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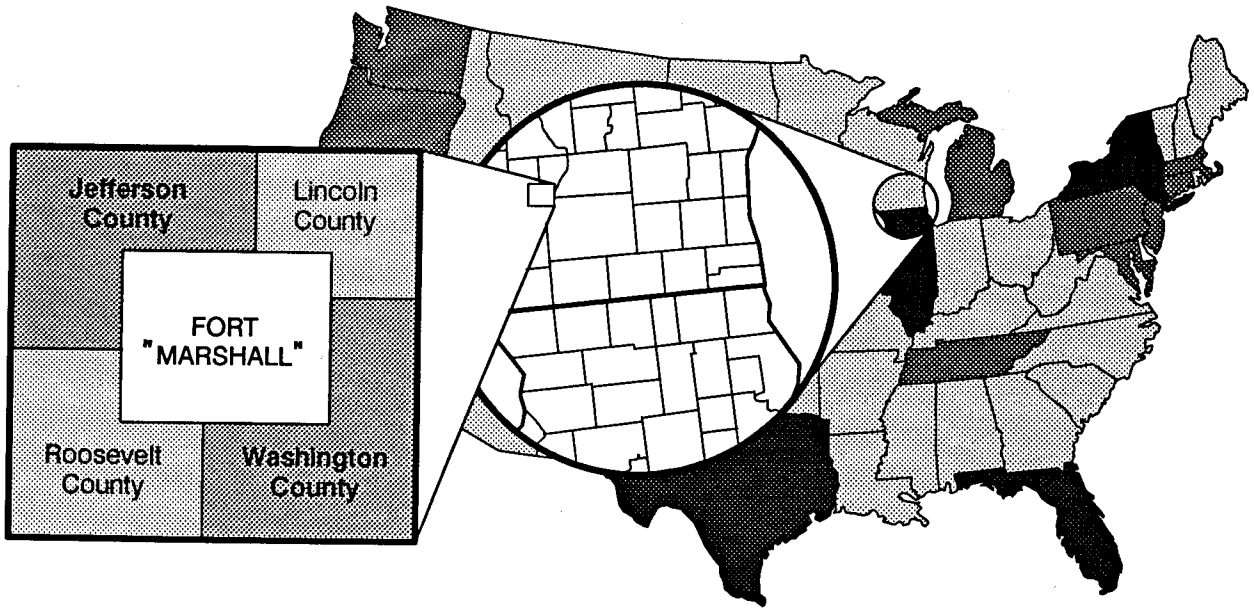
EIFS 5.0

Economic Impact Forecast System



USER'S REFERENCE MANUAL

by
Claire E. Huppertz
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The Economic Impact Forecast System is a multifaceted computer system that provides information useful for estimating the socioeconomic impacts caused by military projects and activities. This report provides information for obtaining and initially interpreting output from current and future versions of EIFS. The information contained in this report supersedes information contained in the USACERL Technical Report N-2 and the 1979 and 1984 editions of USACERL Technical Report N-69.

This manual provides needed information on (1) data contained in the EIFS database; (2) use of the two-tier approach to socioeconomic assessment; (3) use of the Rational Threshold Value and Forecast Significance of Impacts techniques to measure "significance"; (4) hands-on use of the computer system itself; and (5) theoretical underpinnings of the tools available through the EIFS family of models.

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FOREWORD

This research was conducted for the Assistant Secretary of the Army for Installations, Logistics, and Environment (ASA (IL&E)). The existing EIFS model is supported by user fees paid in association with use throughout the Department of Defense. The ASA technical monitor for this work is Phil Huber, ODASA for Environmental, Safety, and Occupational Health (ESOH).

The work was performed by the Technical Assistance Center (TA) and the Environmental Compliance Modeling and Systems Division (EC) of the Environmental Laboratory (EL), U.S. Army Construction Engineering Research Laboratories (USACERL). The principal investigator was Ronald D. Webster, CECER-TA. Claire Huppertz, Army Environmental Policy Institute (AEPI); Kim Bloomquist, Corps of Engineers, Chicago District (CENCC-PD-E); Dr. Dennis Robinson, U.S. Army Corps of Engineers Institute for Water Resources (IWR); Jacinda Barbehenn and Jiemin Guo, CECER-EC; Dr. Geoffrey Hewings, University of Illinois Department of Geography; and the University of Illinois Environmental Technical Information System (ETIS) staff made essential contributions to revision and review of the manuscript. Gary Schanche is Chief, CECER-TA.

This manual represents the combined efforts of many who have contributed to the evolution of the Economic Impact Forecast System (EIFS) into its present comprehensive form. EIFS has benefitted from the active support of the ASA (IL&E) and the Office of the Director of Environmental Programs (ODEP), previously the Army Environmental Office (AEO). Support has been provided by Headquarters, U.S. Air Force and a number of EIFS users, whose applications of the model make its evolution possible. Support has also been provided by the Office of the Assistant Chief of Staff for Installation Management (OACSIM), Base Realignment and Closure Office (DAIM-BO). Significant technical contributions to the EIFS software were made by Margaret Olson and Wayne Hamilton, CECER-TA.

LTC David J. Rehbein is Commander and Acting Director, USACERL, and Dr. Michael J. O'Connor is Technical Director.

CONTENTS

CONTENTS (Cont'd)

FIGURES

TABLES

ECONOMIC IMPACT FORECAST SYSTEM (EIFS): GUIDE TO ECONOMIC MODELS AND USER'S MANUAL FOR SOFTWARE VERSION 5.0

1 INTRODUCTION

Background

Since the advent of the National Environmental Policy Act (NEPA), the Department of Defense (DOD) has sought to develop systems that foster rapid, systematic, and uniform analysis of the socio-economic effects of military activities. The desire for uniformity stems, in part, from the uniqueness and geographic distribution of DOD installations, their effects on local economies, and the complexity of problems associated with determining the social and economic implications of DOD realignment actions.

To address the need for a systematic approach to socioeconomic impact assessment, the Department of the Army (DA) has developed the Economic Impact Forecast System (EIFS) (Webster et al. 1976) with substantial cooperation and support from the Department of the Air Force (AF), and the U.S. Army Corps of Engineers' (USACE) Institute for Water Resources (IWR). This computer-aided system is designed to be a user-oriented, inexpensive, and systematic approach for meeting NEPA requirements. EIFS points out potentially significant problems early in the decisionmaking process so alternatives may be considered.

Beginning in the mid-1970s, EIFS has helped extensively to address the regional economic impact of military actions. EIFS has evolved over the years as a result of efforts by U.S. Army Construction Engineering Research Laboratories (USACERL) researchers and consultants, in cooperation with a number of research efforts undertaken by other agencies and major projects within DOD. Such projects included the MX missile deployment and, more recently, the Intermediate Nuclear Forces (INF) Treaty and Base Realignment and Closure (BRAC) studies.

Objective

The purpose of this report is to discuss in detail the theory and applicability of EIFS economic models in analysis of Army installation planning, closure, and realignment issues.

Approach

This user manual discusses the theory and application of EIFS models and the operation of EIFS software. The document reflects accumulated knowledge—drawing from users' input, seminars and tutorials, technical reports, refereed papers, and the experience of practitioners.

Conventions Used in This Manual

When actual computer output is used in text, it will appear as a different type style to separate it from the surrounding text.

Longer pieces of computer-generated information will be surrounded with a box to simulate the computer screen.

Smaller boxed instructions and/or explanations pertaining to the screen display will appear to the right of the EIFS-generated output (but do not appear on an actual EIFS screen) when the screen dump appears as a figure in text.

The data and models used with EIFS are constantly updated, so samples in this manual may not reflect what the user actually sees on the screen.

Trademark Notice

This report refers to a number of trademark names which are the properties of their respective owners:

- Apple Macintosh and Mac are registered trademarks of Apple Computer, Inc.
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- MicroPhone is a trademark of Software Ventures Corporation
- MS-DOS is a trademark of Microsoft Corporation
- Procomm is a trademark of Datastorm Technologies, Inc.
- UNIX is a trademark of Bell Laboratories.

Mode of Technology Transfer

EIFS 5.0 is accessed through the Environmental Technical Information System (ETIS) at the University of Illinois at Urbana-Champaign (UIUC). Login identifications (IDs) to ETIS, manuals, and technical assistance are available through:

Planning Information Program (PIP) Office, ETIS Support Center
University of Illinois
907 West Nevada Street
Urbana, IL 61801
Telephone (217) 333-1369.

2 EIFS FUNDAMENTALS

This chapter presents an overview of EIFS and describes the relationship among the basic components of an EIFS analysis.

System Overview

EIFS is a computer-based economic modeling and information system that supports regional economic impact analyses by military planners and analysts. EIFS provides (1) selected statistics about the socioeconomic characteristics of any county or multicounty area in the United States and (2) an analytical process for estimating the magnitude and significance of potential socioeconomic effects of proposed military activities in these areas. In short, EIFS is both a detailed database and a powerful modeling system.

The entire system—models, tools, and database—is designed for the study of a populace affected by significant military activities. The models use algorithms that are simple and easy to understand, but are firmly based on regional economic theory. The system is very flexible, allowing different scenarios to be run and what-if games to be played quickly and at little expense. This flexibility has proven highly valuable in resolving conflicts with critics of an analysis or decision.

The EIFS database provides a rich source of county-level information from both public sources (e.g., Bureau of the Census, Bureau of Economic Analysis [BEA], Bureau of Labor Statistics [BLS]) and private sources (e.g., National Planning Data Corporation). Some data also pertain to the nation, states, townships, census tracts, and geographic places. EIFS data are updated regularly.

Data are retrievable for any county or combination of counties in the United States. Commonly used predefined regions available include Metropolitan Statistical Areas (MSAs), BEA Economic Areas, and military installation regions. An option is available to select counties within a specified radius of a location defined in geographical coordinates. Users may also create their own alias regions, which are recognized by EIFS during subsequent sessions. Data may be displayed for individual counties or an aggregated region.

The most common appeal of EIFS is its family of forecast models, which can be run easily and effectively to address a myriad of military activities and programs. The models are easy to use, and require only a handful of inputs from the user. Basic information on the action being studied, in concert with the local area data stored in the system, enables EIFS to estimate economic and social changes that are likely to occur in the affected community due to the proposed action. EIFS estimates changes in total income, total employment, total sales by local businesses, and total population. The significance of these changes can be analyzed using the Rational Threshold Level (RTV) and Forecast Significance of Impacts (FSI) profiles.

For a more detailed study, the Automated Input-Output Multiplier System (AIMS) and the Small Area Assessment Model (SAAM) are also available. AIMS is a nonsurvey input-output (I-O) modeling system that estimates output, employment, and income multipliers for specific industrial sectors and regions. SAAM is an economic base model that can estimate the spatial distribution of income and employment effects among individual counties in a study area.

The combination of user-friendliness and system power has made EIFS a popular method for estimating the regional socioeconomic impacts of military and nonmilitary activities. The ease and

convenience of using EIFS permits timely consideration and comparison of many options. Even in the early stages of planning, when there is often a lack of specific detail on various options, EIFS can compensate by supplying conservative assumptions so preliminary analysis can be run. Later, when more hard data are available, the analysis can easily be rerun to reflect the new information.

Since the development of the original version of EIFS, the system has undergone substantial revision. EIFS 2.0 (Hamilton and Webster 1979, Robinson, Webster, and Olson 1984) introduced several enhancements. These include modifications to the procedures used to calculate the income and employment multipliers (Isserman 1977, Webster et. al. 1978), tract-level socioeconomic data, (Webster and Moy 1978), RTV Technique, (Webster and Shannon 1978), and more sophisticated economic modeling capabilities (Robinson and Webster 1984).

