average population was inflated by a few large values since only 20 percent of the 114 regions (23 regions) had populations over 1.3 million (average of all regions). The largest population was about 32 million for the State of California, while the smallest was just above 5,000 for Lake County in Michigan. The average area was slightly less than 6,000 square miles for all regions. The median was just about 1,600 square miles. Because of the wide

variety in the regions' populations and areas, the population density ranged from a high of almost 16,000 people per square mile for San Francisco to a low of 2 people per square mile for the Death Valley National Park area.

Table 4-1. Variations in Regional Characteristics Across 114 Regions (1996)

Statistics	Population	Area (square miles)	Population Density (per square mile)
Mean	1,276,964	5,890	597
Standard Deviation	3,595,786	18,670	1,828
Coefficient of Variation[a]	282%	317%	306%
Median	313,151	1,626	189
Maximum	31,878,234	155,973	15,746
Minimum	5,478	47	2
Sample size	114	114	114

a. Coefficient of Variation= Standard Deviation / Mean.

Variations in Economic Ratios and Multipliers Across Sectors

Economic ratios vary across industry sectors (Table 4-2). Average job to sales ratios (number of direct jobs per million dollar sales) varied from 30 for the Eating and Drinking sector to less than one for the Petroleum Refinery sector (jobs created from sales received by the petroleum industry, not sales at gas stations). Average income to sales ratios varied from 0.57 for the Local Transportation sector to 0.05 for the Petroleum Refining sector, while value added to sales ratios varied from 0.80 for the Retail Trade sector to 0.14 for the Petroleum Refining sector.

Table 4-2. Direct Effect Ratios for 12 Tourism and Recreation Related Sectors

IMPLAN Sector Name	Sector No.	Average[a]			Sample Size[c]	Model RPC[d]
		Jobs[b]/ $MM Sales	Income/ Sales	Value Added /Sales		
Hotels and Lodging Places	463	21.62	0.35	0.53	114	62%
Eating and Drinking	454	30.21	0.36	0.50	114	88%
Amusement and Recreation	488	30.05	0.35	0.58	113	68%
Retail Trade	N/A[e]	28.87	0.51	0.80	114	91%
Wholesale Trade	447	11.45	0.40	0.69	114	67%
Auto Repair and Services	479	12.52	0.31	0.49	114	85%
Local Transportation	434	28.81	0.57	0.68	109	51%
Food Processing	103	5.58	0.14	0.28	78	39%
Apparel	124	13.39	0.25	0.29	90	4%
Petroleum Refining	210	0.61	0.05	0.14	40	13%
Sporting Goods	421	10.85	0.23	0.44	85	2%
Manufacturing	432	10.55	0.23	0.39	87	2%
Mean (12 sectors)		17.04	0.31	0.48		
Maximum		30.21	0.57	0.80		
Minimum		0.61	0.05	0.14		
Range		29.60	0.52	0.66		

a. Average across all regions.
b. Not full-time equivalent. Any part-time or full-time job is counted as one job.
c. Sample sizes are different because not all sectors existed in all regions.
d. Regional purchase coefficient. RPC's are available in all 114 regions for all sectors.
e. Retail is an average of seven retail trade sectors.

On average, the Eating and Drinking and the Amusement and Recreation sectors generated the most jobs directly from $1 million sales in that industry. Each had more than 30 jobs per $1 million sales in 1996. The Local Transportation and the Retail Trade sectors, on the other hand, had the highest

direct income and value added per sales ratios. Both sectors converted more than half of the direct sales into personal income and converted 70 and 80 percent of the direct sales into value added.

The four primary tourism sectors (Lodging, Eating and Drinking, Recreation and Retail) had higher than average ratios for jobs, income and value added. The higher jobs and income per sales ratios indicate that these tourism sectors are labor intensive (more employees are required to deliver a certain amount of sales and higher percent of sales are passed to employees as income). In contrast, the manufacturing sectors (food processing, apparel, petroleum refining, sporting goods, and general manufacturing) had relatively low direct effects ratios. None of the five manufacturing sectors converted $1 million sales into more than 15 direct jobs. Only a quarter or less of the direct sales were converted into direct income and the highest value added per sales ratio was 0.44 (for the Sporting Goods sector).

The regional purchase coefficients (RPC's) were also lower for the manufacturing sectors, ranging from 2 to 39 percent. The low RPC means that the portion of total demand that is met by local production is low. Manufacturing sectors are less important to tourism economic impact analysis as little visitor spending goes directly to manufacturing sectors in the region, and the linkages between primary tourism sectors to local manufacturers are limited.[9]

[9] Most of the indirect (backward-linked) purchases made by the primary tourism sectors in a region go to service sectors. For example, more than 80% of lodging purchases are from utilities, banking and finance, transportation, and other service sectors.

The means for total effects multipliers (ratios of total effects to direct sales) for different sectors are shown in Table 4-3. The average Type II sales multiplier varied from 1.56 for the Hotel and Lodging sector to 1.34 for the Petroleum Refining sector, while the Type I sales multipliers varied from 1.34 for the Food Processing sector to 1.15 for the Retail Trade sector. The average Type II multipliers for jobs varied from 37 to 3, while the income and value added multipliers varied from 0.76 to 0.14 and 1.06 to 0.34, respectively.

Table 4-3. Economic Multipliers for 12 Tourism and Recreation Related Sectors

IMPLAN Sector Name	Sector No.	Type II Total Effect Multiplier[a]				Type I Sales[a]	Sample Size
		Sales	Jobs[b]/ $MM Sales	Income/ Sales	Value Added/ Sales		
Hotels and Lodging Places	463	1.56	29.90	0.56	0.88	1.33	114
Eating and Drinking	454	1.48	36.78	0.53	0.79	1.26	114
Amusement and Recreation	488	1.51	37.45	0.54	0.90	1.28	113
Retail Trade	N/A[c]	1.42	34.91	0.66	1.06	1.15	114
Wholesale Trade	447	1.43	17.70	0.57	0.96	1.20	114
Auto Repair and Services	479	1.43	18.49	0.46	0.74	1.24	114
Local Transportation	434	1.49	35.79	0.76	0.98	1.17	109
Food Processing	103	1.48	11.69	0.31	0.56	1.34	78
Apparel	124	1.45	19.33	0.41	0.55	1.28	90
Petroleum Refining	210	1.34	3.37	0.14	0.34	1.28	40
Sporting Goods	421	1.50	17.17	0.42	0.74	1.32	85
Manufacturing	432	1.48	16.73	0.41	0.68	1.30	87
Mean (12 sectors)		1.46	23.28	0.48	0.76	1.26	
Maximum		1.56	37.45	0.76	1.06	1.34	
Minimum		1.34	3.37	0.14	0.34	1.15	
Range		0.22	34.08	0.62	0.72	0.19	

a. Average across all 114 regions.
b. Not full-time equivalent. Any part-time or full-time job is counted as one job.
c. Retail is an average of seven retail trade sectors.

Similar to direct effects ratios, service sectors had higher total jobs, income, and value added per $1 million direct sales than manufacturing sectors except for the Auto Repairs and Services sector. The differences between service and manufacturing sectors, however, are not as significant for sales multipliers. This is also because of the fact that service sectors are labor intensive, and less money is spent on purchases of materials to other backward-linked industries compared to manufacturing sectors, which results in lower indirect effects and thus lower Type I multipliers.

Variations in Economic Ratios and Multipliers Across Regions

Variations in multipliers are presented for each of the four economic measures, sales, jobs, income, and value added, that were analyzed in this study. Results are presented for each of the four economic measures using distribution plots of aggregate tourism multipliers and tables of sector-specific multipliers. The aggregate tourism multipliers as defined in the previous chapter (page 57) are used to illustrate distribution of multipliers across regions in this section. Multipliers for the four primary tourism sectors are all highly correlated across regions (Table 4-4). Correlation coefficients for the four sectors are higher than 0.95 for sales, income and value added multipliers. Correlation coefficients are mostly higher than 0.7 for job multipliers except for the recreation sector. The distributions of multipliers for the four primary tourism sectors are all similar and the aggregate tourism multipliers capture the general patterns of the variations in multipliers across regions.

Table 4-4. Pearson Correlation Coefficients for Multipliers Between Tourism Sectors

		Type II Sales Multiplier			
Sector	Lodging	Restaurant	Recreation	Retail	Aggregate
Lodging	1.00	0.95	0.97	0.98	0.99
Restaurant		1.00	0.96	0.95	0.98
Recreation			1.00	0.97	0.98
Retail				1.00	0.99
Aggregate					1.00
		Type II Income Multiplier			
Lodging	1.00	0.97	0.96	0.95	0.99
Restaurant		1.00	0.96	0.93	0.99
Recreation			1.00	0.95	0.98
Retail				1.00	0.97
Aggregate					1.00
		Type II Value Added Multiplier			
Lodging	1.00	0.97	0.96	0.96	0.99
Restaurant		1.00	0.95	0.94	0.99
Recreation			1.00	0.95	0.97
Retail				1.00	0.97
Aggregate					1.00
		Type II Job Multiplier			
Lodging	1.00	0.86	0.25	0.74	0.94
Restaurant		1.00	0.32	0.71	0.93
Recreation			1.00	0.01	0.39
Retail				1.00	0.85
Aggregate					1.00

Four sample regions, representing typical rural (Modoc County, CA), small metro (Redwood National Park area), large metro (Springfield, MA) and state regions (Florida), were selected to illustrate the sizes of multipliers for different types of regions. Descriptive statistics are presented for each of the four primary tourism multipliers.[10] The coefficient of variation (CV) is used as the primary indicator of variation.

Sales Multipliers

The Type II tourism sales multipliers varied from 1.32 for Modoc County in California to 1.67 for the State of Florida (Figure 4-1). Values of the Type II tourism sales multipliers increased as the regions' economic development increased (from rural areas to small metro, large metro, and to state regions). Three cut-off points, 1.4, 1.5, and 1.6, roughly divide the distribution into four groups. About 40 percent of the regions had sales multipliers that were between 1.5 and 1.6, and 30 percent of the regions were between 1.4 and 1.5. The other 30 percent of the regions were equally distributed with multipliers above 1.6 or under 1.4

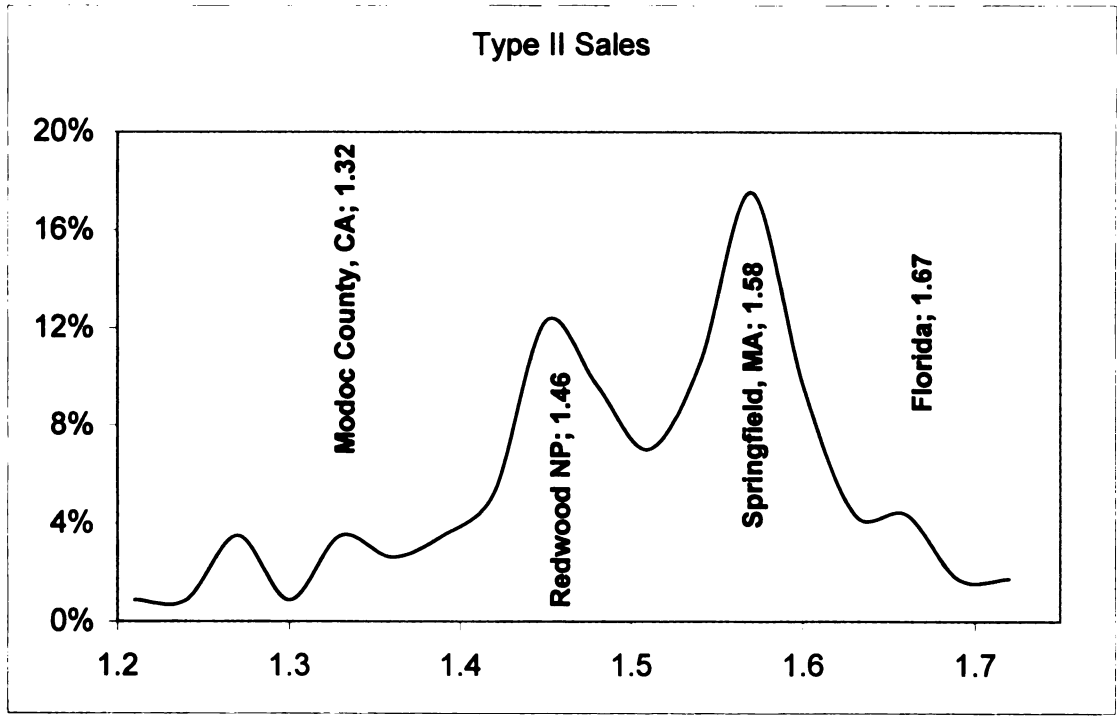

Figure 4-1. Distribution of the Type II Tourism Sales Multipliers Across Regions

[10] Statistics for all other eight tourism-related sectors are given in Appendix B.

The Type II sales multipliers varied from 1.17 to 1.77 across all regions for the Eating and Drinking sector (Table 4-5). The coefficient of variation (CV) for the Eating and Drinking sector was 8 percent of the mean, i.e., a 95 percent confidence interval for these multipliers is within plus or minus 16 percent of the mean. The CV for the Retail Trade sector was the lowest of the four primary tourism sectors at 6 percent. The Type II sales multipliers for the Retail Trade sector varied from 1.14 to 1.58 across all regions. The CV's for the Type I sales multipliers for all four sectors were smaller than for the Type II multipliers, ranging from 3 percent for the Retail Trade sector to 5 percent for the Eating and Drinking and the Amusement and Recreation sectors.

Table 4-5. Regional Variation in Sales Multipliers, Four Primary tourism Sectors

Sector	Mean	Std. Dev.	Coef. of Variation	Median	Maximum	Minimum	Range
Type II Sales Multiplier							
Hotels and Lodging Places	1.56	0.11	7%	1.58	1.76	1.24	0.53
Eating and Drinking	1.48	0.12	8%	1.49	1.77	1.17	0.59
Amusement and Recreation	1.51	0.12	8%	1.53	1.73	1.16	0.58
Retail Trade	1.42	0.09	6%	1.43	1.58	1.14	0.44
Type I Sales Multiplier							
Hotels and Lodging Places	1.33	0.05	4%	1.34	1.42	1.17	0.25
Eating and Drinking	1.26	0.06	5%	1.27	1.43	1.12	0.32
Amusement and Recreation	1.28	0.06	5%	1.29	1.39	1.09	0.30
Retail Trade	1.15	0.03	3%	1.15	1.19	1.05	0.14

Job Multipliers

In contrast to the sales multipliers, the Type II tourism jobs multipliers were larger for regions with less economic development and smaller for areas with greater development (Figure 4-2). Job multipliers varied from 32 for Florida to 43 for Modoc County. Four cut-off points, 28, 33, 36, and 41, roughly divide the distribution into five groups. About 40 percent of the regions had job multipliers that were between 33 and 36, and 30 percent of the regions were between 36 and 41. About 15 percent of the regions had job multipliers between 28 and 33, and the other 15 percent of the regions were equally distributed among the groups that had job multipliers larger than 41 or smaller than 28.