EIFS 3.0 reflected an additional 8 person-years of research and development effort building on this previous work. A number of significant additions and changes were made. These include: (1) update and expansion of the database, (2) a revised menu system, (3) further improvements to the location quotient technique used to calculate regional income and employment multipliers, and (4) revision of the EIFS forecast models to incorporate suggestions made by economists and scientists who have reviewed the models.

EIFS 4.1 refined EIFS 3.0 by: (1) adding sub-county level data (e.g., census tract, township, and place) from the 1980 Census of Population and Housing and (2) expanding output options from the data profiles to make it easier to use information from EIFS in programs on microcomputers.

The present version of this system refines EIFS 4.1 by: (1) basing forecast models on the 1987 economic census, which is the latest census results available and (2) adding the 1990 County Business Patterans and 1990 Multiples.

Detailed instructions for operating EIFS may be found in Appendix A.

Uses for EIFS

EIFS provides quick access to data on the socioeconomic characteristics of any region in the United States. Although the system is used primarily as a decision-support tool for environmental impact assessment, EIFS can be used for other purposes. For example, researchers might use the data to develop a region classification system. For educators EIFS may be valuable in such fields of study as planning, economics, and geography. Private-sector users could use the system's income and demographic data to help determine where to locate new commercial activities. The EIFS forecast models can also be used to analyze the regional impacts of plant relocations and other activities affecting the local economic base. An increasing number of state and local governments now use EIFS to assess the socioeconomic effects of nonmilitary projects.

The largest EIFS user group conducts socioeconomic impact analysis of all Army BRAC actions. The EIFS forecast models estimate the socioeconomic impacts of BRAC activities on employment, income, sales, population, local government finances, and housing demand of communities surrounding affected installations. Examples of usage include an assessment of the socioeconomic impacts of the INF Treaty on three communities in the United States, relocation of the U.S. Army Engineer School from Fort Belvoir, VA, to Fort Leonard Wood, MO, and the economic impact of the Louisville Civil Works District Office on the Louisville, KY, metropolitan area.

The EIFS Operating Environment

EIFS is part of a larger system, the Environmental Technical Information System (ETIS), which is maintained and supported by the University of Illinois at Urbana-Champaign (UIUC). EIFS and ETIS are menu-driven systems in which users are provided with menus (lists) of options from which to choose, explanations of each option, instructions on how to access the options. Information is conveyed in plain English.

ETIS and EIFS are controlled by the UNIX* operating system. Since the user is separated from the operating system by a user-friendly, menu-driven interface, no knowledge of UNIX is required to operate EIFS. However, users familiar with UNIX may be able to exploit its powerful features to enhance the usefulness of EIFS.

Hardware and Software Requirements for Using EIFS

To run EIFS, the user simply needs a terminal—any terminal, even a "dumb" terminal that can use a modem to call the system will work. The user needs to have a terminal emulation that the EIFS UNIX-based system recognizes—vt100 is preferred. Second, the user needs a modem. Third, DOS**-compatible microcomputer and Apple Macintosh users need some kind of communications software (e.g., Crosstalk, Procomm, MicroPhone, or, or other compatible communications programs). This enables the modem to link the terminal to the UNIX computer.

The user might be interested in extra capabilities, such as printing output or downloading files. For printing output, the user needs access to a printer and the communications software needs to "know" where the printer is. For downloading files, the user needs a DOS-compatible microcomputer or Apple Macintosh with hard or floppy drives.

Basic Steps in EIFS Analysis

To conduct a socioeconomic analysis using EIFS, take the following steps:

1. Define an economic Region of Influence (ROI) by typing the names of the counties to be analyzed. When the ROI is defined, the system aggregates the data, calculates multipliers and other variables used in the models, and is ready for user input data.

2. Select the desired model from the menu and input all data elements that describe the Army action: civilians and military personnel to be moved, their salaries, local procurement associated with location of the activity, and any related consumer spending. When these are entered into the system, EIFS projects changes in the local economy, including sales volume, employment, income, and population. These four indicator variables are key measures of socioeconomic impacts. Chapters 3 and 4 discuss the main EIFS model at length.

3. After a model projection is obtained, the RTV and the FSI profiles may be used to evaluate the *significance* of the impact. The RTV and FSI analysis reviews the historical trends for the defined region and develops a measure of local historical fluctuation in sales volume, employment, income, and

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* UNIX is a trademark of Bell Laboratories.
**DOS: disk operating system.

population. This evaluation identifies positive and negative thresholds within which a project can affect the local economy without creating a significant impact. This technique has two major strengths: it is specific to the region under analysis, and it is based on real historical data for the defined region. Chapter 5 discusses RTV and FSI in detail.

4. If the model analysis indicates significance, the EIFS model may be supplemented with a more detailed analysis, using a higher-level I-O model. This model is AIMS. It is easy to use, and provides sector-specific multiplier estimates. This overall approach is referred to as the *two-tier* approach: the analysis is based on simple, defensible model until a *significance threshold* triggers a more detailed analysis. Chapter 5 explains the two-tier approach and Chapter 6 discusses AIMS.

For special needs, EIFS provides additional analysis tools. These tools include an extensive EIFS statistical database, the Air Force Region of Influence (AFROI) Model, the Small Area Assessment Model (SAAM), and the Minimum Requirements Method (MRM). These will be discussed in chapters 7, 8, 9, and 10, respectively.

Basic EIFS Concepts and Components

Figure 1 diagrams the main menu of EIFS and shows the basic menu choices. The main concepts and components of EIFS are described below.

EIFS Forecast Models

EIFS forecast models predict the impact of a proposed action on the ROI. These forecast models include:

1. Standard EIFS Forecast Model
2. Construction
3. Construction of On-Base Housing
4. Training
5. Army Regulation (AR) 5-20 Economic Effects Analysis.

Study Area

The first step in an EIFS analysis is to determine the economic region likely to be affected most heavily by the action. The study area can take the form of several entities, such as a county, a group of counties, a state, or a predefined region. In many cases it may not be completely obvious what the study area should include. The study area must have appropriate boundaries, because it will affect the results of the regional analysis. Chapter 4 discusses how to choose appropriate boundaries for the study area.

RTV and FSI

RTV and FSI models help the EIFS user assess the significance of the proposed action's impact on a region, after the forecast models have been run.

AIMS

AIMS generates I-O multipliers for any county or group of counties in the United States. AIMS can be used to estimate industry-specific multipliers for assessing the economic impacts of both defense-related activities (e.g., base mission changes and realignments) and nonmilitary actions, such as plant relocations. Chapter 6 presents AIMS in detail.

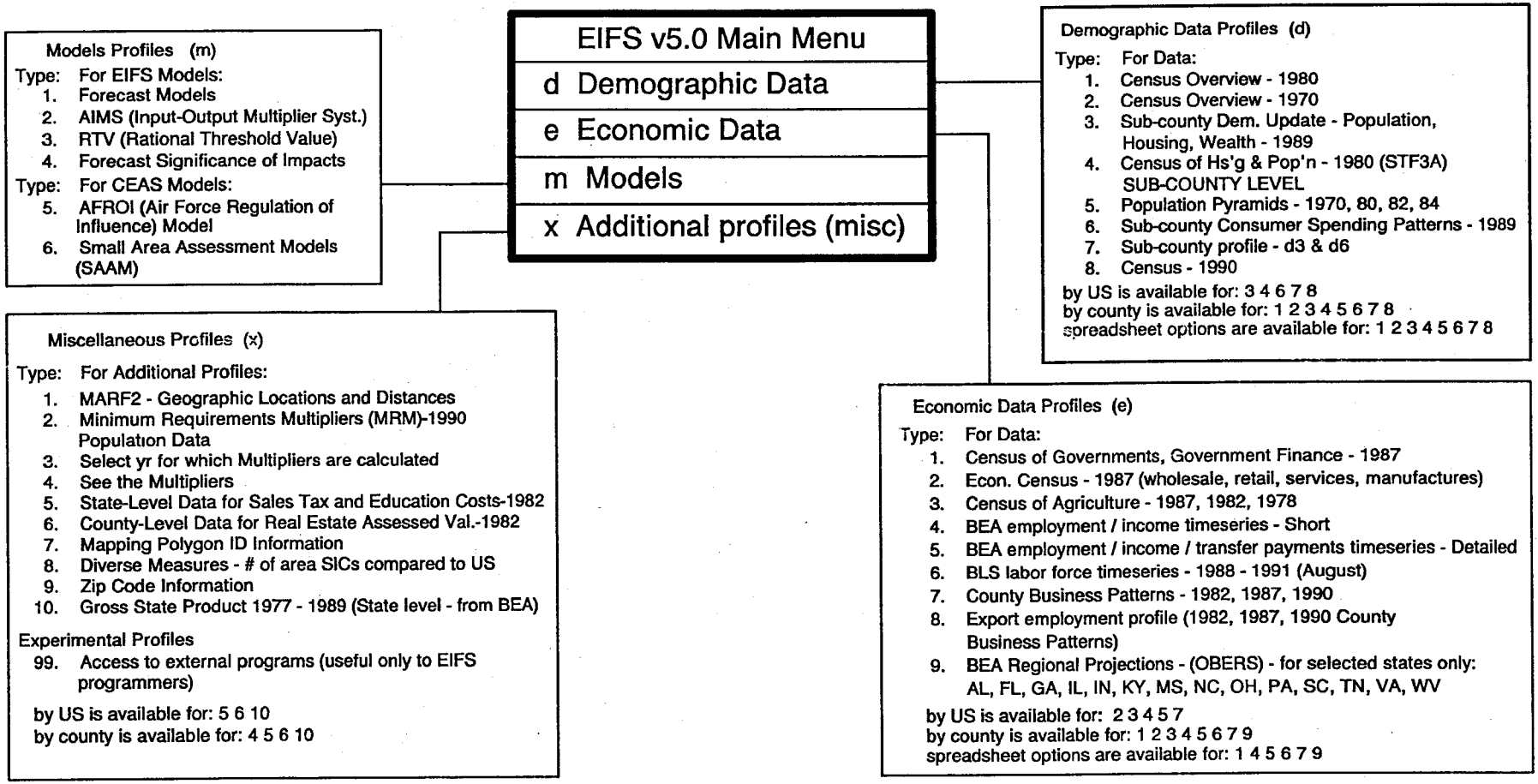

Figure 1. EIFS Main Menu Choices.

Data Profile

EIFS provides a wealth of economic and demographic census data to the user. These data can be used with EIFS or downloaded for use with other software packages. Chapter 7 describes these data profiles.

AFROI

This model identifies geographic areas that would receive significant economic impacts following a base realignment action. It was developed for Air Force use, but can be used for analysis of other service branches too. See Chapter 8 for more information. Also, refer to the AFROI user's manual (Bloomquist, Merritt, and Pierce 1987) for more detailed description and instructions.

SAAM

This model rapidly assesses the local area income and employment impacts associated with water resource projects. SAAM allows accurate assessment of county-level impacts within a relatively large region. See Chapter 9 for more information

MRM

The MRM profile computes regional trade (income) multipliers for impact analysis. This profile enables users to compute MRMs for a community of any size. Therefore, MRMs may be reasonable alternatives to EIFS location quotient-derived multipliers for analysis of subcounty economic impacts. See Chapter 10 for more information.

A Word to Novice Users

Before using EIFS you must collect project information to enter into the system. EIFS uses this information, along with information from its databases for the selected ROI, to estimate the impacts of the proposed action. It is helpful to keep several points in mind:

Choose the Inputs Carefully

The analysis cannot be any more accurate than the input data. Using a computer to help perform this kind of work does not generate the results more accurately than those arrived at by careful reflection and simple manual calculations. Always examine EIFS output to see if it agrees with your own view. If it does not, check the analysis for errors. The PIP office at the ETIS Support Center may be able to offer technical assistance in such cases. Chapter 4 provides guidelines for obtaining the correct input details.

EIFS Does Not Analyze Everything

EIFS impact analysis can provide a time- and cost-effective way to identify and assess the magnitude of socioeconomic impacts. However, the system is not a replacement for thorough analysis and evaluation by the user. Pleeter (1980) states that there are two basic elements to an economic impact analysis: (1) an estimate of the exogenous stimulus that serves as the initial impact, and (2) a model of the regional economy that can produce estimates of the direct and induced effects. EIFS was developed to provide estimates of the direct and induced effects. Estimation of the exogenous stimulus is, by definition, a task that belongs to the analyst.

Understand the Nature of What is Being Modeled

A transitory activity such as a seasonal increase in military training exercises, for example, may have less influence on local development than a project that results in a permanent change to the economic base of a community (e.g., a base closure). Another consideration is the time pattern of impacts—an activity representing a one-shot stimulus versus one that recurs over time (e.g., a multiyear construction project). EIFS assumes that projects are the one-time, permanent type, such as a base closure. Multiyear activities can be modeled using EIFS, but the analyst should first determine the amount of spending in each year of the project cycle, and then carry out a separate model run for each year.

Know the Local Conditions and the Population Affected

While EIFS has baseline data for every county in the United States, sometimes an activity affects a unique subpopulation within a study area. In such cases, the analyst must decide whether to accept or change the default input values provided in EIFS.

3 EIFS MODEL STRUCTURES AND ASSUMPTIONS

This chapter presents the underlying theory and assumptions which shape EIFS forecast models. After a brief overview of the models, this chapter describes the Economic Base model, EIFS multiplier estimation technique, and AIMS methodology. For more background material on these theories, general model types, and EIFS equations, see Appendix B, "EIFS Equations," and Appendix C, "Related Tutorials and Other Reference Materials," for a list of further readings. For further training in EIFS and related databases, see Appendix D, "Workshops."

Brief Overview of the EIFS Forecast Models[*]

EIFS submodels, which may be used separately or in conjunction with the others, are similar enough to be considered as a generic regional economic impact model. The structure of the forecast models is illustrated in Figure 2.

Four common links unite the EIFS forecast models: (1) they belong to a class of regional analytical techniques known as economic base models; (2) they were created to analyze the economic and social consequences of military actions; (3) their geographic coverage extends to the entire nation; and (4) they focus on estimating changes to the local economy. These four characteristics are discussed below.

The Economic Base Model

An economic base model is a regional economic model in which the local industrial activities are classified as either export oriented or service oriented. The export sector (also called the basic sector) includes local production that is sold to businesses, households, and governments outside the local community. Also, other types of local activities whose levels of operations are determined elsewhere are included in the export sector (e.g., a military installation). The service sector consists of firms producing goods and services that are consumed locally.

A change affecting the export sector (e.g., a military realignment action) causes an increase or decrease in the payrolls and employment of local export-oriented firms. Further, the change in payrolls and employment for the export sector is transmitted to the local service sector as a multiple of the original change (i.e., the multiplier effect). In addition to this multiplier process, EIFS converts the direct and indirect effects of business activity, employment, and income into other economic and social impacts by a series of region-specific equations.

Military Actions

EIFS forecast models can estimate the economic and social effects of several types of military actions and programs. EIFS model titles indicate they are oriented to military actions. There are five separate submodels:

- Standard EIFS Forecast Model
- Construction
- Construction of On-Base Housing
- Training
- AR 5-20 Economic Effects Analysis.

[*]The material in this section is taken from Robinson (1985), pp 34-37.

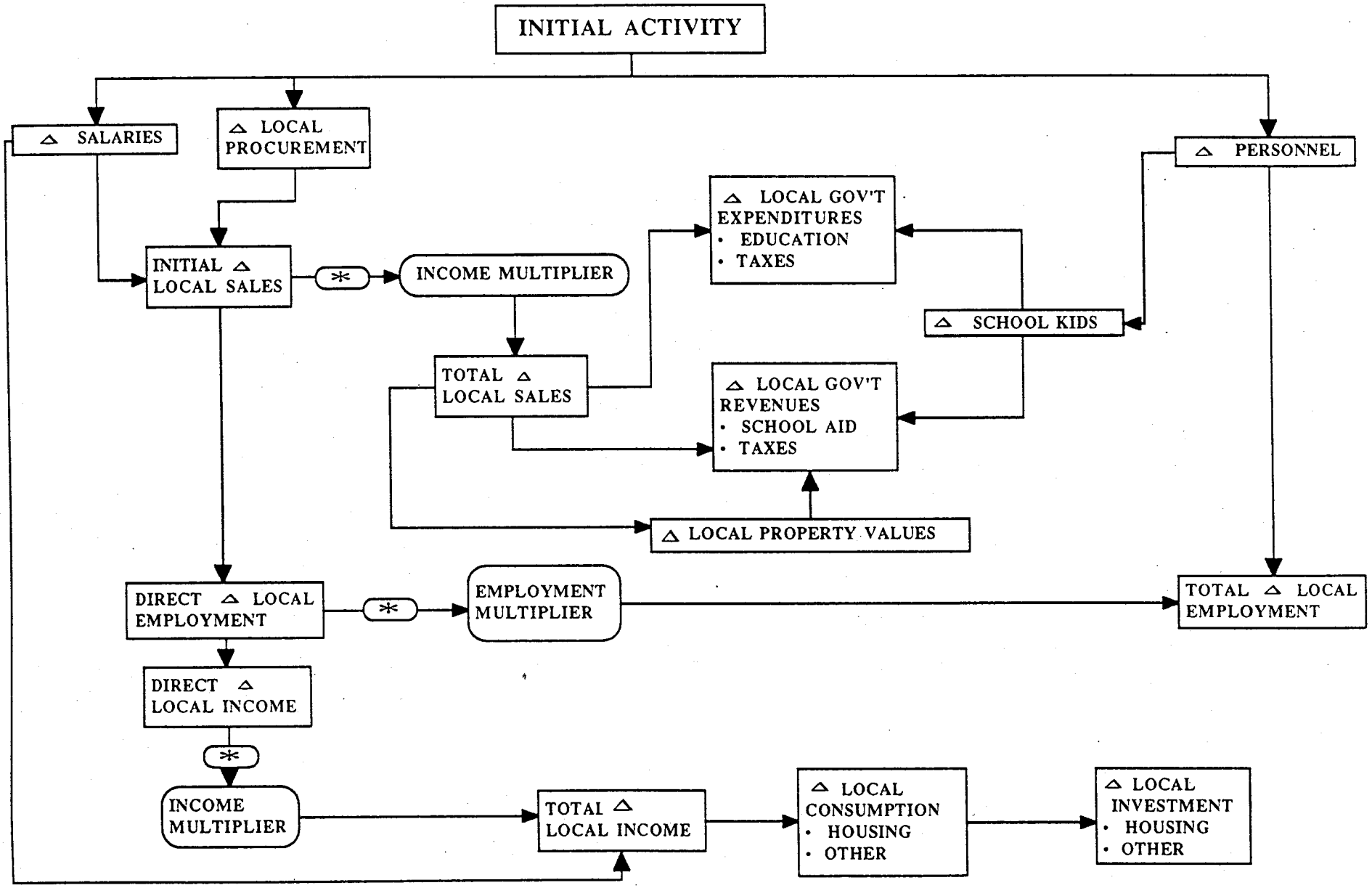

Figure 2. EIFS Forecast Model Structure.

These functional areas (FAs) represent different types of military activities, and are likely to create different economic and social effects in surrounding communities. The differences in these socioeconomic effects are mainly due to the differences in expenditures for locally produced goods and services associated with each of the FAs (both in terms of total expenditures and in terms of their commodity distributions). For example, military trainees that live on post will not only tend to spend less of their income in the local economy than do civilian personnel who reside off post but, in addition, their pattern of expenditures for various types of commodities is also likely to be different. These differences are explained, in part, by the fact that trainees are generally provided room and board and civilian employees have to purchase these items out of their incomes. In addition, various demographic factors are likely to differ between trainees and civilian workers that affect the proportion of income they are likely to spend locally and the industrial pattern of those expenditures: e.g., marriage rates; number of dependents, age, sex, and race compositions; etc.

Nationwide Coverage

A feature which makes EIFS unique among the various commercially available regional economic models is its high degree of adaptability to local communities in all fifty states. The EIFS models may be applied to any single county or combination of counties in the United States. Apart from the few user-supplied inputs, default model parameters automatically are calculated from an extensive online database. This feature permits a high degree of flexibility in defining study areas for specific applications.

Estimating Changes

An important point about EIFS is that only changes of the different socioeconomic aspects of a regional economy are estimated. Consequently, EIFS may be considered a pure regional economic impact model. This attribute sets EIFS apart from the mainstream of regional economic modeling and probably contributes heavily to a lack of comparability of EIFS with other regional economic models.

By contrast, most regional economic models that are used for impact analysis use a Keynesian income consumption modeling framework. These models start with a basic income accounting identity and then estimate its components by as series of behavioral equations with the use of econometric techniques. What is important is that the magnitudes of the components are estimated. When these models are used for impact analysis, a baseline forecast is performed using the current values of the model's parameters and the area's data series. Then a second forecast is made that reflects the changes in the model's parameters or data series. The differences between the two forecasts represents the regional economic impact of the proposed project or action.

Concentrating on the estimation of the changes rather than on the level of activities is both a disadvantage and an advantage. Except for the multiplier computation, EIFS assumes that the magnitude of the socioeconomic effects of a military action are not affected by the size of the local economy. On the other hand, estimating changes rather than levels frees the model from a dependence on particular projections. As a result, the accuracy of the projections will not confuse the issue of estimating changes during public meetings for proposed realignment actions.

The Economic Base Model in Detail*

The economic base model has a considerable history starting with Robert Haig (1928) and Homer Hoyt (1939). For a bibliography of the early work on the economic base model, see Isard (1960).

To begin to understand this model, envision a local economy that depends on external sources of demand for the level of its internal welfare. The economic base model assumes that most local economies depend on income from exports, and provides a simple framework in which to analyze this situation. Local economic activity is classified into two general sectors, either an export sector or a service sector.

The export sector includes firms that sell their products to businesses and households outside the boundaries of the local economy. In addition, establishments within the local economy which cause funds to flow into the area by their activities (such as tourist facilities and Federal government offices) are also considered export industries. The local service sector, in contrast, is made up of firms that sell their goods and services within the local economy, either to firms in the export sector or to the local populace.

Description

The economic base model assumes that external changes resulting in increases (decreases) in export activity cause increases (decreases) in the payroll of export firms which are then transmitted to the local service sector establishments. Also, the inflow or outflow of money causes activity in local services to change by a multiple of the original change (i.e., the multiplier effect) as the influx of funds is spent and re-spent in the local economy or as the initial withdrawal of funds causes decreases in local sales. This, in turn, causes further decreases in local sales as payrolls and employment shrink. For expansions, recirculation continues until the leakages to the system (such as imports, savings, and taxes) exhaust the amount of initial influx. In cases of decreases in export activity, the cumulative decline is halted by decreases in imports, savings, and taxes. Note that export base models predict that without new injections of funds to the local economy through its export sector, the local economy will stagnate because service activities can only respond to changes in local economic conditions.

Most derivations of the economic base model use an analogy from Keynesian income consumption theory. This approach has at least two advantages. One, it couches economic base theory in the mainstream of economic thought. This lends credence to the economic base framework because it is consistent with the historic development of economic theory. And two, it provides a formal structure within which the reasons for economic change can be analyzed.

The equations below characterize the Keynesian income-consumption theory.

Sources of Regional Income

$$Y = C + I + G + X - M \qquad \text{[Eq 1]}$$

Where
Y = regional income
C = consumption
I = investment
G = exogenous government spending
X = exports
M = imports.

*Much of the material in this chapter is excerpted from Robinson (1985), pp 4-32.