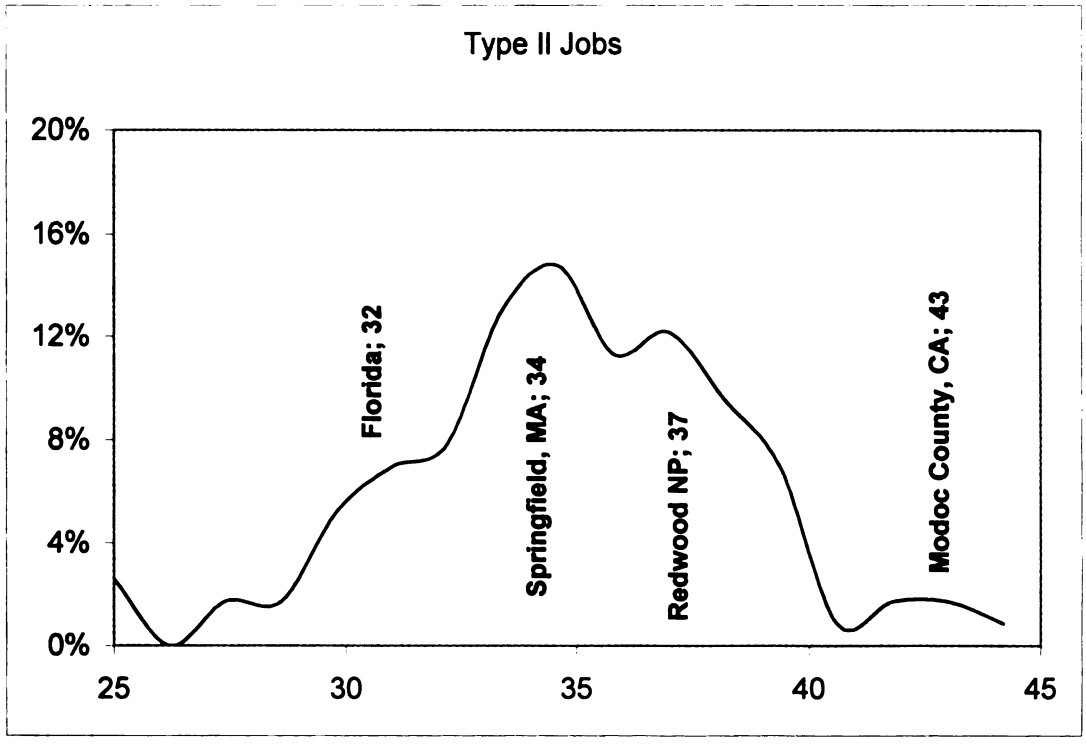

Figure 4-2. Distribution of the Type II Tourism Job multipliers Across Regions

The Coefficients of variation were higher for the Type II job multipliers than for sales multipliers, ranging from 9 to 16 percent (Table 4-6). The Type II job multipliers for the Retail Trade sector varied the most from 22.45 to 61.85 across all regions with a range of 40 jobs. The CV was 16 percent of the mean for the Retail Trade sector. The CV's for the direct job ratios were even higher than for the Type II multipliers, ranging from 11 percent for the Eating and Drinking sector to 20 percent for all the other three sectors.

Table 4-6. Regional Variation in Job Multipliers, Four Primary tourism Sectors

Sector	Mean	Std. Dev.	Coef. of Variation	Median	Maximum	Minimum	Range
Type II Job multiplier							
Hotels and Lodging Places	29.90	4.27	14%	30.12	40.48	16.18	24.30
Eating and Drinking	36.78	3.18	9%	37.30	44.80	27.11	17.69
Amusement and Recreation	37.45	6.13	16%	37.47	51.13	21.93	29.20
Retail Trade	34.91	5.50	16%	34.70	61.85	22.45	39.40
Direct Effect Ratio							
Hotels and Lodging Places	21.62	4.42	20%	21.22	32.95	11.47	21.48
Eating and Drinking	30.21	3.23	11%	30.41	38.86	22.89	15.96
Amusement and Recreation	30.05	6.06	20%	29.86	45.02	16.65	28.37
Retail Trade	28.87	5.69	20%	28.57	57.83	18.05	39.79

Note: Job multipliers are not full-time equivalent. Any part-time or full-time job is counted as one job.

Income Multipliers

The Type II tourism income multipliers varied from 0.47 for Modoc County to 0.66 for Florida. Values of the income multipliers also increased as the regions' economic development increased (from rural to state regions). Three cut-off points, 0.50, 0.57, and 0.63, roughly divide the distribution into four groups. About 40 percent of the regions had income multipliers that were between 0.57 and 0.63, and 25 percent of the regions had multipliers that were between 0.5 and 0.57. About 23 percent of the regions had income multipliers that were larger than 0.63 and 12 percent of the regions had multipliers that were lower than 0.50.

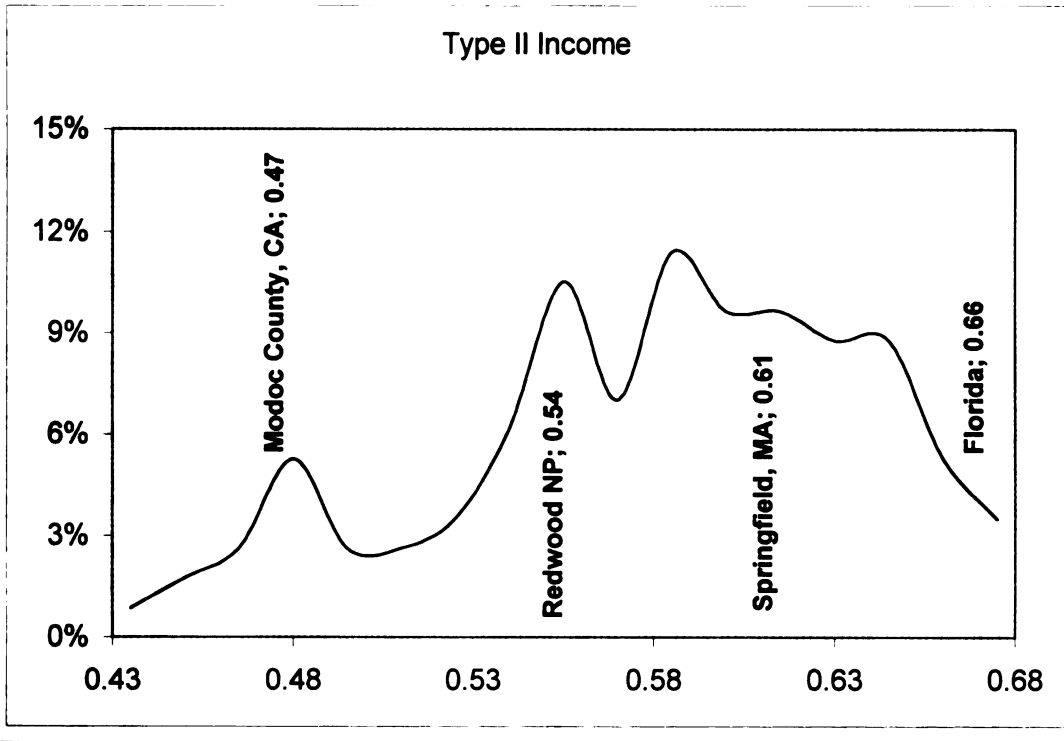

Figure 4-3. Distribution of the Type II Tourism Income Multipliers Across Regions

The CV's for the direct income and value added ratios were all 0 percent for Retail Trade Sector, as IMPLAN uses national income to sales ratios for this sector for all regions (Tables 4-7 and 4-8). The lowest coefficient of variation for the Type II income multipliers was for the Retail Trade sector at 6 percent (Table 4-7). However, this number may be underestimated since there is no variation in the direct income ratio. The highest CV was 14 percent for the Hotel and Lodging sector. The CV's for the direct income ratios were lower than for the Type II multipliers, ranging from 0 percent for the Retail Trade sector to 10 percent for the Hotel and Lodging sector.

Table 4-7. Regional Variation in Income Multipliers, Four Primary tourism Sectors

Sector	Mean	Std. Dev.	Coef. of Variation	Median	Maximum	Minimum	Range
Type II Income Multiplier							
Hotels and Lodging Places	0.56	0.08	14%	0.57	0.67	0.37	0.30
Eating and Drinking	0.53	0.06	12%	0.53	0.65	0.36	0.29
Amusement and Recreation	0.54	0.05	10%	0.55	0.65	0.41	0.24
Retail Trade	0.66	0.04	6%	0.66	0.73	0.56	0.17
Direct Effect Ratio							
Hotels and Lodging Places	0.35	0.03	10%	0.35	0.42	0.26	0.16
Eating and Drinking	0.36	0.03	7%	0.36	0.41	0.28	0.13
Amusement and Recreation	0.35	0.02	5%	0.36	0.39	0.32	0.07
Retail Trade	0.51	0.00	0%	0.51	0.51	0.51	0.00

Value Added Multipliers

The Type II tourism value added multipliers varied from 0.76 for Modoc County to 1.04 for Florida (Figure 4-4). Values of the Type II tourism value added multipliers also increased as the regions' economic development increased. Three cut-off points, 0.80, 0.90, and 0.97, roughly divide the distribution into four groups. About 37 percent of the regions had value added multipliers that were between 0.90 and 0.97, and 25 percent of the regions were between 0.80 and 0.90. About 25 percent of the regions had value added multipliers that were larger than 0.97 and 13 percent of the regions had multipliers that were lower than 0.80.

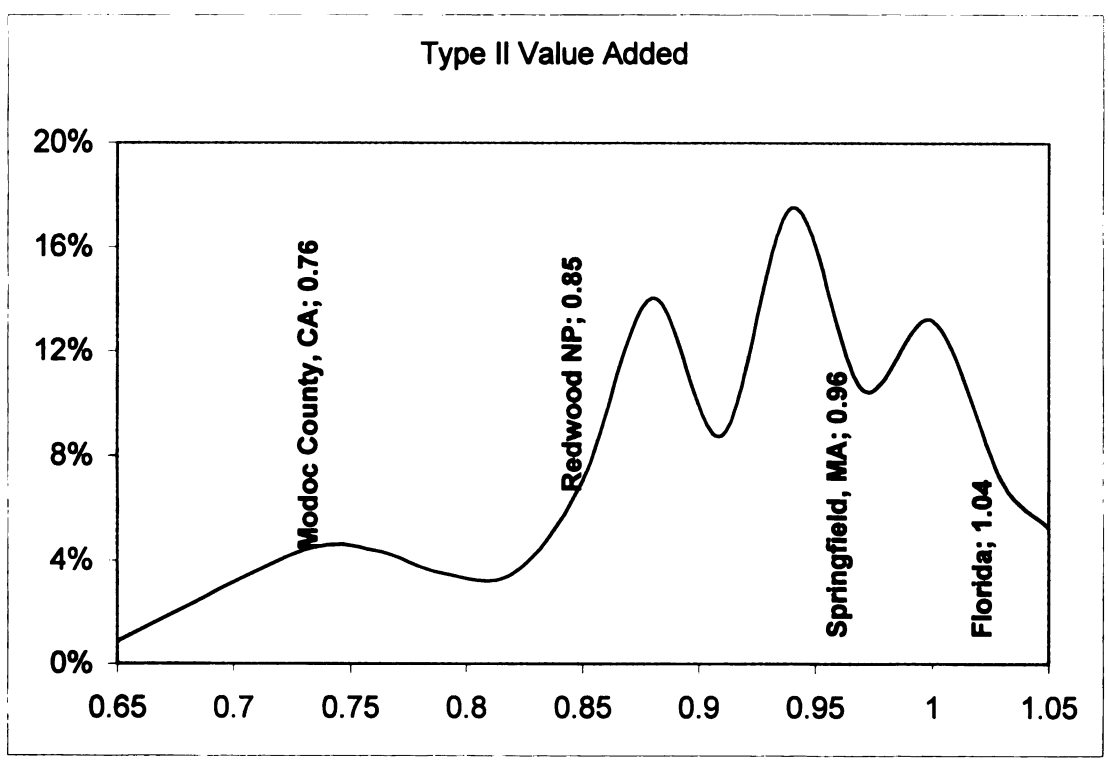

Figure 4-4. Distribution of the Type II Tourism Value Added Multipliers Across Regions

Variations in the value added multipliers are similar to the income multipliers. The lowest CV was 5 percent for the Retail Trade sector[11] and the highest was 13 percent for the Hotel and Lodging sector (Table 4-8). The Type II value added multipliers varied from 0.88 to 1.16 for the Retail Trade sector across all regions and varied from 0.57 to 1.06 for the Hotel ad Lodging sector. The CV's for the direct value added ratios were lower than for the Type II multipliers, ranging from 0 percent for the Retail Trade sector to 10 percent for the Hotel and Lodging sector.

Table 4-8. Regional Variation in Value Added Multipliers, Four Primary tourism Sectors

Sector	Mean	Std. Dev.	Coef. of Variation	Median	Maximum	Minimum	Range
Type II Value Added Multipliers							
Hotels and Lodging Places	0.88	0.11	13%	0.91	1.06	0.57	0.49
Eating and Drinking	0.79	0.10	12%	0.80	0.98	0.51	0.46
Amusement and Recreation	0.90	0.08	9%	0.91	1.05	0.69	0.36
Retail Trade	1.06	0.06	5%	1.06	1.16	0.88	0.28
Direct Effect Ratios							
Hotels and Lodging Places	0.53	0.05	10%	0.53	0.64	0.39	0.25
Eating and Drinking	0.50	0.04	7%	0.49	0.58	0.39	0.18
Amusement and Recreation	0.58	0.03	5%	0.58	0.64	0.52	0.12
Retail Trade	0.80	0.00	0%	0.80	0.80	0.80	0.00

Economic multipliers varied across different industry sectors. Service sectors generally had higher multipliers than manufacturing sectors in all four economic measures. Economic multipliers also varied across regions varying in economic development. Overall, sales, income and value added multipliers increased as the regions' population increased, while job multipliers decreased as the regions' population increased.

Objective 2. Identify Key Factors that Explain Variations in Multipliers

The second research objective is to identify regional characteristics that explain variations in tourism multipliers across regions. Results are presented first for the correlation analysis and then the regression analysis. The aggregate tourism multipliers as weighted averages of multipliers for the four primary tourism sectors are used in this section.

Correlation Analysis

Tourism sales, income, and value added multipliers are highly correlated with each other (Table 4-9). The correlation coefficients are higher than 0.95 among all three multipliers. The coefficients of determination (CD's, computed as r^2) are larger than 0.90 among these three variables, which means that more than 90 percent of variation in one multiplier can be explained by the other (Griffith, 1997). The relationships between job multipliers and the other three

[11] This number may also be underestimated since there is no variation in the direct effect ratio for the Retail Trade Sector.

multipliers are not as strong, where the correlation coefficients range from -0.46 to -0.70 (CD's range from 21 to 48 percent).