Although Equation 1 defines how local residents spend their income at any moment, it does not explain the magnitudes of any of the component expenditures. These magnitudes are determined by a set of behavioral equations:

Assume:

$$C = a + bY \quad \text{[Eq 2]}$$

$$I = Io \quad \text{[Eq 3]}$$

$$G = Go \quad \text{[Eq 4]}$$

$$X = Xo \quad \text{[Eq 5]}$$

$$M = mY \quad \text{[Eq 6]}$$

Where:

a = subsistence level of expenditures for consumption
b = marginal propensity to consume
m = fraction of income for consumption of imports

That is, consumption by local residents is determined by their income; more directly, consumption is some autonomous level of spending (a) plus a fraction of income (b). Autonomous consumer expenditures can be viewed as a subsistence level of purchases. The marginal propensity to consume (b) is assumed to be positive and less than one. Investment, exports, and local expenditures by governments external to the local community are either assumed autonomous or determined elsewhere and are, therefore, assumed exogenous to our model. Finally, imports are a fraction of income; like the marginal propensity to consume, the marginal propensity to import (m) is positive and less than one.

Substituting values from Equations 2, 3, 4, 5, and 6 into Equation 1, Equation 1 can be expressed as:

$$Y = a + bY + Io + Go + Xo - mY \quad \text{[Eq 7]}$$

Combining terms and simplifying yields,

$$Y = \frac{a + Io + Go + Xo}{1 - (b-m)} \quad \text{[Eq 8]}$$

where the ratio: $\frac{1}{1 - (b - m)}$ is defined as the income multiplier k.

Example:

Assume b = 0.7 and m = 0.1, then

$$k = \frac{1}{1 - (0.7-0.1)}$$
$$= 1/0.4$$
$$= 2.5$$

Therefore, for each $1 of income from exogenous sources (e.g., Io, Go, or Xo) an additional $1.50 in income is generated locally.

Equation (8) summarizes the important characteristics of the local economy and several important statements can be made about the determinants of change. First, the ratio is generally known as the *multiplier*. The multiplier summarizes the effect on local income due to an initial change in any of the autonomous expenditures normally referred to as *final demand changes*. Mathematically, the only restriction on the multiplier is that the marginal propensity to consume minus the marginal propensity to import cannot equal 1, but this is guaranteed by assumption. From the perspective of economic theory, the marginal propensity to spend locally must be less than 1 but greater than zero, otherwise positive (negative) changes in final demand expenditures will lead to negative (positive) changes in local income. Assuming the two statements are true leads to the conclusion that the multiplier is greater than 1.

This conclusion is important because it shows that an *increase* in Federal government purchases in a local community, for example, will lead to increases in local economic activity in excess of the original stimulus. Second, temporal and spatial variations in multipliers are to be expected because the various propensities that comprise the multiplier can also vary. For example, the introduction of a new firm in a local economy that produces consumer goods (which were unavailable before), will likely increase the propensity to consume and decrease the propensity to import. This is a likely result because local residents will be able to purchase the commodity closer to home and will save some transportation costs as well. Consequently, this should increase the marginal propensity of local income spending, and result in a larger economic base multiplier. Similarly, rural areas should have smaller economic base multipliers than urban areas, because urban areas tend to be more economically diverse and more likely to provide a greater proportion of local needs than rural communities. One can also modify the various components of consumption, investment, and government expenditures to include separate relationships describing the determinants of those sources of demand (Metzler 1950). These modifications, although interesting, only provide refinements to the basic model structure and would only confuse the discussion here.

Conceptual Problems Inherent in the Economic Base Model

The economic base model is short-term in nature. The model assumes an economy is initially in equilibrium and describes the changes required to reach a new equilibrium position after an exogenous change occurs. Prices, wages, and technology are assumed constant and changes in the distribution of income and resource allocation are not permitted. Other, more serious issues concerning the economic base model are explained in the following paragraphs.

1. First, economic base models emphasize the openness of regional economies, or the importance of trade in inducing regional change. The high degree of interrelatedness between the local economy and the outside world that drives the model is based solely on a demand orientation–where exogenous changes in demand for exports determine regional income and employment changes. In practice, export sales are not the only activity that responds to exogenous forces, even in the short run, and their omission from the model suggests that economic base studies are appropriate primarily for smaller economies.

2. Another argument in favor of applying this methodology to smaller regions is the omission of feedback effects in the analysis. Export increases lead to increases in local income and imports. Imports are, in turn, another region's *exports* and thus *increases* in another region's income can cause further changes in the demand for exports in the first region. Certain internal changes such as productivity, technology, population, urbanization, and agglomeration economies can also result in local income changes frequently not incorporated in economic base models. In fact, implicit in the export orientation of economic base models is the notion that export sales are generated because of a region's comparative advantage. Consequently, any changes in the local economic structure, to the extent that they change the economy's comparative advantage, can cause local income changes. As Wilbur Thompson (1965) has pointed out, in the long-run the local service industry might be considered basic to the growth of the region.

3. The economic base model ignores the supply side of the local economy, implicitly assuming that supply is perfectly elastic. This neglect of the supply side is not a serious defect if the exogenous final demand changes are small relative to the size of the economy. For large-scale projects and for analysis of the long-term, serious capacity constraints should not appear in labor and capital movements. Given the degree of openness of a local economy and the migration propensity of labor, an elastic supply would not be an unrealistic assumption. Capacity constraints can present problems to the degree that local infrastructure is incapable of supporting expansions. If energy, water, and transportation facilities or land are at full capacity prior to an increase in demand, then one would expect prices to rise rather than an expansion in quantity and employment to happen as a result of an increase in demand for exports.

4. Another criticism of the economic base model is its assumption of a relatively stable relationship between local consumption and income. This neglects many factors such as wealth, permanent income, population, and the distribution of income as determinants of consumption. While data on local wealth is unavailable, the influences of permanent income, the distribution of income, and population changes could be incorporated in the model. This would require using many observations that might provide details only marginally important, given the likelihood that significant changes in these variables do occur in short time intervals.

5. Import substitution also distorts the relationship between local income and consumption. As a region grows, goods and services that were previously imported tend to be produced locally. To the extent that this occurs, the local consumption/income relationship will change over time.

6. Finally, the economic base model also ignores the industrial sector, which is initially affected by a change in export demand. An economic base multiplier is a kind of average economic effect on the local economy due to an initial change in final demand. Consequently, the economic base model can provide only a crude estimate of the magnitude of a change in local economic activity when only one or a few of the local industrial sectors are initially affected by a change in export demand. Further, economic base models are most appropriate when a change in export demand is expected to affect many, if not all, industrial sectors of the local economy. For example, an increase in the personnel strength, and hence income, at a local military installation may generate local expenditure patterns (i.e., export demand) that are not known with any certainty.

This evaluation of the conceptual problems inherent in the economic base model concludes that it is not the most appropriate model for explaining long-term growth. However, the difficulties are not serious if the economic base model is considered to be a theory of income determination in the short-run. Many of the problems can be reduced or eliminated by more detailed analyses. Of the problems that remain, only insignificant biases will be introduced provided that the economic base model is appropriately applied. To lend further support for its use for short-run applications, at least two studies have estimated that approximately 90 percent of the projected change occurs within a single year. (Weiss and Gooding

1968.) If the impacts are realized within this short period of time, then the economic base model appears to be an appropriate methodology for estimating regional economic impacts.

Implementation Issues

Units of Measurement: The economic base model, as presented, requires detailed information on the marginal propensities to consume (b) and to import (m) by local residents and business establishments. Since local data on consumption is not readily available (without time-consuming and expensive surveys), some transformation of our model is required to estimate b and m. If we assume the marginal propensity to consume locally (b - m) is equal to the average and that consumption is proportional to income, we can derive:

$$k = \frac{1}{1-(b-m)} \qquad \text{(k is the multiplier)} \quad \text{[Eq 9]}$$

$$= \frac{1}{1 - \left(\frac{\text{local consumption}}{\text{total consumption}}\right)} \qquad \text{[Eq 10]}$$

$$= \frac{1}{\frac{\text{export consumption}}{\text{total consumption}}} \qquad \text{[Eq 11]}$$

$$= \frac{\text{total income}}{\text{export income}} \qquad \text{[Eq 12]}$$

Although income is used here as a proxy for the parameters of the model, other variables such as sales, payrolls, and employment may be applied. Income data originating by sector are available from the BEA by county but are highly aggregated and may introduce other problems (explained below) in the analysis. Sales data have been used in economic base studies but, since they typically involve double counting (counting the same data twice), they may distort the multiplier analysis.

Payroll data has also been recommended, but because it does not include other factor payments such as interest, profits, or rent, multipliers derived from these data will tend to be larger than they should be.

Employment, on the other hand, is probably the most frequently used unit of measurement. In fact, the original work on the economic base model formulated the multiplier as the ratio of basic (export) employment to local service sector employment. Using employment is advantageous since these data are available on a highly disaggregated basis (e.g., at the 4 digit Standard Industrial Classification [SIC] level) for almost all local economies in the United States. In addition, employment forecasts or impacts are frequently requested by those parties commissioning studies.

However, the use of employment data does have some drawbacks. In particular, the ratio of employment to income is neither constant nor stable over time. The total number of jobs conveys no information about the relative distribution of skills, and thus may mask underlying changes in wage levels. Although local income is approximately the same, employment can show net increases. Increases in labor productivity, on the other hand, will generate additional local income without increases in employment, thus distorting the relationship between the two. Additionally, the response of an employer to cyclical

fluctuations will vary by occupation and industry with some employees (i.e., those with high skills and specific human capital) being retained on the payroll even though they contribute little if any to total production.

Identifying the Export Sector, Estimating the Export Share

A region's multiplier (k) has been defined in Equation 12 as:

$$k = \frac{\text{total income}}{\text{export income}}$$

To estimate the export share, how much of a region's total economic activity is devoted to basic (or export) activities has to be identified. The problem is that most goods and services produced in a local community are typically sold in both local and nonlocal markets. Use of a marketing survey to discover the allocation of sales by industry is possible, but these surveys tend to be costly and time-consuming. As an alternative, a number of indirect or nonsurvey methods have been proposed to approximate this allocation. These indirect methods include the assumption (or assignment) approach, regression technique, minimum requirements, and location quotients (EIFS approach).

Assumption Approach

The assumption or assignment approach is a straightforward one. Researchers allocate employment into the basic and service sectors by judgments concerning the market orientation of products in the area of analysis. Sometimes this procedure is accomplished on an ad hoc basis, otherwise industry experts are consulted or sample surveys are undertaken to produce the division. While the use of this approach has the virtue of being quick and inexpensive, it is often inaccurate. One of its primary defects occur when indirect exports are considered; for instance, consider a major exporter like Proctor and Gamble in Cincinnati, OH. This firm manufactures and exports soaps, detergents, and toothpaste. Other firms in the area supply Proctor and Gamble with packaging material. Both surveys and industry experts would reveal that the packaging firms have local markets and should be counted in the service sector. However, since packaging firms supply important inputs to products that are exported, they too should be included in the export category.

Another problem occurs with enterprises that sell to both local and nonlocal markets. The assumption approach would generally categorize their activity into either one or the other classification, not both. While it is possible that errors made in the assignment method offset each other, biases are generally introduced into the analysis.

Regression Technique

An econometric (statistical) method of estimating local export activity, first popularized by Mathur and Rosen (1974) and more recently applied by Mulligan and Gibson (1984), is to regress local industrial activity (such as employment or income) on national economic activity using time series data.

Isserman (1980) has criticized the regression procedure for several reasons. First, due to its inability to separate local or service sector activity before carrying out the analysis, the export portion of local economic activity will tend to be overstated. Also, local economic activity is generally assigned on the basis of secular trends rather than a priori logic. Thus, local government and services are assigned to the export category because of their recent relative growth, whereas Federal military and agriculture tend to be assigned to the local category because their patterns in many areas have differed from that of national

trends (disaggregating by industry). Mulligan and Gibson (1984) found that the estimated split between service and export becomes unstable as this level of industrial disaggregation increases.