Table 4-9. Pearson Correlation Coefficients Between Tourism Multipliers and Regional Characteristics

	Type II Multiplier							Natural log of		
	Sales	Income	VA	Jobs	Pop.	Density	Area	Pop.	Density	Area
Sales	1.00	0.95	0.96	-0.46	0.46	0.05	0.35	0.86	0.59	0.41
Income		1.00	0.99	-0.69	0.43	0.21	0.27	0.90	0.72	0.28
Value added			1.00	-0.67	0.43	0.19	0.28	0.88	0.68	0.30
Jobs				1.00	-0.25	-0.51	-0.07	-0.63	-0.69	0.07
Population					1.00	0.05	0.82	0.58	0.22	0.54
Pop. Density						1.00	-0.07	0.23	0.54	-0.42
Area							1.00	0.40	-0.06	0.67
ln(Popln)								1.00	0.76	0.38
ln(Density)									1.00	-0.31
ln(Area)										1.00

Note: Correlations are across 114 regions and all multipliers were Type II aggregate tourism multipliers.

The relationships between regional characteristics and multipliers are stronger when logarithmic values are used for population and population density. Among all regional characteristics, the natural log of population has the highest correlation coefficients with tourism multipliers ranging from 0.90 for income to 0.63 for jobs. The coefficients of determination between the natural log of population and multipliers are about 75 to 80 percent for sales, income, and value added multipliers but less than 40 percent for job multipliers. The natural log of population density has the highest CD with job multipliers among all regional characteristics at 47 percent. Area size is weakly associated with

tourism multipliers compared to other regional characteristics (all the CD's are under 20 percent).

It should be noted that the relationships among multipliers are also influenced by IMPLAN's assumptions and may not reflect the true variations. IMPLAN's state and county level indirect business taxes (IBT) and other property type income (OPTI) are estimated using the national IBT and OPTI to labor income ratios (MIG, Inc., 2000-p 251). Since the value added effect is a linear function of personal income, they are supposed to be perfectly correlated.[12] The reason that income and value added multipliers are not perfectly correlated is because minor adjustments to state and county level estimates of IBT and OPTI are made so they can be added up to match the next level's estimates.[13] The high correlation between sales multipliers and value added and income multipliers is also influenced by IMPLAN's assumptions. The county (or state) level personal income (or IBT, or OPTI) to employment ratio is compared with the national average. The county or state level total industry output (sales) is then adjusted if the county or state income to employment ratio is higher or lower than the national average (MIG, Inc., 2000-p 255).

[12] Value added = personal income (PI) + IBT + OPTI, where IBT = f(PI) and OPTI = f(PI).
[13] That is, the summation of total counties' estimates is equal to the state value, and the summation of total states' estimates is equal to the national value.

Regression Analysis

Separate regression models for aggregate tourism sales, income, value added, and jobs multipliers were estimated using SPSS 10.0's stepwise procedure. Five independent variables were tested in each model: population, natural log of population, area size, natural log of area size, and population density. In the SPSS stepwise regression procedure the *p*-value of the partial *F* statistic was set at 0.05 to include a variable and at 0.10 for removal. At each step, the SPSS stepwise regression algorithm selects an independent variable with the highest correlation with the dependent variable. The variable is included in the equation if the partial *F* statistic is significant at the 95% level (*p*-value <0.05). The process continues until no variable is significant enough to be included. During each step the algorithm also checks the partial *F* statistic for each included variable in the equation and removes variables that have *p*–values greater than 0.10 (SPSS, 1999).

Model 1: Tourism sales multipliers

Following the stepwise regression procedure, the best prediction equation for the Type II tourism sales multipliers was identified as:

- *Tourism sales multiplier = 1.566 + 0.053 × ln(POP) – 0.010 × POPDEN*

  where

  ln(POP) = natural log of population (in millions)

  POPDEN = population density (thousand people per square mile)

Two predictors were identified for this model and the model explains 76 percent (adjusted $R^2 = 0.76$) of the variation in the Type II tourism sales multipliers (Table 4-10). Based upon the standardized coefficients (Betas), the natural log of population is the most significant determinant of the Type II tourism sales multipliers. This means that there is a linear relationship between the multiplier and population in logarithmic form.

Table 4-10. Least Squares Regression Results for Sales Multipliers

Dependent Variable: Type II Tourism Sales Multiplier

Multiple R	0.876
R Square	0.767
Adjusted R Square	0.763
Standard Error	0.051
Observations	114

	df	*Sum of Squares*	*Mean Square*	*F*	*Sig. F*
Regression	2	0.940	0.470	180.964	0.000
Residual	110	0.286	0.003		
Total	112	1.225			

Variable	*Coef.*	*Standard Error*	*Standardized Beta*	*t Stat*	*P-value*	*Tolerance*	*VIF*
(Constant)	1.566	0.006		245.797	0.000		
ln(POP)[a]	0.053	0.003	0.899	18.994	0.000	0.946	1.057
POPDEN[b]	-0.009	0.003	-0.159	-3.359	0.001	0.946	1.057

a. ln(POP) = natural log of population (in millions)
b. POPDEN = population density (thousand people per square mile)

The partial coefficients for the natural log of population can be interpreted as, holding other variables constant, a one percent increase in population is accompanied by an increase of 0.00053 (one hundredth of the coefficient for the

independent variable) in tourism sales multiplier (Gujarati, 1995). The partial coefficient for population density indicates that each unit (thousand people per square mile) change in population density lowers the tourism sales multiplier by 0.009.

The tolerances for both independent variables are very high (the range of tolerance is from 0 to 1). A high tolerance means that the percent of an independent variable that is not explained by other independent variables is high, which indicates multicollinearity with other independent variables is less problematic.

Model 2: Tourism income multipliers

The best prediction equation for the Type II tourism income multipliers was identified as:

- *Tourism income multiplier = 0.617 + 0.032 × ln(POP) - 0.002 × POP*

  where

  ln(POP) =natural log of population (in millions)

  POP = population (in millions)

Two predictors were identified for this model and the model explains more than 80 percent (adjusted R^2 = 0.82) of the variation in the Type II tourism income multipliers (Table 4-11). Based upon the standardized coefficients, the natural log of population in the region is again the most significant determinant of the regression model. Note that although population was statistically significant

enough to be included in the model as a negative predictor, the standardized beta is very small. The tolerance is 0.66 for both independent variables, which indicates the presence of multicollinearity (between ln(POP) and POP). However, multicollinearity is not serious enough to be problematic as the tolerance is still larger than 0.6.

Table 4-11. Least Squares Regression Results for Income Multipliers

Dependent Variable: Type II Tourism Income Multiplier

Multiple R	0.906
R Square	0.821
Adjusted R Square	0.817
Standard Error	0.025
Observations	114

	df	*Sum of Squares*	*Mean Square*	*F*	*Sig. F*
Regression	2	0.305	0.153	251.751	0.000
Residual	110	0.067	0.001		
Total	112	0.372			

Variable	*Coef.*	*Standard Error*	*Standardized Beta*	*t Stat*	*P-value*	*Tolerance*	*VIF*
(Constant)	0.617	0.004		170.785	0.000		
ln(POP)[a]	0.032	0.002	0.987	19.782	0.000	0.655	1.528
POP[b]	-0.002	0.001	-0.153	-3.060	0.003	0.655	1.528

a. ln(POP) = natural log of population (in millions)
b. POP = population (in millions)

Model 3: Tourism value added multipliers

The best prediction equation for the Type II tourism value added multipliers was identified as:

- *Tourism value added multiplier = 0.968 + 0.048 × ln(POP) – 0.003 × POP*

where

ln(POP) = natural log of population (in millions)

POP = population (in millions)

Based on the near perfect correlation between income and value added multipliers, it is not surprising to see similar regression results for these two variables. The two predictors identified for this model were the same as for the previous income model. This model explains almost 80 percent (adjusted R^2 = 0.78) of the variations in Type II tourism value added multipliers (Table 4-12).

Table 4-12. Least Squares Regression Results for Value Added Multipliers

Dependent Variable: Type II Tourism Value Added Multiplier

Multiple R	0.887
R Square	0.786
Adjusted R Square	0.782
Standard Error	0.041
Observations	114

	df	*Sum of Squares*	*Mean Square*	*F*	*Sig. F*
Regression	2	0.674	0.337	202.050	0.000
Residual	110	0.184	0.002		
Total	112	0.858			

Variable	*Coef.*	*Standard Error*	*Standardized Beta*	*t Stat*	*P-value*	*Tolerance*	*VIF*
(Constant)	0.968	0.006		161.498	0.000		
ln(POP)[a]	0.048	0.003	0.960	17.616	0.000	0.655	1.528
POP[b]	-0.003	0.001	-0.137	-2.521	0.013	0.655	1.528

a. ln(POP) = natural log of population (in millions)
b. POP = population (in millions)

Based upon the standardized coefficients, the log of population in the region is again the most significant determinant of the dependent variable. The tolerance is also 0.66 for both independent variables.

Model 4: Tourism job multipliers

The best prediction equation for the Type II tourism job multipliers was identified as:[14]

- *Tourism job multiplier = 33.216 - 1.116 × ln(POP) – 0.762 × POPDEN*

  where

  ln(POP) =natural log of population (in millions)

  POPDEN = population density (thousand people per square mile)

Two predictors were identified for this model and all of them have negative coefficients, i.e., the size of job multipliers is negatively correlated with the log of population and population density. This model explains 52 percent (adjusted R^2 = 0.52) of the variations in Type II tourism job multipliers (Table 4-13). Based upon the standardized coefficients, the log of population is still the most significant determinant of the dependent variable, but not as predominant as the previous three models. The tolerances for these two independent variables are very high, which indicates multicollinearity between these two independent variables is less problematic.

[14] One independent variable, the natural log of area, was dropped from the equation because of multicollinearity (tolerance < 0.6). Dropping this independent variable decreases the model's R square from 53 to 52%.

Table 4-13. Least Squares Regression Results for Job multipliers

Dependent Variable: Type II Tourism Job multiplier

Multiple R	0.729
R Square	0.531
Adjusted R Square	0.522
Standard Error	2.530
Observations	

	df	*Sum of Squares*	*Mean Square*	*F*	*Sig. F*
Regression	2	796.792	398.396	62.226	0.000
Residual	110	704.259	6.402		
Total	112	1501.051			

Variable	*Coef.*	*Standard Error*	*Standardized Beta*	*t Stat*	*P-value*	*Tolerance*	*VIF*
(Constant)	33.216	0.316		104.992	0.000		
ln(POP)[a]	-1.116	0.139	-0.538	-8.016	0.000	0.946	1.057
POPDEN[b]	-0.762	0.134	-0.382	-5.687	0.000	0.946	1.057

a. ln(POP) = natural log of population (in millions)
b. POPDEN = population density (thousand people per square mile)

All four models are statistically significant at 0.01 level. Models for sales, income and value added multipliers explain more than 75 percent of variation while the job multiplier model explains 52 percent of variation in multipliers. The outputs of SPSS's stepwise regression models indicate one single independent variable alone can explain almost all variation in the dependent variables. For the sales, income, and value added multiplier models, adding one more independent variable in addition to the log of population only increased the R square by 1 to 2 percent. For the job multiplier model, the two independent

variables explain 52 percent while the natural log of population alone explains 40 percent of variation in the job multipliers.

On average, the mean absolute percent errors (MAPE) range from 3 to 4 percent for sales, income and value added multipliers and is the highest for job multipliers at 6 percent (Table 4-14). The maximum errors range from 10 to 12 percent for sales, income and value added multipliers and is 26 percent for job multipliers.

Table 4-14. Errors in Regression Predicted Multipliers

	Type II Tourism Sales	Type II Tourism Jobs	Type II Tourism Income	Type II Tourism Value Added
MAPE[a]	3%	6%	3%	4%
Max APE[b]	10%	26%	10%	12%

a. MAPE =Mean absolute percent error
b. Max APE= Maximum absolute percentage error

Objective 3. Propose and Evaluate Procedures for Predicting Multipliers

The final research objective is to propose and evaluate procedures for predicting tourism multipliers for a given region. One procedure is to use the regression models identified in the previous section. The second approach is to use a "multiplier lookup" procedure to choose multipliers for a given region. The lookup approach involves identifying a small numbers of types of regions and using multipliers for these types to represent a class of region. The lookup and regression approaches for predicting multipliers were both evaluated and compared.

Develop a Multiplier Lookup Procedure

The 114 regions were first sorted based on the Type II tourism sales multipliers. Cut-off points at 1.40, 1.51 and 1.58 were identified based on the distribution of multipliers across regions (Figure 4-1) to form four primary groups. The average Type II multipliers within each group were 1.30, 1.45, 1.55, and 1.65.

As income and value added multipliers were highly correlated with sales multipliers (Table 4-9), the resulting groups are also homogeneous across sales, income and value added multipliers. Regions with multipliers that were close to the cut-off points and were better off by relocating to another region were shifted. Eight regions were shifted from one group to another to reduce errors in income, value added and job multipliers. The cut-off points and means were slightly changed as a result of this adjustment. Job to sales ratios do not correlate as well with sales multipliers as some regions experienced job to sales ratios that were more than 15 percent below the average for their group.

All 114 regions were formed into four groups, each representing a type of region with distinct values of multipliers. These four types of regions were then classified according to regional characteristics and were categorized as rural, small metro, large metro, and state regions (Table 4-15).

Table 4-15. Characteristics of Four Types of Regions

Rural • Smaller rural regions with low population (below 30,000). • Low sales multipliers and high job to sales ratios. • Representative regions: Modoc County (CA), Antrim County (MI) Pictured Rock NL, Dinosaur NP, Bents NM.
Small metro • Larger rural regions or small metro areas with population up to 500,000. Regions with smaller populations that serve as population centers of the surrounding areas may fit into this category. • Low to medium sales multipliers and medium to high job to sales ratios. • Representative regions: Redwood NP, Mesa Verde NP, Gainesville MSA (FL), Lansing MSA (MI), Pueblos MSA (CO).
Large metro • Medium to larger metro areas with population up to 1,000,000. Regions with smaller populations that serve as population centers of the surrounding areas may fit into this category. • Medium to high sales multipliers and medium to low job to sales ratios. • Representative regions: Rocky Mt. NP, Lassen Volcanic NP, Springfield MSA (MA), Santa Barbara MSA (CA), Grand Rapids MSA (MI).
State • State level regions or regions including larger metro areas (1,000,000 and more). • High sales multipliers and low job to sales ratios.   • Representative regions: State models, Everglades NP, San Diego MSA (CA), Denver MSA (CO), Detroit MSA (MI).

Note, MSA: Metropolitan Statistical Area; NP: National Park; NM: National Monument; NL: National Lakeshore.

The rural area represents single or multiple county non-metro regions where populations are below 30,000 and have limited economic development. The small metro area is for larger rural regions or small metro areas with populations up to 500,000, while the large metro area is for regions with populations up to 1,000,000 and the state area is for regions with populations of 1 million and more. There was some overlap in population size between groups.

For example, regions with smaller populations that serve as the economic center of the surrounding area may be included in a group with higher population. A complete list of all regions within each group is available in Appendix C.

Population size was compared across the four types of regions. Table 4-16 reports the descriptive statistics and ANOVA results for population across four groups of regions. Populations are significantly different across these four groups of regions and there was little overlap of ranges of population between groups. The results of the ANOVA and the regression analysis from the previous section show that population size can be used to explain variations in multipliers across regions. Population size is therefore the primary variable for classifying regions into groups that explain differences in multipliers.

Table 4-16. Descriptive Statistics and ANOVA Table for Population by the Four Region Types

Descriptive					
	Mean	Std. Error	Minimum	Maximum	N
Rural	21,413	2,733	5,478	54,565	19
Small metro	210,789	27,391	21,999	645,068	34
Large metro	734,124	106,904	108,371	3,015,783	44
State	6,217,572	1,861,033	1,008,633	31,878,234	17
Total	1,276,964	336,776	5,478	31,878,234	114

ANOVA					
	df	Sum of Squares	Mean Square	F	Sig.
Between Groups	3	4.97E+14	1.66E+14	18.88	0.000
Within Groups	110	9.65E+14	8.77E+12		
Total	113	1.46E+15			

Ranges of multipliers for the four primary groups are shown in Table 4-17. These four sets of "generic" multipliers can be used to represent regions of

different populations and levels of economic diversity. These aggregate multipliers would correspond to what might be used in the old MGM model, when only a single multiplier is applied to visitor spending.

Table 4-17. Ranges of Multipliers for Regions Within Four Primary Groups

Group	*Multiplier*[a]	Sales II	Jobs II	Income II	Value Added II
Rural	Mean	1.31	37.58	0.48	0.76
N= 19	Minimum	1.18	33.01	0.42	0.65
	Maximum	1.40	43.08	0.53	0.85
	CV[b]	5%	9%	6%	6%
Small metro	Mean	1.45	35.66	0.55	0.86
N= 34	Minimum	1.38	24.42	0.51	0.79
	Maximum	1.51	38.68	0.58	0.91
	CV	2%	8%	4%	3%
Large metro	Mean	1.54	32.51	0.60	0.95
N= 44	Minimum	1.43	24.58	0.57	0.90
	Maximum	1.60	38.22	0.65	1.01
	CV	2%	10%	3%	3%
State	Mean	1.63	31.75	0.65	1.01
N= 17	Minimum	1.58	29.13	0.62	0.97
	Maximum	1.71	36.08	0.67	1.06
	CV	2%	6%	3%	3%

a. All multipliers are aggregate tourism multipliers as defined in chapter 3 (p.57).
b. CV= Coefficient of variations = standard deviation/mean

Both income and value added multipliers are positively correlated with sales multipliers while job multipliers are negatively correlated with all other multipliers. Rural regions had the lowest sales multipliers and the highest job multipliers, while state and other large metro regions had the highest sales multipliers and the lowest job multipliers. The coefficients of variation ranged

from 2 to 6 percent for sales, income and value added multipliers across groups of regions and ranged from 6 to 10 percent for job multipliers.

The generic tourism multipliers perform reasonably well in explaining variations across regions of different degrees of economic development and population. Variations in multipliers for individual sectors across the four types of regions were also examined and similar results are obtained. The lodging sector is used to illustrate how generic multipliers vary across regions (Table 4-18).

Table 4-18. Multipliers for the Lodging Sector by Type of Region

Multiplier	Rural	Small Metro	Large Metro	State
Direct effects				
Jobs/ MM sales	27.84	23.41	19.09	18.02
Personal inc/sales	0.30	0.33	0.37	0.37
Value Added /sales	0.46	0.51	0.56	0.57
Total effects				
Type I Sales	1.24	1.32	1.34	1.38
Type II Sales	1.36	1.52	1.61	1.70
Type II jobs	33.59	31.73	27.84	27.41
Type II income	0.43	0.53	0.60	0.64
Type II value added	0.69	0.84	0.95	1.01

The Type II sales multipliers increase from 1.36 for rural regions to 1.70 for state and large metro areas. All sales, income and value added multipliers and ratios increase with increasing economic development. The job multipliers and ratios, however, decline with increasing economic development (from rural to state areas). The Type II job multipliers decrease from 34 for rural regions to 27

for state and large metro areas. Detailed sector-by-sector values for multipliers of all 12 sectors for each primary group are given in Appendix D.

Evaluate Procedures for Selecting/ Predicting Multipliers

A "multiplier Lookup" approach was presented in the previous section. Four sets of sector-specific multipliers were developed, representing typical rural, small metro, large metro, and state regions. Table 4-15 can be used as a "lookup table" to select the type of region. Users can then apply generic multipliers from Tables D-1 to D-4 for that type of region. Criteria provided for selecting a type of region are 1) the study region's population, 2) whether the region serves as a population center of the surrounding area, and 3) the similarity of the region with other regions that are included in the lookup table.

To evaluate this multiplier lookup procedure, mean absolute percent errors (MAPE) were computed by comparing the "generic" multipliers (predicted values) with IMPLAN model multipliers for each region (observed values) (Table 4-19). On average, the MAPE's range from 2 to 4 percent for different groups of regions for the aggregate tourism sales multipliers. The MAPE's are higher for job multipliers at about 5 to 9 percent. All MAPE's for income multipliers are less than 4 percent within each group and are less than 5 percent for value added multipliers.

Table 4-19. Ranges of Errors by Using the Multiplier Lookup Approach

Group	*Multiplier*[a]	Sales II	Job II	Income II	Value Added II
Rural	MAPE[b]	4%	7%	4%	5%
	Max APE[c]	11%	14%	12%	16%
Small Metro	MAPE	2%	6%	3%	2%
	Max APE	5%	46%	8%	9%
Large Metro	MAPE	2%	9%	3%	3%
	Max APE	8%	32%	6%	6%
State	MAPE	2%	5%	2%	2%
	Max APE	4%	12%	5%	4%

a. All multipliers are aggregate tourism multipliers as defined in chapter 3.
b. MAPE =Mean absolute percent error (comparing group average multiplier with multipliers for each individual region in the group).
c. Max APE= Maximum absolute percentage error, the largest error in the group.

The maximum APE represents the greatest errors within each group. Except for a couple of regions, the maximum errors are less than 10 percent for regions within each group for sales, income and value added multipliers. The errors from using generic sales, income and value added multipliers will be less than 10 percent when the appropriate set of multipliers is selected and in most cases will fall in the 2 to 5 percent range. The prediction of job multipliers is the weakest among all multipliers. The MAPE's range from 5 to 9 percent while the maximum APE's range from 12 to 46 percent for different types of regions. The weak prediction is caused partly by the fact that many regions had lower than

group average job multipliers. Effects of regions with lower job multipliers will be evaluated later in this chapter.

Absolute percent errors were also computed by comparing multipliers predicted by regression models with each individual region's multipliers. On average, the MAPE's range from 2 to 4 percent for the aggregate tourism sales multipliers for different types of regions (Table 4-20). The MAPE's are higher for job multipliers at about 5 to 7 percent. All MAPE's for income and value added multipliers are less than 6 percent. The maximum APE's are generally less than 10 percent for regions within each group for sales, income and value added multipliers. The maximum APE's are higher for job multipliers, ranging from 11 to 26 percent.

Table 4-20. Ranges of Errors by Using the Regression Models

Group	***Multiplier***	Sales II	Job II	Income II	Value Added II
Rural	MAPE[a]	4%	7%	5%	6%
	Max APE[b]	9%	14%	9%	10%
Small	MAPE	2%	5%	3%	4%
Metro	Max APE	6%	11%	10%	12%
Large	MAPE	3%	7%	4%	4%
Metro	Max APE	10%	26%	10%	9%
State	MAPE	2%	5%	2%	2%
	Max APE	4%	15%	8%	7%

a. MAPE =Mean absolute percent error (comparing regression predicted values with multipliers for each individual region in the group).
b. Max APE= Maximum absolute percentage error, the largest error in the group.

To illustrate the possible ranges of errors for different types of regions, multipliers estimated by I-O models and predicted by both lookup and regression approaches were plotted against population (Figures 4-5 to 4-8). The aggregate tourism multipliers for sales, income, value added, and jobs are presented. The horizontal dashed bars in these figures represent values of generic multipliers for the four different types of regions. Population is used to illustrate the types of regions because of two reasons. First, population is one of the three criteria used in the multiplier lookup approach and is the only quantifiable criterion among the three. Second, population (in logarithmic value) is the most significant determinant identified in all regression models. Adding other independent variables only slightly increases the R Squares of these regression models.

The comparisons between predicted and I-O estimated multipliers for the sales, income, and value added multipliers are similar (Figures 4-5 to 4-7). Both approaches perform better for the large metro and state areas than for the small metro and rural areas. The regression approach performs better than the lookup approach for a few large regions with very high multipliers and populations (i.e., state areas). The lookup approach, on the other hand, performs better than the regression approach for the large metro and small metro areas. The distribution of I-O estimated multipliers for these two types of regions (small and large metro areas) indicate the advantage of using the lookup approach where multipliers do not vary a lot within a type of regions.

Errors in predicted multipliers for the rural areas are higher than for the other three types of regions for both approaches. Since natural resource-based tourism areas are mostly located in rural areas, the results also suggest that more rural regions should be included in the analysis and maybe to further break up rural areas into more types of regions for the lookup approach.

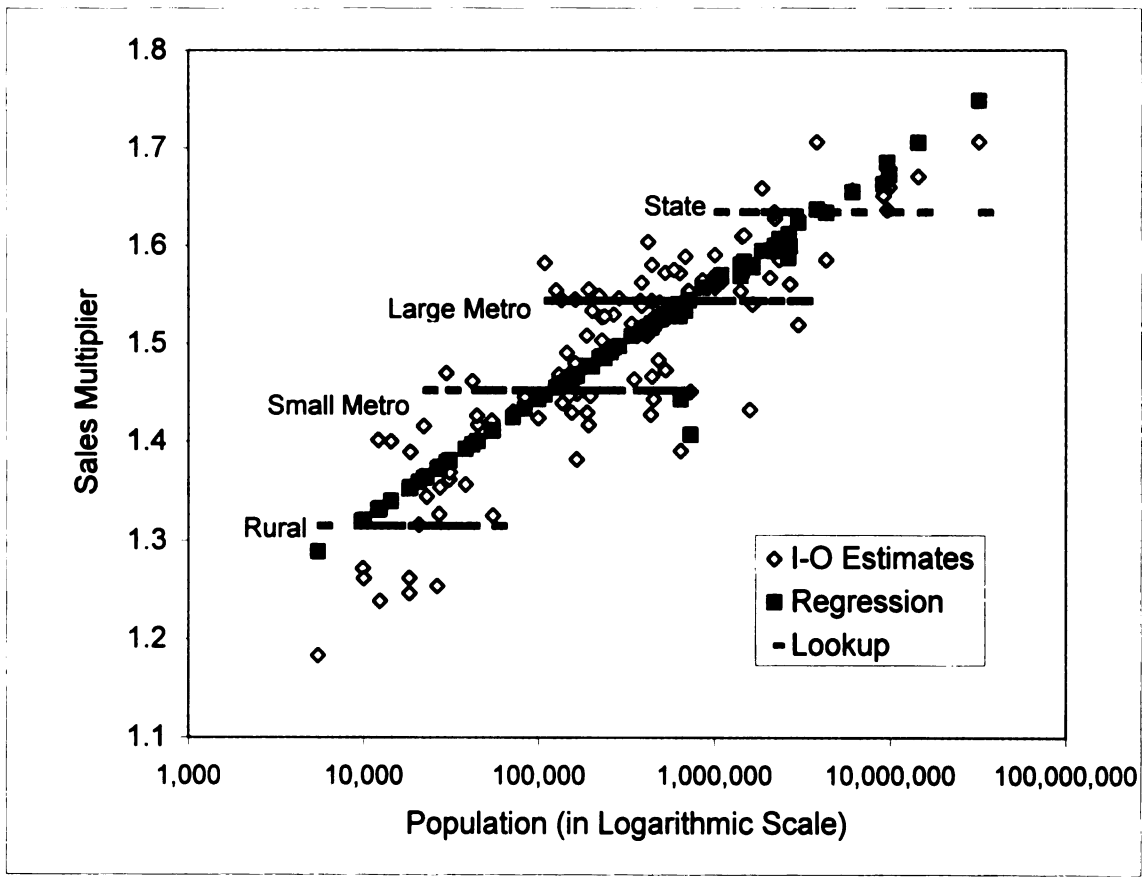

Figure 4-5. Distribution of Sales Multipliers Predicted by the Lookup and Regression Approaches

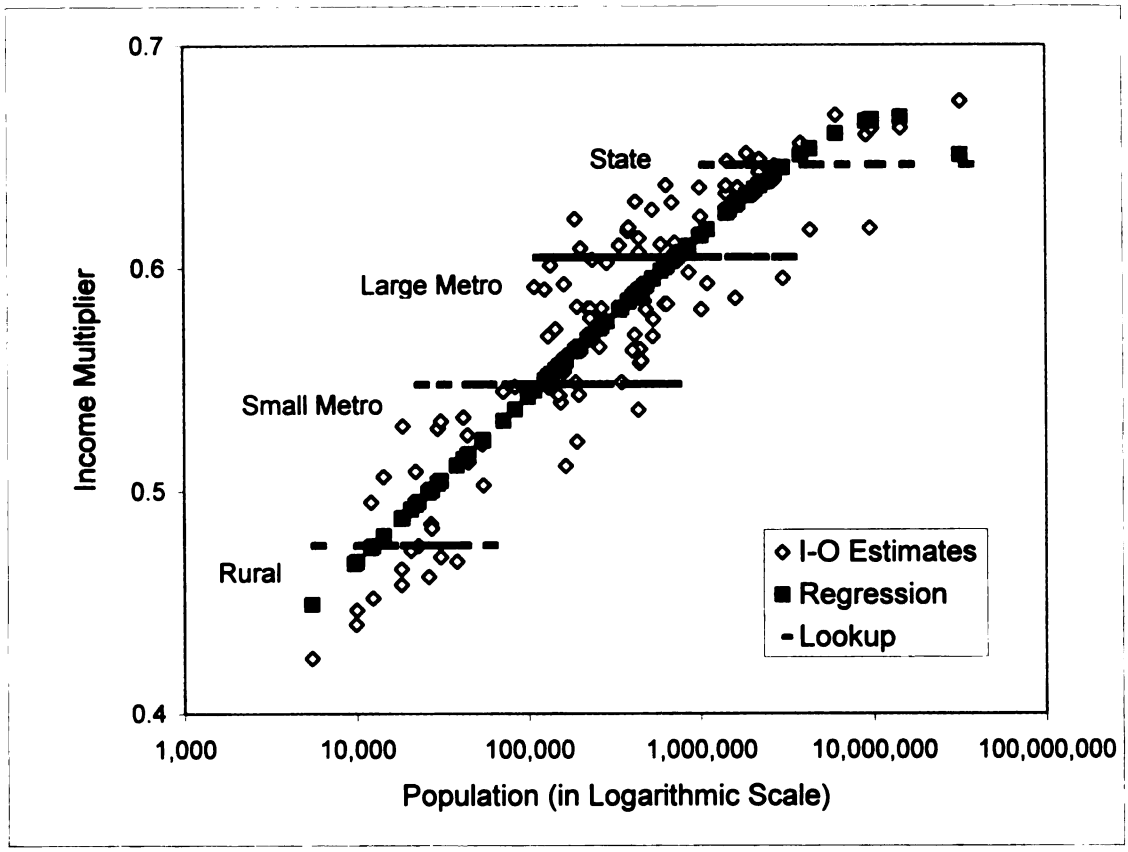

Figure 4-6. Distribution of Income Multipliers Predicted by the Lookup and Regression Approaches