Minimum Requirements Approach

The minimum requirements approach compares a given region with the smallest region of the country for each industry in order to calculate exports. Following the procedures conceived by Ullman et al. (1969) and further developed by Moore et al. (1975), a group of similar regions are used to compute the percentage of total economic activity for each industry.

This minimum percentage of industrial activity is considered the minimum required to satisfy local needs. Any activity in excess of this minimum percentage is then assumed to be exported. The assumptions necessary for the minimum requirements approach are:

- Consumer tastes and income distributions are the same everywhere
- Production functions for each industry are identical, regardless of location
- Local production satisfies local demand
- All areas satisfy their local needs.

These assumptions are rather broad. To elaborate, because the minimum requirements area satisfies its own needs for a commodity, every other area is assumed to also meet its own local requirements for the commodity. Consequently, no area imports anything. Modifications have been suggested to reduce the significance of this assumption. For example, an arbitrary decision can be made to raise the self sufficiency level from the minimum to some higher percentage. But the higher the cutoff point chosen, the smaller the percentage of total economic activity is export activity and the greater will be the multiplier.

In an attempt to resurrect the minimum requirements approach, Greytak (1969) measured the error associated with the technique. He found that the procedure performed well when data are highly aggregated by industry. However, as the degree of industrial disaggregation increases, export estimates for practically all industries falls toward zero. Clearly, this is untenable. Greytak also demonstrated that the minimum requirements approach is subject to multiplicative errors and is very difficult to adjust for methodological problems.

Location Quotients (EIFS Approach)

The location quotient approach compares the regional concentration of industrial activity with that for the nation as a whole. Because exports for the nation are assumed to be negligible by this model and since national production of a commodity must satisfy national needs, a region having a greater concentration of its economic activity in that commodity than at the national level must not only be satisfying its local needs for the product, but also exporting. Using employment as the measure of economic activity, the location quotient is calculated:

$$LQir = \frac{Eir/Eor}{Eio/Eoo} \qquad \text{[Eq 13]}$$

Where LQir is the location quotient for industry i in region r, Eir is regional employment for industry i, Eor is total regional employment, Eio is national employment for industry i, and Eoo is total

national employment. In other words, location quotients compare a given region to the average region in the country and assume that:

- Consumer tastes and income distributions are the same throughout the country
- Production functions are identical in every region for each industry (This is equivalent to assuming that productivity and returns to scale are the same everywhere)
- Local demand is satisfied by local production
- The nation neither imports nor exports.

While these assumptions appear to be stringent, more recent research has made adjustments to account for them. Differences in productivity and income distributions are related to one another and Meyer and Pleeter (1973) have adjusted location quotients to account for these differences. Isserman (1977) has suggested modifications that incorporate national exports into the calculations. While little information is available in the EIFS database on consumer tastes, a number of researchers have recommended more disaggregated comparisons with other similar regions, as the basis for computing location quotients.

In computing exports using location quotients, if location quotients are *greater than one*, the region is an exporter of those commodities because their region appears to be producing more than its domestic needs for the goods. Location quotients *less than one* indicate that the region is not satisfying the local requirements and must import these products. A location quotient *equal to one* means that the area is neither an exporter nor an importer of that commodity. Again using employment, an estimate of the export activity (X_{ir}) of regional employment in industry i (E_{ir}), assuming that the location quotient (LQir) is greater than one, is:

$$X_{ir} = (1 - 1 / LQir)\ E_{ir} \qquad \text{[Eq 14]}$$

For example, if industry i accounts for 6 percent of employment in region r, but only 5 percent of the nation's total employment, then the region is assumed to produce for export an amount equivalent to $(1 - 1 / (6 / 5)) = 1 / 6$ of the region's employment in industry i. If the location quotient is equal to or less than 1 for an industry, it is assumed that the industry does not export from the region, as the region has less than its share of the industry.

When using the location quotient approach it is important to consider the level of industrial disaggregation of the data. Specifically, industrially disaggregated data tend to alleviate a significant problem inherent in more aggregate studies, namely the industry mix problem. For example, using aggregated data we might conclude that an industrial sector, like transportation equipment, is neither an importer nor an exporter in the region. However, this 2 digit SIC sector is an aggregation of industries such as automobile equipment, aircraft engines and parts, motorcycles, etc. When exports estimates are computed at this more detailed level and then summed, the interregional trade picture of transportation equipment for the region is likely to look quite different. In fact, Isserman (1977) was able to show that as the level of industrial detail in the data increases, the proportion of total economic activity devoted to export also tends to increase. And, as a result, the estimated multipliers decrease.

Alternate Modeling Techniques

Two other classes of techniques have been used to conduct regional economic impact studies: I-O analysis and econometric models. The distinguishing characteristic of I-O models is their explicit consideration of the interrelationships between industrial sectors of a regional economy and how these interactions affect the process of economic change. As a result, I-O models provide a great deal more information than economic base models on the economic transactions that take place within a local

economy. They also offer some understanding as to how impacts originating in one sector are transmitted throughout the economy. The primary drawback to I-O analysis is the cost of collecting data on the inter-industry transactions needed to make these models operational. While various nonsurvey methods have been devised to create regional I-O tables by adjusting coefficients borrowed from other studies (e.g., location quotients, regional purchase coefficients, the Regional Accounting System [RAS]), these techniques are subject to many of the same criticisms that economic base models are.

In terms of both data requirements and information content, *regional econometric models* are viewed by some researchers as a compromise between economic base and I-O analysis (Glickman 1977, p 38). The main contribution of econometric models is the use of time series data. As such, they can show the time pattern of impact of an exogenous (outside) shock over a period of years. As a result, econometric models are better suited for long-run prediction of impacts; unlike economic base models which are primarily useful for short-run impact estimation. However, few sub-state econometric models have been developed. This is largely due to the lack of available time series data at the local level. Also, these models lack a consistent theoretical base, unlike economic base and I-O models which have their basis in regional growth theory. Finally, due to data constraints, econometric models often suffer from statistical estimation problems such as autocorrelation, multicollinearity, and few degrees of freedom.

In sum, econometric models offer many advantages over economic base models, since they are more appropriate for long-run analysis and are capable of providing much more detailed information. Behavioral relationships are estimated with time series data by regression analysis so that underlying trends can be examined. But, these features are only available at additional cost. Simple econometric models are generally equivalent to economic base models. Complex econometric models with their advantages still present numerous conceptual and technical problems.

Discussion Summary of Economic Base Models

One of the virtues of the economic base model is its ease of implementation. Data required for the model are generally available from published sources and can be acquired at moderate cost. Of course, there is a great deal of variation in the way studies are completed and there is, at present, no consensus as to the most appropriate methodology to follow. Certain procedures appear to be more accurate than others and the use of these techniques would improve the forecasts that are made. Of the nonsurvey techniques, location quotients based on disaggregated employment data and adjusted to account for productivity and income differences seem to be the preferred methodology. Disaggregating employment data helps alleviate the industry mix problem, although it still exists at a lesser degree.

The income multiplier which is at the heart of the EIFS forecast models is estimated using a hybrid version of the location quotient technique. This procedure is discussed in the next section.

Multiplier Estimation in EIFS

Users of EIFS often want to know how the multipliers (the measure of the recirculation of dollars in a local economy) are calculated. This section explains the multiplier estimation procedure which underlies the EIFS forecast models. Much of this is excerpted from the report *Multiplier Estimation in EIFS* available from ETIS (See Appendix C).

The previous section describes alternate methods for estimating economic base multipliers, including the location quotient method, which EIFS uses. This section discusses the modified location quotient technique also used in EIFS to calculate the income and employment multipliers used in the forecast models. Included here is a detailed description of the data and procedures used in estimating the multipliers.

The Modified Location Quotient Technique

The use of location quotients for estimating regional economic impact multipliers has often been criticized for under counting the actual amount of export-related activity, hence, overstating the multiplier and the impacts (Tiebout 1962; Greytak 1969; Leigh 1970). The reason for this problem largely stems from the inability of the location quotient to account for cross hauling that takes place in a regional economy. In other words, a region may both import and export products which are included within the same category of industry data. Isserman (1977) suggested that more export related activity could be identified by calculating the multiplier using data at a lower level of the SIC Code.

Use of Disaggregated Data

The effects of disaggregation on estimates of export activity are described in the following example:

The location quotient for the meat products industry (SIC Code 201) was less than 1 in the Philadelphia standard metropolitan statistical area (SMSA) in 1972. Therefore, if the multiplier had been calculated on the 3 digit code level, no export activity from that industry would have been identified. However, if the meat products industry had been disaggregated to the 4 digit level, 2,165 export jobs in sausages and other meats (SIC Code 2013) would have been identified. This phenomenon can be explained quite simply. Philadelphia may not have more than its share of employment in all meat products, but does have more than its share in sausages and other meats (Isserman 1977, p 35).

Taking this type of problem into account, EIFS uses data which is disaggregated to the 4 digit level SIC code.

Assignment of Exogenous Sectors

A second modification to the traditional location quotient method was to assign all government employment (both military and nonmilitary) and hotel, tourist court, and motel employment to the exogenous (or export) sector. The rationale for this adjustment was that such activities generate income for the region similar to exports and that hotel and related industries, in particular, are not oriented to serve local needs. This is especially true for the smaller regions for which EIFS was designed.

The modified location quotient income and employment multipliers compare favorably with those derived by alternate techniques (Isserman 1977).

AIMS Methodology*

AIMS estimates industry-specific gross output multipliers using a quicker, nonsurvey technique originally developed by Drake (1976). This procedure relies on the view that multipliers can be broken down into three components: the initial effect, the direct effect, and the indirect effect. The initial effect (always equal to 1.0), represents the initial final demand change. The direct effect is the sum of the first round of interindustry sales: the sum of the regional direct requirements for inputs for the industry experiencing the initial final demand change. The indirect effect is the sum of all other rounds of expenditures (Here, the term "indirect" also encompasses induced effects in the case of models closed with respect to households).

*This section is excerpted from Bloomquist, Webster, and Robinson (1987).

Direct Effect Estimation

The 517 sector national I-O table used by AIMS was created from the 531 sector 1977 national I-O table (U.S. Department of Commerce, Bureau of Economic Analysis 1977).

The first step in creating the AIMS table was to estimate the direct effect component of the multiplier from the I-O table by converting from a commodity-by-industry basis to an industry-by-industry basis. This step is necessary since much of the information relating to the availability of inputs in a region is collected and reported by industry. This regional information is the basis for scaling the national table to a particular region. (U.S. Department of Commerce Bureau of Economic Analysis 1981).

Next, the table was adjusted for imports by subtracting from each cell the proportion of the column (purchasing) industry's direct requirement for imports. This step removes those input requirements that are not produced domestically. The resulting table procedures contain 517 individual sectors (for industries 1.0100 to 77.0700) for which multipliers may be calculated.

When the AIMS user selects a study area and one or more industries, the appropriate columns of direct coefficients are extracted from the 517 sector U.S. table and regionalized in two steps. First, data from the Enhanced County Business Patterns (CBP) are used to create a file of regional industries. Sectors not found in the region are deleted from the column of direct coefficients.

When creating the Enhanced CBP file, the National Planning Data Corporation estimated the undisclosed cells found (especially in rural areas), in the published CBP file. Coverage of county employment down to the 4 digit level is thus provided in much greater detail. Second, the column coefficients are further regionalized using simple location quotients calculated using CBP data.