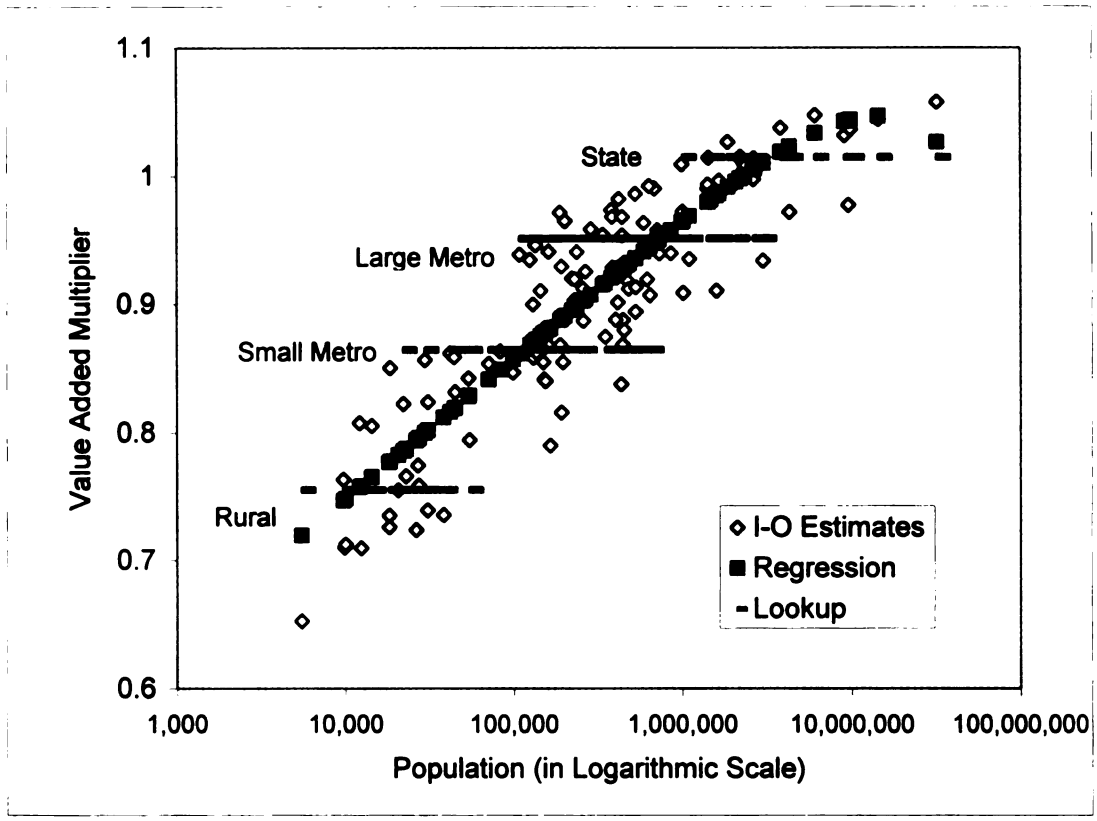

Figure 4-7. Distribution of Value Added Multipliers Predicted by the Lookup and Regression Approaches

Job multipliers do not have the same distribution as sales, income and value added multipliers (Figure 4-8). In general, both lookup and regression approaches do not predict job multipliers as well as sales, income, or value added multipliers. Errors in predicted job multipliers are higher for the state and rural areas than for the small and large metro regions. Both regression and lookup approaches yield similar errors in job multipliers. The comparison between job and sales multipliers indicates that regions may be grouped differently if they were grouped solely based on job multipliers.

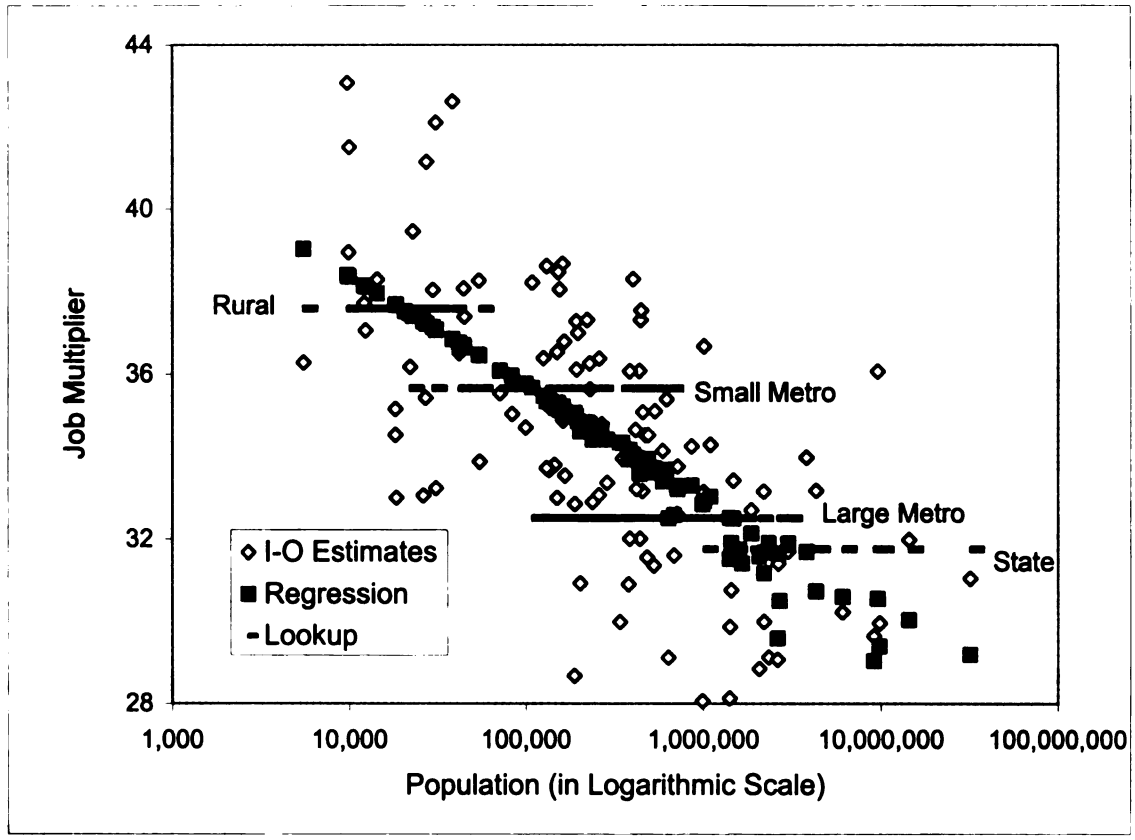

Figure 4-8. Distribution of Job Multipliers Predicted by the Lookup and Regression Approaches

Handling Regions with Low Job Multipliers

When forming regions into four primary groups, some regions experienced job to sales ratios that were more than 15 percent below the average for their group. These regions had comparable sales, income, and value added multipliers but lower job multipliers when compared with group averages. To evaluate the effects of regions with lower job multipliers, thirty-two regions were split out from the rural, small metro, and large metro groups.

Job multipliers for the 32 split out regions, on average, were 10 percent lower across all groups relative to the parent groups that were computed with all 114 regions. Job multipliers for the 32 split out regions were about 15 percent lower than the remaining 82 groups (Table 4-21). By splitting out the 32 regions, job multipliers for the remaining 82 regions are more homogeneous within each group. The MAPE's for job multipliers are down from 6 to 9 percent for all 114 regions to 3 to 5 percent for the remaining 82 regions across all groups. The maximum APE's for job multipliers are less than 10 percent for all groups when computed with the remaining 82 regions. This suggests that regions could be formed into subgroups to better capture variations in job multipliers. Note that splitting out these 32 regions in the generic multiplier analysis does not alter the results for sales, income, and value added multipliers. The means and MAPE's are almost identical to results for these 32 split out regions and to the 82 remaining regions.

Table 4-21. Evaluation of the Low Job Multiplier Subgroup

Group[b]	Statistics	Type II Job Multipliers[a]		
		32 low multiplier regions	Remaining 82 regions	All 114 regions
Rural	Mean	34.04	39.64	37.58
	Minimum	33.01	36.28	33.01
	Maximum	35.43	43.08	43.08
	CV[c]	3%	6%	9%
	MAPE[d]	2%	5%	7%
	Max APE[e]	4%	9%	14%
	# of regions	7	12	19
Small Metro	Mean	32.20	36.72	35.66
	Minimum	24.42	33.72	24.42
	Maximum	33.81	38.68	38.68
	CV	10%	4%	8%
	MAPE	7%	3%	6%
	Max APE	32%	9%	46%
	# of regions	8	26	34
Large Metro	Mean	29.03	34.70	32.51
	Minimum	24.58	32.01	24.58
	Maximum	31.70	38.22	38.22
	CV	8%	5%	10%
	MAPE	6%	4%	9%
	Max APE	18%	9%	32%
	# of regions	17	27	44

a. All multipliers are aggregate tourism multipliers as defined in chapter 3.
b. No region was split out from the state group.
c. CV= Coefficient of variations = Standard deviation/mean
d. MAPE =Mean absolute percent error (comparing regression predicted values with multipliers for each individual region in the group).
e. Max APE= Maximum absolute percentage error, the largest error in the group.

These 32 regions with lower than average job multipliers typically were large metropolitan regions, rural areas with substantial tourism development, and regions with a strong year-round tourism market. Using hotels as an example, the lower job to sales ratios could be a result of higher room rates, or fewer part

time and seasonal jobs (resulting in higher average wages). Table 4-22 shows the average personal income for hotel employees within each of the four primary groups for regions that were split out from the groups and the remaining regions. It indicates that in those 32 regions where lower job to sales ratios were found, the average personal income in the hotel sector was much higher than the remaining 82 regions. Since all 32 regions with low job multipliers are consistently over-estimated by the regression model, this also suggests that, for future research, job multipliers may be better predicted by including other independent variables in the regression model.[15]

Table 4-22. Average Personal income for the Lodging Sector within each Group of Regions

Group	Average Personal Income for the 32 Low Job Multiplier Regions[a]	Average Personal Income for the Remaining Regions[a]	t-statistics	df	Significance
Rural	$17,912	$13,649	3.272	17	0.004
Small metro	$23,137	$18,105	4.835	31	0.000
Large metro	$33,750	$23,063	7.952	43	0.000
State	N/A	$28,394	N/A	N/A	N/A

a. Computed using IMPLAN 1996 personal income and employment data for the hotel and lodging sector.

This chapter has presented findings for the three study objectives. Multipliers vary across industry sectors and across regions with different characteristics. Service sectors had higher total jobs, income, and value added

[15] For example, including average personal income for the hotel sector as an independent variable in the job multiplier regression model increases the model's adjusted R Square from 52% to 82%.

per $1 million direct sales than manufacturing sectors. Sales, income and value added multipliers increased as the region's population increased, while job multipliers decreased as the region's population increased. Regions were classified into groups with distinct multipliers. Errors in the multiplier lookup procedure are similar to the regression model approach, if the appropriate region is selected. The results indicate that the lookup procedure delivers similar accuracy compared to the regression models.

Chapter 5

DISCUSSION AND CONCLUSIONS

The major goal of this study was to explain variations in multipliers for the tourism and recreation sectors. The three study objectives are to describe variations in economic multipliers, to identify key factors associated with these variations, and to propose and evaluate procedures for predicting multipliers for recreation and tourism applications. The development of a multiplier lookup procedure is to allow analysts to select a type of region that matches the regional characteristics of his or her study area and use the "generic" multipliers for that type of region. A total of 114 regional input-output models were built for this study. Multipliers were extracted from these models and regions were formed into four groups based on regional multipliers within each group. A lookup table was developed to help analysts select a set of sector-specific multipliers. Errors introduced by the multiplier lookup approach are on average between 2 and 9 percent and are comparable with results from regression models. This chapter interprets the findings and explains how these results fit each research objective. A sample application of the multiplier lookup procedure is provided. Conclusions and recommendations for future research are also included in this chapter.

Discussion of the Results

Objective 1. Describe Variations in Multipliers

Economic multipliers vary across different industry sectors. The values of multipliers in one sector could be several times higher than in another sector (Tables 4-1, 4-2). Overall, multipliers for service sectors were higher than for manufacturing sectors. This is caused by the fact that service sectors are more labor intensive than manufacturing sectors. More workers are required to deliver a fixed amount of sales in service sectors compared to manufacturing sectors, where a majority of the direct cost goes to purchases of raw materials and equipment. As a result, more income will result from sales in service sectors. The higher worker income is in a region, the more purchases employees will make in the local region. And these local purchases will result in more money being re-circulated in the region, higher induced effects, and higher multipliers.

To capture spending on different items and to reflect the variations in multipliers across sectors, this study recommends the use of sector-specific multipliers. Sector-specific multipliers can reduce aggregation errors and increase flexibility in terms of applying multipliers to spending in different categories. For example, day visitors who spend the most money on souvenirs would have very different multiplier effects than overnight visitors who spend the bulk of their money on lodging and restaurants. By applying an aggregate multiplier to visitor spending, the variations in multipliers across sectors won't be captured.

Economic multipliers also vary across regions. The largest multipliers were mostly 50 to 100 percent higher than the smallest multipliers across regions for the same sector (Tables 4-3 to 4-6). Therefore, by applying the state multipliers to a rural region, the impacts can be overestimated by as much as 100 percent. The coefficients of variations were between 5 and 20 percent for most multipliers, which means the ranges for all multipliers were plus or minus 10 percent to 40 percent of the means in 95 out of 100 times. The variations in multipliers across regions show the importance of using multipliers that are appropriate and can reflect the region's characteristics. The results from objective 1 show why there is a need for better understanding of the different types of regions and for a system to adopt multipliers for a particular type of regions.

Objective 2. Identify Key Factors that Explain Variations in Multipliers

Population and population density explain more than 75 percent of the variations in multipliers for sales, income and value added. The model explains about 52 percent of the variations in job multipliers. For all four models, population (in logarithmic value) is the most significant predictor. Multipliers will increase with population (except for job multipliers, which are negatively correlated with population) in a nonlinear relation. As the population grows, the multipliers will increase at a slower speed and will stop at certain thresholds, even when the region's population continues to grow. This finding supports Mulligan and Gibson's study (1984) in which they found that the economic base

multiplier grows at a decelerated rate and stops at a certain value as the region's employment increases.