The CBP data has deficiencies that must be overcome. Coverage is poor in certain industries, notably agriculture. The Census of Agriculture farm income data and BEA farm employment and farm income data are used to supplement the CBP data and to disaggregate the farm data prior to regionalizing the U.S. I-O table. Furthermore, the CBP data, which covers one pay period in March, does not represent an average annual employment estimate. Since many seasonal industries are operating at a relatively low level of output during March in some parts of the country, it is necessary to adjust the CBP estimates. The BEA Regional Economic Information System (REIS) provides division-level employment for all counties in the United States. These division-level totals are used to adjust the CBP data to annual estimates.

Indirect Effect Estimation

The indirect/induced effect component of the multiplier can be approximated by a linear homogenous function of the direct component. The theoretical basis for this relationship is discussed elsewhere (Drake 1976; and Robinson and Webster 1984) and is not repeated here. AIMS calculates the indirect/induced component of the multiplier using the following formula:

$$\log Mi = 0.65 - 0.79 * P1 - 0.13 * P2 + 0.17 * \log S2 + \log Md \qquad \text{[Eq 15]}$$

where:

- log Mi is the natural logarithm of the indirect/induced component
- log Md is the natural logarithm of the direct effect
- P1 is the agriculture proportion of total nongovernment earnings
- P2 is the manufacturing proportion of total nongovernment earnings
- log S2 is the natural log of the local share of U.S. nongovernment earnings.

Users can view the actual equations used in the EIFS forecast model online. Look under the models sub-menu.

4 EIFS FORECAST MODELS

Before using EIFS, collect the information described below. Then determine how you will adjust for inflation. EIFS can make this adjustment, if desired. The instructions below provide more detail. Novice EIFS users may want to refer to Appendix A for step-by-step instructions on how to start and run EIFS.

What You Need To Begin

Collect details about expected changes in project spending and civilian and military employment before running EIFS. EIFS requests this information with the display in Figure 3.

Note that all information you enter should be on a yearly basis. See the section "Determining Time Frame" for more explanation. A description of these variables is given below.

Total Expenditures and Local Expenditures

Local expenditures equals money spent only in the study area. If *total expenditures* are entered, EIFS computes the local expenditures as a percentage of the total. Enter local expenditures if available.

Change in Expenditures for Local Services and Supplies

This is the dollar value of expenditures in the relevant year for all local services and supplies related to the action. Enter a negative value for a decrease in activity and a positive value if there is an expansion. Note that for the Construction forecast model these represent construction expenditures; otherwise they represent expenditures for services and supplies.

Change in Civilian Employment

This represents separated or newly added civilian employees for the relevant year. Enter a positive number for an increase or a negative number for a decrease. Do not include personnel shifted from one position to another within the same geographic area. Notice that one person hired does not always mean one less person unemployed in the region. Employers may not hire someone to replace the departed employee.

Average Income of Affected Civilian Personnel

Represents the average annual gross (before-tax) income of civilian personnel affected by the action. Average income figures are entered as positive numbers. In EIFS, *income*, refers to a broader concept than just employees' wages and salaries. Also to be considered, if possible, are wages earned from second jobs, working dependents, unearned income (i.e., interest, dividends, and rents), etc.

> *NOTE: "average income" refers to employee salary, not the personnel costs to the employer. Employee benefits, for example, can vary widely between employers, and often do not affect the local economy as directly as salary does.*

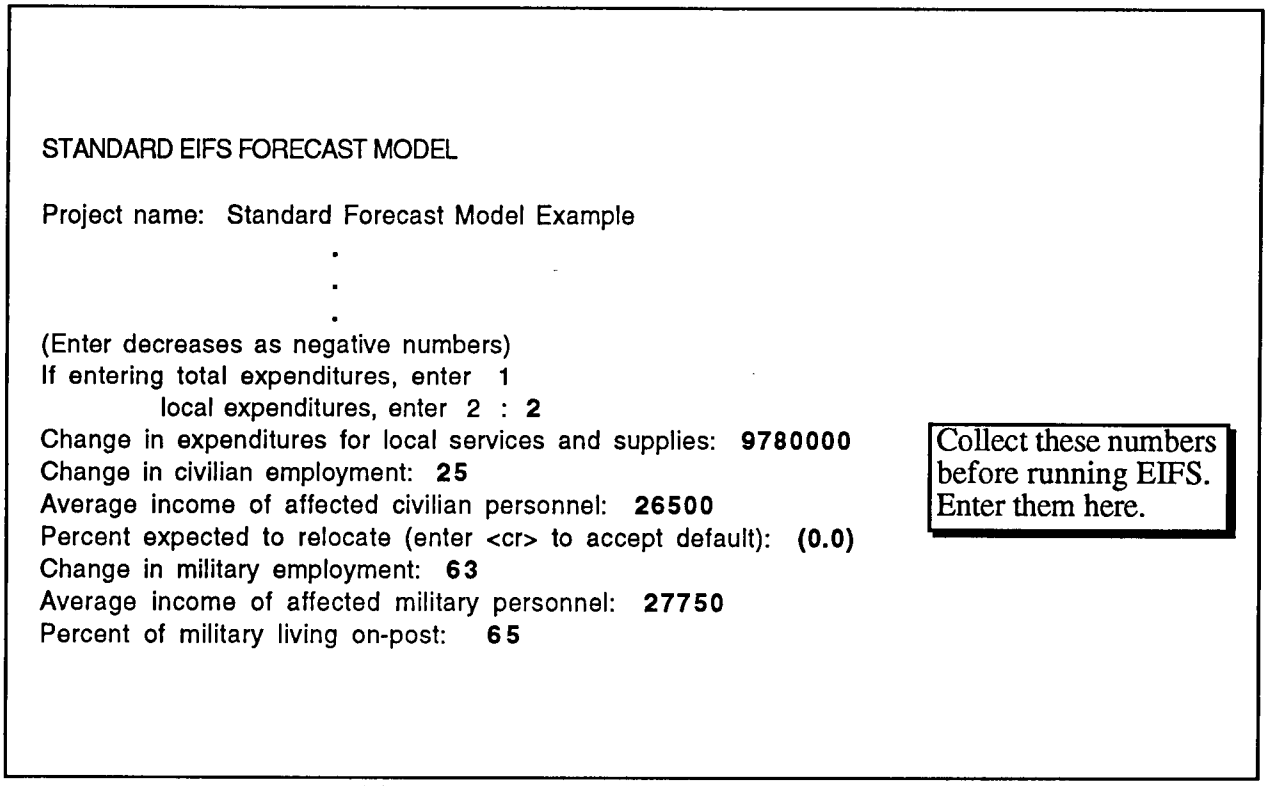

Figure 3. EIFS Request for Input Screen.

Percentage of Civilian Personnel Expected To Relocate

The default value for this variable is zero. The actual value will vary, depending on work availability of labor in the required skill categories. If the affected employees generally are clerical or semiskilled, then the proportion of civilian personnel expected to relocate will probably be small. If, on the other hand, the action involves managerial, professional, or highly skilled technical personnel, a relatively large proportion of these workers will probably move to (or from) other geographic areas. When the action involves a large number of professional personnel, the proportion of civilians expected to relocate will probably increase, since a larger portion of the civilian personnel will be professional. This parameter will depend on many other factors, such as the presence of working spouses and the expectation of finding alternative employment.

Change in Military Employment

These are the military personnel transferred to or out of the region, or newly added military personnel. Do not include personnel shifted from one position on the installation to another, or within the same geographic area. Enter a positive number for an increase or a negative number for a decrease. For the Training forecast model, these are nonbasic trainee-type military personnel.

Average Income of Affected Military Personnel

Average annual gross (before-tax) income of all military personnel affected by the military action. Average income figures are entered as positive numbers. As with the civilian average income variable, note that this variable includes only employee salary, not the employer's personnel costs.

Percentage of Construction Expenditures Used to Hire Labor

This variable applies to the Construction forecast model. Employee compensation should include such items as wages, employers' contributions to private pension and welfare funds, and privately administered workman's compensation funds. It should be adjusted for expected sick, annual, and holiday leave payments. This category of expenditures is a proportion of total spending. Obviously, this variable plus the materials and supplies percentage (described below) should normally total less than 100 percent, because construction firms have to pay Federal, State, and local taxes and have a profit margin in addition to the payments to labor, materials, and supplies. EIFS provides a default labor value of 34.2 percent. This percentage is calculated by dividing employee compensation by total industry output. A good source for such information is the latest detailed national I-O table (*Survey of Current Business* 1984). The national I-O table provides the most detail for construction project types (single-family housing, apartments, hospitals, etc.). Other possible sources of information are local construction firms and the latest Census of Construction (from the U.S. Bureau of the Census), which has state-specific receipts and expenditures by type of construction activity, including spending for labor and materials.

Percentage of Construction Expenditures Used to Purchase Materials and Supplies

This variable applies to the Construction forecast model. Ideally, this required information should be as specific to the proposed construction project as is possible. This plus the labor percentage (described above) should normally total less than 100 percent. EIFS provides a default materials value of 57.8 percent. This variable is calculated by dividing total intermediate inputs by total industry output. A good source for this information is the latest detailed national I-O table. Other possible sources of information are local construction firms and the latest Census of Construction (from the U.S. Bureau of the Census), which has state-specific receipts and expenditures by type of construction activity, including spending for labor and materials. Remember: this is a proportion of *total* construction spending; users often use an incomplete basis for this percentage.

Dollar Value of the Contracted Service

This figure, which is for the AR 5-20 Economic Effects Analysis FA forecast model, represents a contract with a local business establishment.

Adjusting for Inflation: EIFS Helps

EIFS uses 1987 as the baseline year for selling parameters used in the system's equations. In other words, the dollar value of EIFS inputs must be deflated to 1987 levels. EIFS provides default price deflators, which will usually perform an adequate conversion of your inputs into 1987 dollar values. However, to obtain the most accurate conversion, you may need to customize the price deflators to the specific ROI being analyzed.

EIFS allows the user to customize the price deflators at the beginning of a Forecast Model run. The default value is based on the latest complete published year. The price deflator screen is illustrated in Figure 4.

Failing to deflate current monetary values will cause EIFS to overstate the true level of impacts. While default price deflators are available in the EIFS forecast models, special applications may require price deflation before running EIFS. The following discussion focuses on the importance of accounting for the effects of inflation on monetary inputs. This section demonstrates how to restate a price index in

another base year and how to deflate monetary values. For more specific instructions, consult the EIFS Tutorial, *Deflating Monetary Values*, referenced in Appendix C.

Effects of Inflation

Deflation compensates for the impacts of inflation on an EIFS analysis. Inflation affects the monetary evaluation of physical quantities in two ways. First, inflation reduces the overall purchasing power of expenditures. Second, inflation alters the mix of commodities purchased by expenditures. That is, although inflation generally affects the prices of all goods and services, some commodities are more affected than others. Thus, the relative prices of goods and services change. As this occurs, consumers and producers purchase more of some items and less of others, especially when commodities can be substituted. Consumers and producers make these changes in an attempt to reduce the damaging effects that inflation has on their general welfare or profit situation.

Price Indexes

A price index is a number that indicates the relative change in the price of a commodity over time or shows the relative change in an average of the prices for several goods over time. Price indexes are compiled with reference to a base year (e.g., 1987) and computed in relation to a standard value (e.g., 1987 = 100).

The arithmetic of deflating monetary values is simple—divide the monetary value by the appropriate price index. The monetary values have been made consistent with the prices that existed during a reference period. That is, the effects of price changes since the base period have been removed, revealing the changes in the physical quantities since the base year (expressed in terms of the prices for the base period).