The results of this analysis are encouraging based on the fact the all models explain variations in multipliers well, and the average errors are 3 to 6 percent for different multipliers. These results provide two useful pieces of information. First, population alone can explain variations in multipliers well. As regions are formed into groups based on multipliers, population within each group should be homogeneous. These regional characteristics can be used to describe types of regions within each group and used as guidelines for choosing multipliers for a given region. Second, the results of regression models can be used as benchmarks to evaluate the accuracy of the multiplier lookup approach as proposed in this study. A comparison between the results of the multiplier lookup procedure and the regression model approach can help evaluate whether the multiplier lookup procedure is an accurate means of choosing multipliers.

Objective 3. Propose and Evaluate Procedures for Predicting Multipliers

All regions were formed into four groups each with distinct multipliers. Multipliers for three economic measures (sales, income and value added) were highly correlated. Multipliers for these three measures show reasonable homogeneity within each group. All regions (except for one or two from each group) fell within 10 percent of the group's average.

The results from this analysis show that the multiplier lookup approach for estimating economic impacts may be adequate for most recreation and tourism

applications. Errors introduced by "generic" multipliers are on average between 2 and 5 percent for sales, income and value added multipliers and at most 10 percent compared to multipliers that were estimated from I-O models for the regions. The average errors are also similar to multipliers that are estimated from regression models. The possible errors that may result from using the proposed generic sector specific multipliers are considered to be less than using state multipliers in a rural area or borrowing multipliers from one region to another.

Some regions experienced job multipliers that were more than 15 percent lower than their primary groups because of inconsistency in job multipliers with other economic measures. Problems in grouping job multipliers were expected because job estimates are confounded by part-time and seasonal workers and thus would not be as highly correlated with sales as other economic measures. This problem can be reduced by splitting out a separate sub-group of regions with low job multipliers.

Applications of the Proposed Multiplier Lookup Procedure

Three components are needed to estimate economic impacts of visitor spending on a given region- total visitation, average spending per visit, and economic multipliers for the region. This study proposes a multiplier lookup procedure for selecting economic multipliers for a given region. Four sets of "generic" multipliers each representing a type of region of certain size and economic diversity are provided. There are three steps for carrying out the

impact analysis of visitor spending on a local area. Estimate of economic impacts of visitor spending to Lake Mendocino in California is used to illustrate the procedure. Lake Mendocino is a U.S. Army Corps of Engineers recreation project and is located about 100 miles north of San Francisco.

1. Estimate total visitor spending. Lake Mendocino attracts 520,000 day visits and 40,000 overnight visits a year (in person trips). Visitors to this lake spend an average of $15 per person per trip for day visitors and $65 for overnight visitors in the local area.[16] By multiplying an average visitor spending for each segment by total number of visits for each segment, total spending for these 560,000 visits is estimated at $10.4 million a year (Table 5-1).

Table 5-1. Sample Computation of Total Visitor Spending, Lake Mendocino Area

	Day Visitor	***Overnight Visitor***	***Total***
Number of Visits (person trip)	520,000	40,000	560,000
Spending Category			
Lodging	$ 0	$ 20	$800,000
Eating and Drinking	3	12	$2,040,000
Recreation	2	3	$1,160,000
General Merchandise	10	30	$6,400,000
Total	$ 15	$ 65	$10,400,000

[16] The average party size is 2.8 people for day visitors and 3 for overnight visitors. The average length of stay is 2.5 nights for overnight visitors. Thus, the corresponding per party per night spending is $42 for day users and is $78 for overnight users.

2. Select multipliers for the region based on regional characteristics shown in the lookup table. Table 5-2 shows sample multipliers for Lake Mendocino areas that were estimated from the lookup approach[17] and from an actual IMPLAN I-O model for this region. Using Table 4-15, users can select the type of region represented by the study area. In this case, Lake Mendocino is located in Mendocino County in California. The county's population is 85,216 (in 2000 U.S. Census) with no city over 20,000 people. The Lake Mendocino area is therefore classified into the small metro area category.

Table 5-2. Multipliers for Lake Mendocino Area

	Generic Multipliers for Small Metro Area[a]			***Actual IMPLAN Model Multipliers***[b]		
Sector	Direct Jobs/ Sales	Type II sales	Type II Jobs	Direct Jobs/ Sales	Type II sales	Type II Jobs
Hotels And Lodging Places	23.41	1.52	31.73	22.60	1.51	30.87
Eating and Drinking	31.51	1.43	37.89	31.11	1.42	37.66
Amusement And Recreation	32.07	1.46	39.26	29.73	1.46	37.22
Retail Trade	30.23	1.38	36.20	12.30	1.40	36.13
Manufacturing	10.93	1.40	16.56	13.07	1.38	18.72

a. Complete sets of sector-specific multipliers for the four types of regions are given in Tables D-1 to D-4 in Appendix D.
b. Multipliers were estimated using IMPLAN with 1996 data.

[17] Complete sets of sector-specific multipliers for the four types of regions are given in Tables D-1 to D-4 in Appendix D.

3. Compute economic impacts of total visitor spending. Economic impacts can be estimated by multiplying the direct sales effects by corresponding sector-specific multipliers. Spending on manufactured goods from Table 5-1 is first separated into margins and producer prices, and the producer price is further divided into local production and imports (column two in Table 5-3).[18] Only local margins and local production are included as direct sales effects (column three in Table 5-3). These direct sales effects are then multiplied by the generic multipliers for small metro area in Table 5-2 to estimate jobs and sales effects (columns 4 to 6 in Table 5-3).

Table 5-3. Sample Computation of Visitor Spending Impacts

Sector	Total Spending ($MM)	Direct Sales ($MM)	Direct Jobs	Total Sales ($MM)	Total Jobs
Lodging	$ 0.80	$ 0.80	19	$ 1.22	25
Eating and Drinking	$ 2.04	$ 2.04	64	$ 2.92	77
Recreation	$ 1.16	$ 1.16	37	$ 1.69	46
Retail Trade	$ 2.20	$ 2.20	67	$ 3.04	80
Local Production	$ 1.30	$ 1.30	14	$ 1.82	22
Imports	$ 2.90	$ -	-	$ -	-
Total	$ 10.40	$ 7.50	201	$ 10.68	249

In the above example, 72% of the $10.4 million visitor spending is captured as direct sales by the region's economy (column three). These sales

[18] An example of extracting retail margins on purchases of good is given in Table 2-6 in Chapter 2. See "Estimating National Park visitor spending and economic impacts; The MGM2 Model," (Stynes et a., 2000-p 4.10) for details on settings for local production and retail, wholesale margins.

support 201 direct jobs (column four). With multiplier effects, visitor spending in this region results in $10.68 million total sales (column five) and supports 249 jobs (column six). Should multipliers computed from an I-O model for the region have been used (columns 5 to 7 in Table 5-2), the same spending would have resulted in $10.8 million total sales and supported 249 total jobs. The errors made by using generic multipliers instead of multipliers specific to the region are around 2 to 3 percent in this case.

Conclusions

Sector-specific multiplier approaches are the compromise between accuracy and practical issues when conducting EIA of visitor spending. By using the sector-specific multipliers, analysts can get reliable results of economic impacts of recreation and tourism without directly using an I-O model.

Multipliers vary across regions and the magnitude of multipliers increase with increasing economic diversity and size. Sales, income and value added multipliers are highly correlated with each other and are positively correlated with population in the region while job multipliers are negatively correlated with the region's population. Four sets of generic sector-specific multipliers were developed to capture variations in multipliers across regions and sectors.

The evaluation of the multiplier lookup procedure shows this approach can provide reasonably accurate estimates of multipliers for a given region. The "multiplier lookup" approach developed in this study will serve as a tool to help tourism analysts choose appropriate multipliers for a given region and

application. Although the proposed "multiplier lookup" approach and generic multipliers have been developed for the National Park Service's Money Generation Model, the multiplier lookup approach can be used in estimating economic impacts of recreation visitor spending for many applications. Currently, this approach is also used in the Michigan Tourism Economic Impact Model and in the US Army Corps of Engineers' Recreation Economic Assessment System. With modification of the sectors, the proposed multiplier lookup approach could also be used by tourism analysts who are interested in special market segments (i.e., add a boat building and repair sector for boaters). In addition, this quick and cost effective approach for selecting multipliers will allow tourism analysts to conduct economic impact analysis without directly using an I-O model while still benefiting from the detailed direct effects and reliable aggregate secondary effects. This approach can substantially reduce costs of public and private sector agencies' efforts to assess economic implications of any current and proposed policies and plans.

Recommendations for Future Study

This study examined multipliers that were generated from IMPLAN models and evaluated the feasibility of a simple "multiplier lookup" procedure. The analysis and findings suggest five related topics for further research.

1. Include multipliers for different sectors to accommodate other recreation and tourism analysis. This study has focused on variations in multipliers for the four primary tourism sectors, lodging, restaurant,

recreation, and retail trade. However, tourism analysts also need to assess the economic impacts from visitors of special market segments or of constructions and operations. Similar analysis can be done for other sectors such as the Water Transportation sector (for spending on boating and cruising), the Maintenance and Repair of Facilities sector (for maintenance and operational costs), and the Boating and Repairing sector (for purchases of new boats) to accommodate other types of recreation and tourism impacts. To include multipliers for other sectors can also help understand how these multipliers vary across regions for different sectors.

2. Extend analysis to additional regions. The selections of study regions for this study were limited by the availability of datasets. Michigan State University has purchased the datasets from the Minnesota IMPLAN Group for a project to revise USDI National Park Service's Money Generation Model. Further study can include additional regions from other states to test the generalizability of the methods used in this study. Multipliers can be extracted from other regions to see if variations in multipliers across regions have similar patterns, and to see whether regions can be formed into similar types of groups as found in this study.

3. Study how multipliers change over time. Multipliers may change over time because of price changes or structural changes in economy (e.g., new industries move in to the region). This change may be small and the multipliers may not need to be updated very often. The USDC Bureau of Economic Analysis, for instance, only publishes RIMS II multipliers every five years. This is the case for sales, income, and value added multipliers. Job multipliers, however, will probably need to be updated more frequently since the increase of wages and salary over time will directly result in lower job per sales ratios. To know how multipliers change over time can reduce the efforts and frequency on updating multipliers and will allow adjustments to be made when multipliers and spending data are from different years.

4. Disaggregation of tourism sectors used in current I-O models. I-O models such as IMPLAN generally do not have sectors for many different recreation and tourism businesses. The Hotel and Lodging Places sector in IMPLAN, for instance, includes large and small hotels, bed and breakfasts, camp grounds and all other commercial lodging places. As the operation for a small bed and breakfast will not be the same as for a nationwide-chain hotel, the production functions of these two businesses will be very different (proportions of commodities used to produce one dollar of sales). These differences will result in different indirect effects and thus different multipliers. Therefore, the

industry average ratios and multipliers may not reflect the recreation and tourism part of the industry well. The new North American Industry Classification System (NAICS) is in the transition of replacing the old Standard Industry Classification (SIC) system. There are nine new service sectors and 250 new service industries being recognized in the new NAISC, which include casinos, casino hotels and other tourism and recreation industries (USDC Census Bureau, 2001). To incorporate the new NAICS industries or other recreation and tourism sectors into I-O models can help identify the relationships between these industries and better estimate the indirect effects of recreation and tourism.

5. Evaluate the accuracy of induced effects estimated by IMPLAN and other I-O models. Since recreation and tourism industries are labor intensive, a high percentage of sales goes into wages and salaries that makes induced effects very important. However, high numbers of part-time and seasonal employees may distort the estimates of induced effects. IMPLAN is one of the most used input-output systems to estimate economic impact analysis of tourism and recreation. Chapter 2 reviews several studies that compare IMPLAN multipliers with other systems, and one of the findings is that IMPLAN tends to overestimate induced effects for service sectors. However, all of those comparisons were made based on the old IMPLAN Type III multipliers and IMPLAN

has since changed its multipliers to Type II and to the current Type SAM multipliers for capturing the induced effects. Although the Type SAM multipliers are considered an improvement over IMPLAN's earlier Type II and Type III multipliers, it would be particularly useful to know how accurate are the estimated induced effects. It is also useful to know how the current IMPLAN multipliers compare to the old multipliers and multipliers estimated by alternative systems so analysts can make adjustments when comparing findings from different reports or want to borrow multipliers from other study.

APPENDICES

APPENDIX A

STUDY REGIONS AND CORRESPONDING PARKS AND CITIES

Table A. Study Regions and Corresponding Parks and Cities

Region Name[a]	Number of counties	NPS Parks/MSA's in the region[b]	Population (000's)	Area (square miles)
California				
CA96	-	(State model)	31878	155973
SantaMNRA	2	Santa Monica NRA/ Los Angeles MSA, Ventura MSA	9842	5906
LA-MSA	1	Los Angeles MSA	9128	4060
RiversideMSA	2	Joshua Tree NM/ Riverside-San Bernardino MSA	3016	27270
SanDiegoMSA	1	San Diego MSA	2655	4205
OrangeCyMSA	1	Orange County MSA	2637	790
OaklandMSA	2	Oakland MSA	2210	1458
SanFranciscoMSA	3	Golden Gate NRA, etc/ San Francisco MSA	1655	1016
SanJoseMSA	1	San Jose MSA	1600	1291
SacramentoMSA	3	Sacramento MSA	1482	4082
KingsCanyonNP	2	Kings Canyon NP	1101	10788
FresnoMSA	2	Fresno MSA	862	8102
SanFranciscoCo	1	Golden Gate NRA, etc	735	47
VenturaMSA	1	Ventura MSA	715	1846
BakersfieldMSA	1	Bakersfield MSA	623	8142
StocktonMSA	1	Stockton MSA	533	1399
NapaMSA	2	Vallejo-Fairfield-Napa MSA	482	1582
SantaRosaMSA	1	Santa Rosa MSA	421	1576
ModestoMSA	1	Modesto MSA	416	1495
SantaBarbaraMSA	1	Santa Barbara MSA	386	2739
VisaliaMSA	1	Visalia-Tulare-Porterville MSA	350	4824
SalinasMSA	1	Salinas MSA	339	3322
LassenV-NP	4	Lassen Volcanic NP/ Redding MSA	268	13848
SantaCruzMSA	1	Santa Cruz MSA	238	446
SanLuisMSA	1	San Luis MSA	229	3305
ChicoMSA	1	Chico-Paradise MSA	193	1640
MercedMSA	1	Merced MSA	192	1929
YosemiteNP	4	Yosemite NP	189	8870
ReddingMSA	1	Whiskeytown Shasta-Trinity NRA/ Redding MSA	162	3786
RedwoodNP	2	Red Wood NP	150	4581
YoloMSA	1	Yolo MSA	150	1012
YubaMSA	2	Yuba City MSA	137	1233

Table A. (cont'd)

Region Name[a]	Number of counties	NPS Parks/MSA's in the region[b]	Population (000's)	Area (square miles)
MendocinoCo	1	(single county region)	83	3509
LavaBedsNM	2	Lava Beds NM	54	10232
SiskiyouCo	1	(single county region)	44	6287
DelNorteCo	1	(single county region)	27	1008
GlennCo	1	(single county region)	26	1315
DeathValleyNP	1	Death Valley NP	18	10192
ModocCo	1	(single county region)	10	3944
Colorado				
CO96	-	State model	3823	103729
DenverMSA	5	Denver MSA	1867	3761
RockyMtNP	3	Rocky Mountain NP	489	5194
COSpringsMSA	1	Florissant Fossil Beds NM/ Colorado Springs MSA	473	2127
BoulderMSA	1	Boulder MSA	258	743
FtCollinsMSA	1	Fort Collins MSA	222	2601
GreeleyMSA	1	Greeley MSA	152	3993
PueblosMSA	1	Pueblos MSA	131	2389
GDJunctionMSA	1	Colorado NM/ Grand Junction MSA	108	3328
CurecantiNRA	2	Curecanti NRA, Black Canyon of the Gunnison NM	42	5480
MontroseCo	1	Black Canyon of the Gunnison NM	30	2241
MesaVerdeNP	1	Mesa Verde NP	22	2037
AlamosaCo	1	Great Sand Dunes NM	14	723
DinosaurNP	1	Dinosaur NP	12	4743
BentsNM	1	Bent's Old Fort NHS	5	1514
Florida				
FL96	-	State model	14400	53937
EvergladesNP	3	EvergladesNP, Biscanye NP, Dry Tortugas NP/ Miami MSA	2345	4967
TampaMSA	4	Tampa-St. Pertersburg-Clear Water MSA	2199	2555
MiamiMSA	1	Miami MSA/ Biscanye NP	2076	1945
FtLauderdaleMSA	1	Ft Lauderdale MSA	1438	1209
OrlandoMSA	4	Orlando MSA	1417	3491
JacksonvilleMSA	4	Ft. Caroline NM, Castillo de San Marcos NM, Ft. Matanzas NM/ Jacksonville MSA	1009	2636
WPalmB-MSA	1	West Palm Beach-Boca Raton MSA	993	1974
SarasotaMSA	2	DeSoto NM/ Sarasota-Bradenton MSA	529	1313
DaytonaMSA	2	Daytona MSA	456	1591
MelbourmeMSA	1	Melbourme-Titusville-Palm Bay MSA	454	1019
LakelandMSA	1	Lakeland-Winter Haven MSA	441	1875
PensacolaMSA	2	Gulf Islands NS/ Pensacola MSA	386	1679
FtMyersMSA	1	Fort Myers-Cape Coral MSA	380	804
FtPierceMSA	2	Fort Pierce-Port St. Lucie MSA	287	1128

Table A. (cont'd)

Region Name[a]	Number of counties	NPS Parks/MSA's in the region[2]	Population (000's)	Area (square miles)
TallahasseeMSA	2	Tallahassee MSA	259	1183
OcalaMSA	1	Ocala MSA	230	1579
GainesvilleMSA	1	Gainesville MSA	197	874
NaplesMSA	1	Naples MSA	188	2026
FtWaltonB-MSA	1	Ft. Walton Beach MSA	166	936
PanamaMSA	1	Panama MSA	145	764
PuntaGordaMSA	1	Punta Gorda MSA	130	694
JacksonCo	1	(single county region)	45	916
OkeechobeeCo	1	(single county region)	31	774
HolmesCo	1	(single county region)	18	483
TaylorCo	1	(single county region)	18	1042
DixieCo	1	(single county region)	12	704
Massachusetts				
MASS96	-	State model	6092	7838
GrBoston[c]	4	Massachusetts part of Boston MSA[b]/ Boston area NHS's and NHP's	2695	1282
MiddlesexCo	1	Longfellow NHS, Lowell NHS, Minute Man NHP	1413	824
Boston	1	Boston African American NHS, Boston NHP	645	59
NorfolkCo	1	Adams NHS, F L Olmsted NHS, J F Kennedy NHS	637	400
WorcesterCo	1	(single county region)	720	1513
EssexCo	1	Salem Maritime NHS, Saugus Iron Works NHS	687	498
SpringfieldMSA	2	Springfield MSA/ Springfield NHS	592	1148
SpringfieldNHS	1	Springfield NHS	442	619
CapeCodNS	1	Cape Cod NS/ Barnstable-Yarmouth MSA	202	396
PittsfieldMSA	1	Pittsfield MSA	135	931
FranklinCo	1	(single county region)	71	702
Michigan				
MI96	-	State model	9594	56809
DetroitMSA	6	Detroit MSA	4318	3897
GrRapidsMSA	4	Grandrapids-Muskegon-Holland MSA	1015	2759
AnnArborMSA	3	Ann Arbor MSA	530	2029
LansingMSA	3	Lansing-East Lansing MSA	448	1707
Kzo-BtCk-MSA	3	Kalamazoo-Battle Creek MSA	444	1882
FlintMSA	1	Flint MSA	436	640
SaginawMSA	3	Saginaw-Bay City-Midland MSA	403	1775
MuskegonCo	1	(single county region)	165	509
BentonHarborMSA	1	Benton Harbor MSA	161	571
JacksonMSA	1	Jackson MSA	155	707

Table A. (cont'd)

Region Name[a]	Number of counties	NPS Parks/MSA's in the region[b]	Population (000's)	Area (square miles)
SleepBD-NP	3	Sleeping Bear Dunes NL	125	1612
Straits	4	(Mackinac Strait area counties)	99	3766
E-UP	3	(Eastern Upper Peninsula counties)	55	3486
IsleRoyaleNP	2	Isle Royale NP, Keweenaw NHP	38	1553
AlpenaCo	1	(single county region)	31	574
DickinsonCo	1	(single county region)	27	766
RoscommonCo	1	(single county region)	23	521
AntrimCo	1	(single county region)	21	477
PicturedRocksNP	1	Pictured Rocks NL	10	918
LakeCo	1	(single county region)	10	568

a. All models were named to indicate which of the above four categories they belonged to (i.e., model names ended with "MSA" indicate metropolitan statistical areas; model names ended with "NP" indicate National Park regions; model names ended with "CO" indicate single or multiple county regions).
b. MSA: Metropolitan Statistical Area; NP: National Park; NM: National Monument; NRA: National Recreation Area; NHS: National Historical Site; NHP: National Historical Park, NL: National Lakeshore; NS: National Seashore.
c. The BEA defined Boston-Worcester-Lawrence-Lowell-Brocktn MSA model was not constructed because data sets for counties in New Hampshire were not available.

APPENDIX B

VARIATIONS IN MULTIPLIERS FOR EIGHT OTHER SECTORS

Table B-1. Regional Variation in Sales Multipliers, Other Sectors

Sector	Mean	Std. Dev.	Coef. of Variation	Median	Maximum	Minimum	Range
Type II Sales Multiplier							
Wholesale Trade	1.43	0.10	7%	1.45	1.63	1.15	0.49
Auto Repair and Services	1.43	0.11	8%	1.44	1.88	1.13	0.74
Local Transportation	1.49	0.11	8%	1.50	1.74	1.16	0.58
Food Processing	1.48	0.09	6%	1.47	1.69	1.26	0.43
Apparel	1.45	0.11	8%	1.44	1.72	1.15	0.57
Petroleum Refining	1.34	0.13	10%	1.28	1.61	1.15	0.46
Sporting Goods	1.50	0.11	7%	1.51	1.73	1.18	0.54
Manufacturing	1.48	0.08	6%	1.48	1.67	1.28	0.39
Type I Sales Multiplier							
Wholesale Trade	1.20	0.05	4%	1.20	1.29	1.08	0.21
Auto Repair and Services	1.24	0.07	5%	1.24	1.54	1.08	0.46
Local Transportation	1.17	0.05	4%	1.17	1.28	1.07	0.21
Food Processing	1.34	0.07	5%	1.34	1.52	1.20	0.32
Apparel	1.28	0.08	6%	1.26	1.45	1.09	0.36
Petroleum Refining	1.28	0.11	9%	1.24	1.53	1.12	0.41
Sporting Goods	1.32	0.08	6%	1.33	1.44	1.11	0.34
Manufacturing	1.30	0.05	4%	1.30	1.42	1.18	0.24

Table B-2. Regional Variation in Job multipliers, Other Sectors

Sector	Mean	Std. Dev.	Coef. of Variation	Median	Maximum	Minimum	Range
Type II Job multiplier							
Wholesale Trade	17.70	2.80	16%	17.45	24.24	10.77	13.47
Auto Repair and Services	18.49	1.49	8%	18.58	21.36	14.03	7.33
Local Transportation	35.79	5.94	17%	34.31	58.58	24.52	34.06
Food Processing	11.69	1.62	14%	11.39	16.53	8.32	8.21
Apparel	19.33	2.01	10%	19.55	25.80	13.68	12.12
Petroleum Refining	3.37	0.97	29%	3.24	5.24	1.72	3.52
Sporting Goods	17.17	3.40	20%	17.07	28.22	10.65	17.57
Manufacturing	16.73	1.89	11%	16.96	21.94	10.48	11.46
Direct Effect Ratio							
Wholesale Trade	11.45	2.95	26%	10.94	19.69	6.28	13.40
Auto Repair and Services	12.52	1.31	10%	12.47	17.22	9.99	7.23
Local Transportation	28.81	6.08	21%	27.24	52.57	20.98	31.59
Food Processing	5.58	0.75	14%	5.60	7.61	3.68	3.93
Apparel	13.39	1.97	15%	13.51	21.47	7.66	13.80
Petroleum Refining	0.61	0.03	5%	0.61	0.67	0.54	0.13
Sporting Goods	10.85	2.97	27%	10.70	21.19	5.70	15.49
Manufacturing	10.55	1.50	14%	10.64	15.13	6.71	8.43

Table B-3. Regional Variation in Income Multipliers, Other Sectors

Sector	Mean	Std. Dev.	Coef. of Variation	Median	Maximum	Minimum	Range
Type II Income Multiplier							
Wholesale Trade	0.57	0.04	8%	0.57	0.65	0.45	0.20
Auto Repair and Services	0.46	0.05	12%	0.47	0.66	0.31	0.36
Local Transportation	0.76	0.07	9%	0.77	0.86	0.55	0.31
Food Processing	0.31	0.05	17%	0.31	0.42	0.17	0.25
Apparel	0.41	0.10	24%	0.40	0.66	0.18	0.47
Petroleum Refining	0.14	0.04	27%	0.13	0.21	0.08	0.13
Sporting Goods	0.42	0.06	15%	0.43	0.55	0.23	0.31
Manufacturing	0.41	0.05	12%	0.41	0.51	0.28	0.23
Direct Effect Ratio							
Wholesale Trade	0.40	0.00	1%	0.41	0.41	0.39	0.01
Auto Repair and Services	0.31	0.02	6%	0.31	0.34	0.24	0.10
Local Transportation	0.57	0.03	5%	0.58	0.61	0.44	0.18
Food Processing	0.14	0.04	27%	0.14	0.24	0.04	0.20
Apparel	0.25	0.07	30%	0.24	0.48	0.03	0.45
Petroleum Refining	0.05	0.01	26%	0.05	0.08	0.02	0.06
Sporting Goods	0.23	0.05	20%	0.24	0.31	0.08	0.24
Manufacturing	0.23	0.03	15%	0.23	0.31	0.12	0.20

Table B-4. Regional Variation in Value Added Multipliers, Other Sectors

Sector	Mean	Std. Dev.	Coef. of Variation	Median	Maximum	Minimum	Range
Type II Value Added Multiplier							
Wholesale Trade	0.96	0.07	7%	0.96	1.08	0.77	0.32
Auto Repair and Services	0.74	0.08	11%	0.76	0.87	0.51	0.36
Local Transportation	0.98	0.09	10%	0.99	1.14	0.70	0.45
Food Processing	0.56	0.10	17%	0.56	0.75	0.29	0.45
Apparel	0.55	0.13	23%	0.55	0.86	0.28	0.58
Petroleum Refining	0.34	0.10	29%	0.31	0.53	0.17	0.36
Sporting Goods	0.74	0.11	15%	0.76	0.96	0.42	0.54
Manufacturing	0.68	0.08	12%	0.68	0.85	0.47	0.39
Direct Effect Ratio							
Wholesale Trade	0.69	0.00	1%	0.69	0.69	0.67	0.02
Auto Repair and Services	0.49	0.03	6%	0.49	0.54	0.38	0.16
Local Transportation	0.68	0.04	5%	0.68	0.72	0.52	0.21
Food Processing	0.28	0.08	27%	0.28	0.46	0.07	0.39
Apparel	0.29	0.09	30%	0.28	0.57	0.03	0.54
Petroleum Refining	0.14	0.04	26%	0.14	0.22	0.06	0.16
Sporting Goods	0.44	0.09	20%	0.45	0.59	0.14	0.45
Manufacturing	0.39	0.06	15%	0.39	0.54	0.21	0.34

APPENDIX C

REGIONAL CHARACTERISTICS AND MULTIPLIERS BY TYPE OF REGION

Table C-1. Rural Regions (N=19)

Model[a]	Population	Population density[b]	Multiplier[c]			
			Sales II	Jobs II	Income II	VA II
BentsNM	5,478	4	1.18	36.28	0.42	0.65
DixieCo	12,352	18	1.24	37.05	0.45	0.71
GlennCo	26,202	20	1.25	33.06	0.46	0.72
HolmesCo	18,174	38	1.25	34.53	0.46	0.73
PicturedRocksNL	9,971	11	1.26	41.51	0.45	0.71
TaylorCo	18,173	17	1.26	35.16	0.47	0.74
LakeCo	9,874	17	1.27	38.94	0.44	0.71
AntrimCo	20,595	43	1.32	37.50	0.47	0.76
ModocCo	9,693	2	1.32	43.08	0.47	0.76
DelNorteCo	26,947	27	1.33	35.43	0.49	0.77
Eastern Upper Peninsula	54,565	16	1.33	33.88	0.50	0.79
RoscommonCo	22,847	44	1.34	39.46	0.48	0.77
DickinsonCo	27,285	36	1.35	41.16	0.48	0.76
AlpenaCo	30,746	54	1.36	42.11	0.47	0.74
IsleRoyaleNP	38,240	25	1.36	42.62	0.47	0.74
OkeechobeeCo	30,894	40	1.37	33.24	0.53	0.82
DeathValleyNP	18,433	2	1.39	33.01	0.53	0.85
AlamosaCo	14,300	20	1.40	38.29	0.51	0.81
DinosaurNP	12,086	3	1.40	37.72	0.49	0.81
Average	21,413	23	1.31	37.58	0.48	0.76

a. Sorted by Type II sales multipliers.
b. People per square mile.
c. All multipliers are aggregate tourism multipliers as defined in chapter 3.