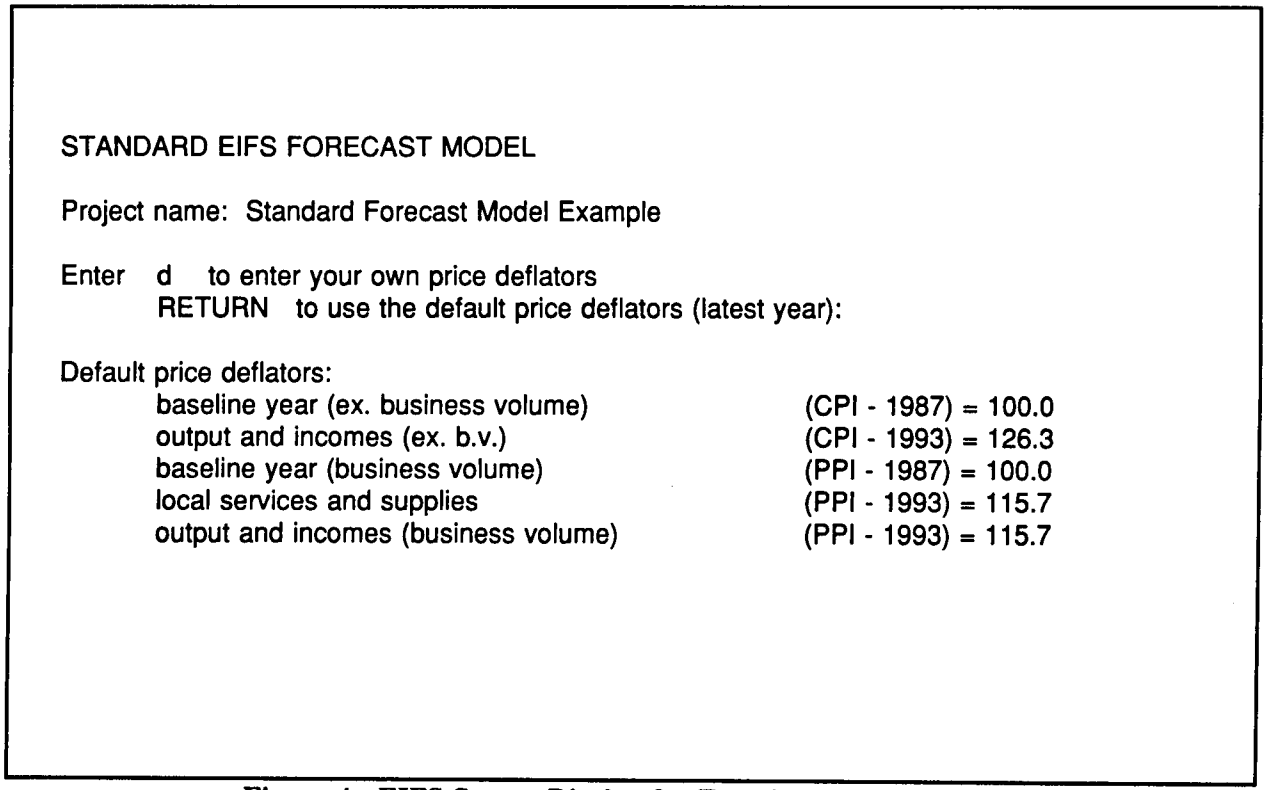

Figure 4. EIFS Screen Display for Entering Price Deflators.

There are two types of price indexes: commodity price indexes and composite price indexes. A commodity price index applies to a specific good or service (e.g., cotton), or to a narrowly defined group of commodities (e.g., household appliances). Deflating the change in spending by product type or industrial sector permits a user to accurately estimate the relevant change in spending, because commodity indexes account for the differential effects of inflation on the relative prices of goods and services. Detailed commodity price indexes are published monthly, reporting prices paid both by producers and consumers. Check with the BLS for copies of the reports *Producer Price Indexes* and *CPI Detailed Report*. These reports will contain the latest available commodity price indexes.

A composite price index is the average relative change in prices for a broad range of commodities over time. Composite price indexes have been compiled for many groups of commodities (e.g., consumer spending, construction spending, government purchases, investment spending). The latest annual values of these indexes are available as default values in the EIFS forecast models. A good source for many composite price indexes is the current issue of *Survey of Current Business*, published by the BEA. Also, EIFS supplies several acceptable types of price deflators; they can be found in the Models Profiles menu.

Since composite price indexes are weighted averages of relative price changes for specific commodities, their validity in any analysis depends on whether the weighing factors used in the index apply to the specific situation being analyzed. These indexes can be useful when applied appropriately, especially to deflate expenditures for which the specific mix of commodities purchased is unknown. However, composite price indexes can also present problems when used improperly in impact analysis. For example, the most widely used price index for measuring the overall rate of inflation is probably the Consumer Price Index (CPI). The CPI is used to determine the change in benefits paid to recipients of Social Security, Federal retirement, and many State retirement programs. Union wage contracts are even sometimes negotiated on the basis of the CPI. However, there seems to be little understanding of, and little attention paid to, the procedures used to compile the CPI. Specifically, the 1987 CPI is computed on the basis of commodity prices paid by urban residents, and weighted by an expenditure pattern that existed from 1982 to 1984. Thus, it may be inappropriate to deflate consumer expenditures made by rural residents, or military installation expenditures for services and supplies, using the CPI. The spending pattern on which the CPI is based (i.e., urban spending) simply may not apply to a nonurban case.

Determining Time Frame

It is important to carefully determine how long it will take to implement a proposed action. If the project will take more than 1 year, you may wish to analyze the impacts for 1 year at a time. If so, then all information should be entered into EIFS on a yearly basis. In such a case, of course, the analysis should also be run on a yearly basis. You should run EIFS one time for each project year. If it is reasonable to expect the same basic scenario year after year, then run EIFS to forecast the total effects for all years of the action.

Selecting the Most Appropriate Study Area

The most important basic task in an EIFS analysis is selecting the most appropriate study area or ROI. Of the many factors necessary to implement a socioeconomic impact analysis, probably one of the most-challenged issues is the analyst's definition of the ROI. This decision can significantly affect the conclusions of the analysis, in part because the magnitude of forecasted economic impacts varies with the size of the study area (Chalmers 1977). Justifying a particular study area may not be straightforward. Even among experienced regional analysts, delineating a study region can be a thorny issue, but it is very important. This section offers practical advice to help the EIFS user define and justify study areas.

Examine the ROI thoroughly. The proposed activity may affect areas outside traditional regional boundaries, such as a county or MSA boundaries. Use your knowledge of the area, data, and analyses by others to determine which areas will be affected. Do several preliminary runs of EIFS, varying the study area boundaries to see how impacts change as the study area changes.

Determine the *smallest geographic unit* for which data are available. This is important not only for defining the ROI, but, also for conducting the economic impact analysis. Within EIFS, the *county* is the smallest geographic unit available for delineating impact study areas. Subcounty-level data for population, housing, and income are available to those searching for data, but the EIFS study area is still confined to the county level.

Defining an ROI requires three steps: (1) defining the primary impact area, (2) defining the secondary impact area, and (3) performing geographic sensitivity analysis (Chalmers and Anderson 1977). The *primary impact area* is the region where civilian and military personnel and their dependents directly affected by the proposed military action reside and shop. The *secondary impact area* is generally larger than the primary impact area. It encompasses the geographic area most likely to be affected by the significant secondary economic impacts of changes in spending behavior by the affected personnel and their dependents, as well as any changes in post spending for services and supplies affected by the action.

Primary Impact Area

The primary impact area is usually determined by the residence pattern of the affected civilian and military personnel assuming that they and their dependents shop near their residences. If the geographic pattern of expenditures by the affected personnel and their dependents is expected to differ greatly from their residence pattern, then some effort must be made to determine in what area the demographic and social effects are likely to be the most pronounced. In this circumstance, determining the primary impact area may be the most controversial part of the study.

There are two ways to delineate primary impact areas. One way is to specify on a map a radius defining the distance surrounding the installation within which post employees are likely to live and shop. In effect, this approach eliminates how far the affected installation personnel commute to work. One recent survey of military and civilian AF personnel indicates that fewer than 1 percent live more than 50 mi from the base where they work (Gunther 1982).

Another approach is to more rigorously define the primary impact area. This is advisable if a proposed military action is expected to generate significant economic and social effects, or if it is likely to be controversial with nearby communities. In this approach, the analyst determines the actual residential and shopping patterns of the affected personnel. This can be done either through a survey or by using information from personnel. Based on these findings, a simple rule of thumb can be adopted—for example, if 5 percent or more of the installation's affected personnel live in a particular county, then that county should be included in the primary impact area. Note that the exact percentage for this kind of rule of thumb is determined by judgment, and will undoubtedly depend on the significance of the expected impacts or the level of controversy they are likely to generate. If the residence pattern of the affected civilian and military cannot be determined (e.g., the specific personnel affected are not identified), then the residence pattern of the entire installation work force—both affected and unaffected personnel—may be substituted. Keep in mind that the geographic area may change if the residence pattern of the entire work force is much different than that of the employees directly affected by the proposed military action.

Secondary Impact Area

Defining the secondary impact area is not as straightforward as determining the primary impact area. Essentially, defining the secondary impact area is equivalent to answering the following questions:

1. Where does the installation spend money for supplies and services?

2. Where do the merchants that serve personnel and post operations with goods and services purchase their inventories?

3. Where do the employees of these merchants and suppliers live?

In other words, the secondary impact area is the region in which all the spending, responding, and productive activities implied by the multiplier effect occur. Considering the importance of trade activity in the multiplier effect, the secondary impact area should not only contain the primary impact area, but also any nearby business centers and their market areas as well. In practice, this means that the study area for analyzing the secondary impacts of most military actions will be larger than the primary impact area—how much larger will vary, depending on the region being studied.

In general, the more sparsely populated a study area is, the larger the market area of the wholesale-retail center will be. Consequently, regional (secondary) impact area will include large geographic areas and will differ substantially from the local (primary) impact area. In more densely populated parts of the country, less difference will exist in the geographic boundaries of the two areas. In many parts of the East and the Upper Midwest, in fact, the two areas may coincide (Chalmers and Anderson 1977, p 40).

MSA boundaries may help the analyst delineate a secondary impact area. MSAs include a central city (or cities) and the surrounding territory that is economically and socially dominated by the city. Since MSA is by definition a major regional trade and service center, it is often an appropriate part of the secondary impact area.

The current standards for establishing and defining MSAs were adopted in January 1980. They provide that each MSA must include at least one city with 50,000 or more inhabitants, or an urbanized area as defined by the Census Bureau of at least 50,000 inhabitants and a total MSA population of at least 100,000 (75,000 in New England).

MSAs include as central counties the county in which the central city is located, and any adjacent counties with at least 50 percent of their population within the urbanized area. Additional outlying counties are included if they meet specified requirements of commuting to the central counties and are of metropolitan character.

Primary metropolitan statistical areas (PMSAs) are defined within metropolitan complexes of 1 million or more people, if specified criteria are met. The PMSA classification is used for more heavily populated areas. An MSA cannot be part of a PMSA, and vice versa. Any area containing MSAs or PMSAs is designated a consolidated metropolitan statistical area (CMSA).

The commuting patterns of workers in densely populated areas largely determines the boundaries of MSAs and PMSAs. Consequently, not all areas of the country fall within the boundaries of an MSA or PMSA. If the primary impact area does not fall within the limits of an MSA, the analyst must decide which, if any, MSA to include in the secondary impact area. Choosing the MSA nearest to the primary impact area may not always be appropriate, because that MSA may not be the trade and service center that most attracts shoppers from the primary impact area.

Instead of MSAs or PMSAs, the analyst can include BEA economic areas in the secondary impact area. These areas—183 in all—cover the entire United States, including Alaska and Hawaii. Specifically, BEA economic areas are FAs created to facilitate regional economical analysis. Each area consists of an economic *node*—an MSA or similar area that serves as a center of economic activity—and surrounding counties that are economically related to the center. To the extent possible, each area includes the workplace and residence of its labor force (U.S. Department of Commerce 1977, p 1).