Table C-2. Small Metro Regions (N= 34)

Model[a]	Population	Population density[b]	Multiplier[c]			
			Sales II	Jobs II	Income II	VA II
Muskegon	164,913	324	1.38	36.79	0.51	0.79
Boston	645,068	11027	1.39	24.42	0.58	0.91
JacksonCo	44,728	49	1.42	37.39	0.51	0.83
LavaBedsNM	53,886	5	1.42	38.26	0.52	0.84
MercedMSA	192,311	100	1.42	36.11	0.52	0.82
MesaVerdeNP	21,999	11	1.42	36.18	0.51	0.82
Mackinac Strait area	99,248	26	1.42	34.71	0.55	0.85
FlintMSA	436,128	682	1.43	36.08	0.54	0.84
FranklinCo	71,209	101	1.43	35.54	0.54	0.85
JacksonMSA	154,563	219	1.43	38.05	0.54	0.84
SyskiyouCo	44,193	7	1.43	38.08	0.53	0.86
YosemiteNP	189,043	21	1.43	32.86	0.55	0.87
YubaMSA	136,555	111	1.44	35.19	0.55	0.86
MelbourmeMSA	453,998	446	1.44	33.17	0.56	0.88
GainesvilleMSA	196,525	225	1.45	37.00	0.54	0.86
MendocinoCo	83,298	24	1.45	35.04	0.55	0.86
FtWaltonB-MSA	165,873	177	1.45	33.55	0.56	0.88
YoloMSA	149,925	148	1.45	33.01	0.55	0.86
CurecantiNRA	41,749	8	1.46	36.51	0.53	0.86
RedwoodNP	149,970	33	1.46	36.54	0.54	0.85
VisaliaMSA	349,922	73	1.46	33.96	0.55	0.87
AnnArborMSA	529,898	261	1.47	33.72	0.57	0.89
GreeleyMSA	152,189	38	1.47	38.48	0.54	0.84
Kzo-BtCk-MSA	444,428	236	1.47	37.31	0.56	0.87
MontroseCo	29,601	13	1.47	38.04	0.53	0.86
PueblosMSA	131,217	55	1.47	38.61	0.55	0.86
PuntaGordaMSA	130,426	188	1.47	33.73	0.57	0.90
BentonHarborMSA	161,434	283	1.48	38.68	0.55	0.87
TallahasseeMSA	259,380	219	1.49	36.38	0.56	0.89
BoulderMSA	258,234	348	1.49	33.08	0.58	0.91
PanamaMSA	144,637	189	1.49	33.81	0.57	0.91
SanLuisMSA	229,437	69	1.50	36.26	0.58	0.90
LansingMSA	447,538	262	1.51	37.54	0.56	0.89
SaginawMSA	403,301	227	1.51	38.30	0.56	0.89
Average	210,789	477	1.45	35.66	0.55	0.86

a. Sorted by Type II sales multipliers.
b. People per square mile.
c. All multipliers are aggregate tourism multipliers as defined in chapter 3.

Table C-3. Large Metro Regions (N= 44)

Model[a]	Population	Population density[b]	Multiplier[c]			
			Sales II	Jobs II	Income II	VA II
SanJoseMSA	1,599,604	1239	1.43	27.01	0.59	0.91
SanFranciscoCo	735,315	15746	1.45	24.58	0.60	0.94
NapaMSA	482,048	305	1.48	31.56	0.58	0.91
ModestoMSA	415,786	278	1.51	34.66	0.57	0.90
NaplesMSA	188,187	93	1.51	28.68	0.62	0.97
COSpringsMSA	472,924	222	1.52	34.53	0.59	0.92
DaytonaMSA	456,464	287	1.52	35.09	0.59	0.93
StocktonMSA	533,392	381	1.52	35.11	0.58	0.91
RiversideMSA	3,015,783	111	1.52	31.70	0.60	0.93
SalinasMSA	339,047	102	1.52	29.99	0.61	0.95
BakersfieldMSA	622,729	76	1.53	35.40	0.58	0.92
LassenV-NP	267,876	19	1.53	34.80	0.58	0.93
OcalaMSA	230,068	146	1.53	35.64	0.58	0.92
SantaCruzMSA	237,821	534	1.53	32.90	0.60	0.94
CapeCodNS	201,970	510	1.53	30.94	0.61	0.96
LakelandMSA	440,954	235	1.54	32.01	0.61	0.95
PensacolaMSA	385,820	230	1.54	36.07	0.59	0.93
PittsfieldMSA	134,788	145	1.54	33.69	0.60	0.95
RockyMtNP	489,495	94	1.54	34.53	0.59	0.93
FtMyersMSA	380,001	473	1.54	30.91	0.62	0.97
SanFranciscoMSA	1,655,454	1630	1.54	24.94	0.64	1.00
FtCollinsMSA	221,725	85	1.55	37.31	0.58	0.92
FtPierceMSA	287,255	255	1.55	33.38	0.60	0.96
ReddingMSA	161,740	43	1.55	34.88	0.59	0.94
SleepBD-NL	125,134	78	1.55	36.39	0.59	0.93
VenturaMSA	714,733	387	1.55	32.62	0.61	0.96
Worcester	719,545	476	1.55	33.77	0.61	0.95
MiddlesexCo	1,412,561	1715	1.55	28.13	0.63	0.99
ChicoMSA	192,507	117	1.56	37.28	0.58	0.93
FresnoMSA	861,753	106	1.56	34.26	0.60	0.94
GrRapidsMH-MSA	1,015,099	368	1.56	36.68	0.58	0.91
KingsCanyonNP	1,101,194	102	1.56	34.29	0.59	0.94
SantaBarbaraMSA	385,573	141	1.56	32.02	0.62	0.97
GrBoston	2,695,017	2103	1.56	26.89	0.65	1.00
NorfolkCo	637,388	1595	1.57	29.13	0.64	0.99
SarasotaMSA	528,803	403	1.57	31.37	0.63	0.99
WPalmB-MSA	992,840	503	1.57	28.07	0.64	1.01

Table C-3. (Cont'd)

Model[a]	Population	Population density[b]	Multiplier[c]			
			Sales II	Jobs II	Income II	VA II
MiamiMSA	2,076,175	1068	1.57	28.85	0.63	0.99
GDJunctionMSA	108,371	33	1.58	38.22	0.59	0.94
SpringfieldMSA	591,804	516	1.58	34.15	0.61	0.96
SpringfieldNHS	442,194	715	1.58	34.01	0.61	0.97
EssexCo	686,774	1379	1.59	31.61	0.63	0.99
OrangeCyMSA	2,636,888	3339	1.59	29.08	0.64	1.00
SantaRosaMSA	420,872	267	1.60	33.23	0.63	0.98
Average	734,124	878	1.54	32.51	0.60	0.95

a. Sorted by Type II sales multipliers.
b. People per square mile.
c. All multipliers are aggregate tourism multipliers as defined in chapter 3.

Table C-4. States and Other Large MSA's (N= 17)

Model[a]	Population	Population density[b]	Multiplier[c]			
			Sales II	Jobs II	Income II	VA II
OrlandoMSA	1,417,291	406	1.58	29.88	0.64	0.99
DetroitMSA	4,318,145	1108	1.59	33.19	0.62	0.97
EvergladeNP	2,345,092	472	1.59	29.13	0.64	1.01
JacksonvilleMSA	1,008,633	383	1.59	33.16	0.62	0.97
FtLauderdaleMSA	1,438,228	1190	1.61	30.77	0.65	1.01
SacramentoMSA	1,482,208	363	1.61	33.43	0.63	0.99
SanDiegoMSA	2,655,463	632	1.61	31.41	0.64	1.01
OaklandMSA	2,209,629	1516	1.63	30.00	0.65	1.01
TampaMSA	2,199,231	861	1.63	33.17	0.64	1.01
Michigan	9,594,350	169	1.64	36.08	0.62	0.98
LA-MSA	9,127,751	2248	1.65	29.66	0.66	1.03
DenverMSA	1,866,978	496	1.66	32.71	0.65	1.03
Massachusetts	6,092,352	777	1.66	30.24	0.67	1.05
SantaMNRA	9,842,484	1667	1.66	29.97	0.66	1.04
Florida	14,399,985	267	1.67	31.99	0.66	1.04
California	31,878,234	204	1.71	31.06	0.67	1.06
Colorado	3,822,676	37	1.71	34.00	0.66	1.04
Average	6,217,572	753	1.63	31.75	0.65	1.01

a. Sorted by Type II sales multipliers.
b. People per square mile.
c. All multipliers are aggregate tourism multipliers as defined in chapter 3.

APPENDIX D

SECTOR SPECIFIC MULTIPLIERS FOR THE FOUR TYPES OF REGIONS

Table D-1. Multipliers for Tourism-Related Sectors – Rural Areas

Sector	Direct effect ratio			Total effect multiplier				Type I	
	jobs /MM sales	income /sales	value Added /sales	sales	jobs /MM sales	income /sales	value added /sales	sales	Model RPC[a]
Hotels and lodging places	27.48	0.30	0.46	1.36	33.59	0.43	0.69	1.24	67%
Eating and drinking	33.88	0.33	0.46	1.30	38.87	0.43	0.64	1.18	86%
Amusement and recreation	30.63	0.35	0.58	1.32	35.98	0.46	0.77	1.18	59%
Retail trade[b]	37.11	0.51	0.80	1.27	41.81	0.60	0.96	1.10	78%
Wholesale trade	14.84	0.40	0.68	1.26	19.43	0.49	0.84	1.12	43%
Auto repair and service	14.21	0.28	0.45	1.26	18.74	0.37	0.61	1.16	82%
Local transportation	35.64	0.54	0.64	1.29	40.98	0.64	0.81	1.10	26%
Food processing	5.74	0.13	0.26	1.29	10.33	0.23	0.43	1.22	14%
Apparel	15.47	0.16	0.19	1.21	18.74	0.23	0.31	1.16	2%
Petroleum refining	0.62	0.05	0.12	1.51	4.24	0.16	0.44	1.45	3%
Sporting goods	9.11	0.26	0.49	1.24	13.06	0.34	0.63	1.15	1%
Manufacturing	10.74	0.22	0.39	1.30	15.66	0.33	0.56	1.20	0%

a. Regional purchase coefficient.

b. Retail is an average of seven retail trade sectors.

Note: All multipliers are computed as averages for regions in the group.

Table D-2. Multipliers for Selected Tourism-Related Sectors – Small Metro

Sector	Direct effect ratio: jobs /MM sales	Direct effect ratio: income /sales	Direct effect ratio: value Added /sales	Total effect multiplier: sales	Total effect multiplier: jobs /MM sales	Total effect multiplier: income /sales	Total effect multiplier: value added /sales	Type I sales	Model RPC[a]
Hotels and lodging places	23.41	0.33	0.51	1.52	31.73	0.53	0.84	1.32	56%
Eating and drinking	31.51	0.35	0.48	1.43	37.89	0.50	0.75	1.24	88%
Amusement and recreation	32.07	0.35	0.57	1.46	39.26	0.52	0.86	1.26	65%
Retail trade[b]	30.23	0.51	0.80	1.38	36.20	0.65	1.04	1.14	92%
Wholesale trade	12.33	0.40	0.69	1.39	18.44	0.55	0.93	1.18	56%
Auto repair and service	12.66	0.31	0.48	1.40	18.63	0.45	0.72	1.23	84%
Local transportation	30.25	0.57	0.67	1.43	37.04	0.73	0.94	1.15	45%
Food processing	5.95	0.12	0.24	1.41	11.63	0.26	0.47	1.31	39%
Apparel	14.06	0.22	0.26	1.36	19.33	0.35	0.47	1.23	4%
Petroleum refining	0.62	0.05	0.12	1.26	3.17	0.11	0.28	1.22	7%
Sporting goods	12.45	0.21	0.40	1.41	18.32	0.36	0.64	1.27	3%
Manufacturing	10.93	0.22	0.38	1.40	16.56	0.37	0.62	1.26	2%

a. Regional purchase coefficient.

b. Retail is an average of seven retail trade sectors.

Note: All multipliers are computed as averages for regions in the group.

Table D-3. Multipliers for Selected Tourism-Related Sectors – Larger Metro

Sector	Direct effect ratio: jobs /MM sales	Direct effect ratio: income /sales	Direct effect ratio: value Added /sales	Total effect multipliers: sales	Total effect multipliers: jobs /MM sales	Total effect multipliers: income /sales	Total effect multipliers: value added /sales	Type I sales	Model RPC[a]
Hotels and lodging places	19.09	0.37	0.56	1.61	27.84	0.60	0.95	1.34	63%
Eating and drinking	28.71	0.37	0.51	1.53	35.68	0.56	0.84	1.29	88%
Amusement and recreation	29.49	0.36	0.58	1.56	37.41	0.57	0.94	1.31	71%
Retail trade[b]	25.86	0.51	0.80	1.46	32.24	0.68	1.09	1.16	94%
Wholesale trade	10.20	0.41	0.69	1.48	16.88	0.59	0.99	1.22	76%
Auto repair and service	11.89	0.32	0.50	1.47	18.16	0.49	0.79	1.25	87%
Local transportation	26.89	0.58	0.69	1.53	34.18	0.78	1.02	1.18	59%
Food processing	5.45	0.15	0.29	1.48	11.61	0.32	0.58	1.34	44%
Apparel	13.12	0.26	0.30	1.47	19.23	0.43	0.58	1.29	5%
Petroleum refining	0.60	0.05	0.15	1.34	3.20	0.14	0.35	1.28	15%
Sporting goods	10.45	0.24	0.45	1.53	16.92	0.44	0.77	1.33	2%
Manufacturing	10.50	0.23	0.40	1.49	16.76	0.41	0.69	1.31	2%

a. Regional purchase coefficient.

b. Retail is an average of seven retail trade sectors.

Note: All multipliers are computed as averages for regions in the group.

Table D-4. Multipliers for Selected Tourism-Related Sectors – State

Sector	Direct effect ratio: jobs /MM sales	Direct effect ratio: income /sales	Direct effect ratio: value Added /sales	Total effect multipliers: sales	Total effect multipliers: jobs /MM sales	Total effect multipliers: income /sales	Total effect multipliers: value added /sales	Type I sales	Model RPC[a]
Hotels and lodging places	18.02	0.37	0.57	1.70	27.41	0.64	1.01	1.38	66%
Eating and drinking	27.37	0.38	0.53	1.64	35.05	0.61	0.91	1.34	89%
Amusement and recreation	26.87	0.36	0.59	1.66	35.47	0.62	1.01	1.35	77%
Retail trade[b]	24.73	0.51	0.80	1.53	31.54	0.71	1.13	1.18	95%
Wholesale trade	9.10	0.41	0.69	1.57	16.40	0.63	1.04	1.26	91%
Auto repair and service	11.95	0.31	0.50	1.57	18.80	0.53	0.84	1.31	84%
Local transportation	24.96	0.59	0.70	1.64	32.98	0.83	1.09	1.23	71%
Food processing	5.37	0.15	0.30	1.57	12.11	0.36	0.63	1.39	53%
Apparel	12.70	0.27	0.32	1.58	19.72	0.48	0.66	1.34	7%
Petroleum refining	0.61	0.05	0.13	1.37	3.67	0.15	0.35	1.30	29%
Sporting goods	9.97	0.25	0.47	1.62	17.11	0.48	0.84	1.39	4%
Manufacturing	10.08	0.24	0.41	1.59	17.02	0.46	0.76	1.36	3%

a. Regional purchase coefficient.
b. Retail is an average of seven retail trade sectors.
Note: All multipliers are computed as averages for regions in the group.

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