Geographic Sensitivity Analysis

Region-specific characteristics can significantly affect the impact of the proposed action. For example, a community's size makes a difference in the degree to which it is affected by a change in industry. A smaller community would be affected more if a new company locates there than would a larger community if the same company moved there.

RTV and FSI models can help the analyst determine the magnitude of an impact. These models are described in Chapter 5. The causes of impact magnitude vary regionally. To determine the impact of regional differences, compare the study area with other areas after running the forecast model. This can be done by looking at the economic and demographic profiles (selections e and d respectively or the main menu for other areas).

Also, examine as much information about the area as possible from maps, data, local officials, and other socioeconomic impact analyses to determine the areas that may be affected by the action in question. Run the EIFS models several times varying the boundaries of the study area to see how the socioeconomic impacts change as the geographic area changes.

Examine the industry structure and the size of the study area. The economic impact of a military action on an entire state is generally greater in *absolute* terms than the impact on a single county. On the other hand, the *relative* impact is usually greater at the local level. For a large region, you may wish to use SAAM, also available in EIFS (see Chapter 9). SAAM allows more accurate estimation of county-level impacts that occur within a larger region.

The industry structure also influences the impact magnitude and the ROI boundaries. In Figure 5, no one major industry dominates City One's economic activity. Thus, the employment levels fluctuate relatively little. This contrasts with City Two, where one organization employer employs a significant proportion of the region's population. Therefore, the proposed activity's employment impact would be relatively smaller on City One than on City Two.

Interpreting EIFS Output

Interpreting model results is not a simple or straightforward task. It is perhaps the most difficult task in performing an impact study. Figure 6 shows an example of output for the Standard EIFS Forecast Model. The text that follows shows how to interpret the output, field by field.

Export Income Multiplier

The Export Income Multiplier is a factor representing how many dollars in income result from a $1 change in the region's exports. In Figure 6, the region has an export income multiplier of 2.2130 and the

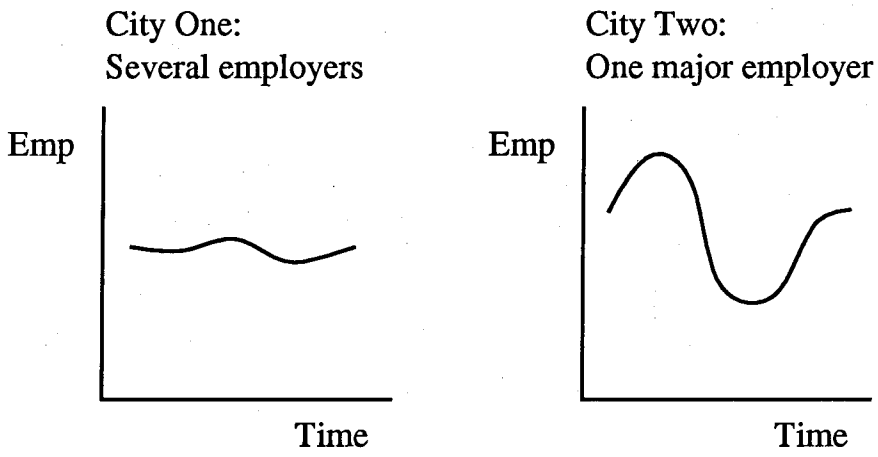

Figure 5. Example of Industry Structure's Impact on Cities' Employment.

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*** STANDARD EIFS MODEL FORECAST FOR Standard Forecast Model Example  ***


Export income multiplier:                              2.2130
Change in local
  Sales volume ..... Direct:          $10,829,000
                     Induced:         $13,136,000
                       Total:         $23,965,000     (   0.560%)
  Employment ..... Direct:                    90
                       Total:                287     (   0.264%)
  Income ..... Direct:                $1,433,000
               Total (place of work):  $5,583,000
          Total (place of residence):  $5,467,000     (   0.177%)
  Local population .....:                     157     (   0.092%)
  Local off-base population .....:             55
  Number of school children .....:             26
  Demand for housing ..... Rental:             14
                     Owner occupied:            8
  Government expenditures.....:           $303,000
  Government revenues .....:              $442,000
  Net Government revenues .....:          $139,000
Civilian employees expected to relocate:          0
Military employees expected to relocate:         63
```

Here is the EIFS output. Interpretations are provided in text.

Figure 6. Sample Standard EIFS Forecast Run.

direct change in sales volume is $10,829,000. Therefore, the *total* change in sales volume is $10,829,000 x 2.2130 or $23,965,000. (Note that numbers are rounded down to the nearest thousand dollars).

Change in Local Sales Volume (Direct)

The direct change in local business volume due to the proposed action is $10,829,000 for the current year. Please note: this is not equal to the number you entered for the change in expenditures for local services and supplies. Business volume is defined as local business activity or sales and is the sum of total retail and wholesale trade sales, total selected service receipts, and value-added by manufacturing.

Change in Local Sales Volume (Induced)

The direct change in sales volume changes the local demand for *nonbasic* goods and services. The induced change in sales volume is the dollar amount for this change in demand for the current year. In Figure 6, induced change in local business volume due to the proposed action is $13,136,000.

Change in Local Sales Volume (Total)

Total change in local business volume due to the proposed action equals direct plus indirect change in local sales volume for the current year. In Figure 6, the value is $10,829,000 + $13,136,000 or $23,965,000. The *0.56 percent* indicates that the proposed action increases total sales volume by 0.56 percent compared to a *no-action* scenario.

Employment (Direct)

The direct change in local employment due to the proposed action for the current year is 90. These are assumed to be the employees of the local retail, wholesale, and service establishments that are initially affected by the military action.

Employment (Total)

This is the total change in local employment due to the proposed action for the current year—in this case, 287. This includes not only the direct and secondary changes in local employment, but also those personnel who are initially affected by the military action. The *0.264 percent* indicates that the proposed action increases total employment by 0.264 percent compared to a "no-action" scenario.

Income (Direct)

The direct change in local wages and salaries in Figure 6 due to the proposed action is $1,433,000 for the current year. This is assumed to be earnings of the employees of the local retail, wholesale, and service establishments that are initially affected by the proposed action.

Income (Total, Place of Residence)

The total change in local personal income due to the suggested action for the current year is $5,467,000 in Figure 6. This includes not only the direct and secondary changes in local personal income adjusted for commuting patterns, but also includes the income of the civilian and military personnel initially affected by the military action.

Income (Total, Place of Work)

The total change in local wages and salaries due to the proposed action is $5,583,000 for the current year in Figure 6. This is the sum of the direct and secondary wages and salaries, plus the income of the civilian and military personnel affected by the suggested action. The (0.177%) indicates that the proposed action increases total income by 0.177 percent compared to a "no-action" scenario.

Local Population

The change in local population due to the proposed action is 157 for the current year, which is a 0.092 percent increase over a no-action situation. The *local off-base population* will increase by 55.

Number of School Children

This number represents the change in the number of children attending local public schools as a result of the suggested action—26 in this example. These children are the dependents of the civilian and military personnel affected by the suggested action.

Demand for Housing

This is the direct change in housing activity for the current year attributable to the proposed action. In Figure 6, 14 rental units and 8 owner-occupied units are occupied due to the action.

Government Expenditures

The total change in local government spending attributable to the proposed action for the current year is $303,000 in the above example. These expenditures pay for local fire and police protection, sanitation, education, welfare and income assistance, parks and recreation, public transportation, etc.

Government Revenues

This is the total of government revenues for the current year attributable to the action—$442,000 in the current example. The total includes local property tax and sales tax changes resulting from the action.

Net Government Revenues

This figure represents government revenues minus expenditures, or $139,000 in Figure 6.

Civilian Employees Expected to Relocate

The user inputs this value. The change in the number of civilians who will relocate their residence is 0 in Figure 6.

Military Employees Expected to Relocate

The user inputs this value. In Figure 6, 63 military employees are expected to relocate during the current year due to the proposed action.

5 ESTIMATING SIGNIFICANCE OF IMPACT: RTV AND FSI

When the EIFS forecast is complete, the analyst will wish to determine the significance of the forecasted impacts. The EIFS model output is not sufficient to address impact significance: analytical tools are required. RTV and FSI models provide information to assess the magnitude of an action's forecasted effect on a region. If one or both of these models indicate the projected impacts are significant, you may wish to conduct a more detailed analysis. This strategy for analysis is called the *two-tier* approach. This chapter describes the RTV and FSI methodologies, and explains the two-tier concept. For detailed descriptions and sample case studies, contact the ETIS Support Center for recent publications. For instructions on running the program, see Appendix A.

Rational Threshold Value

The RTV model provides boundaries, *or threshold values*, to assess the significance of an action's impact. If the changes predicted in the EIFS forecast model do not fall within these boundaries, these changes may affect the region significantly. This section describes the RTV method.

Indicator Variables: What EIFS Selected

The following list indicates considerations that have been controversial with respect to DOD projects (*Breckinridge et al. v Schlesinger* 1975; *McDowell v Schlesinger* 1975) in the socioeconomic arena:

1. Change in business volume
2. Change in personal income
3. Change in employment
4. Impact on local government revenues and expenditures
5. Changes in income and employment distribution
6. Impact on local housing
7. Impact on regional economic stability
8. Impact on local school systems
9. Impact on local government bond obligations
10. Change in population
11. Change in welfare and dependence
12. Change in social control
13. Aesthetic considerations.

Selection of indicators was based on predictive capability of existing forecasting techniques and data availability. The primary indicators of socioeconomic change are *business volume*, *employment*, *personal income*, and *population*. Population is included not only because it is important in its own right, but the change in population is also an indicator of several other factors (e.g., impact on local government revenues and expenditures, housing, local school systems, and the change in welfare and dependency). Any impacts on these four variables would be accompanied, and probably driven, by a population change.

RTV Methodology

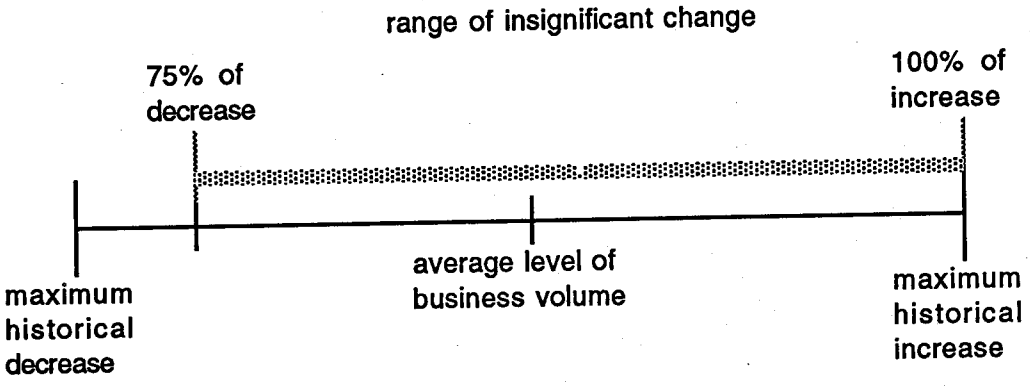
Using these indicators, the RTV model provides threshold values to assess the magnitude of an action's impacts. The largest historical changes (both increase and decrease) provide a basis for

comparing an action's impact to the historical fluctuation in a particular area. Specifically, EIFS sets the threshold values by multiplying the maximum historical deviation of:

	Increase*	Decrease*
total business volume**	x 100 percent	75 percent
total employment	x 100 percent	67 percent
personal income	x 100 percent	67 percent
total population	x 100 percent	50 percent

The maximum positive historical fluctuation is allowed with expansion because of the positive connotations of economic growth. While cases of damaging economic growth have been cited, and although the zero-growth concept is being accepted by many local planning groups, the effects of reductions and closures generally are much more damaging than expansions. The calculations above determine the range of change that will not significantly impact a region. This range is illustrated in Figure 7.

These boundaries determine the amount of change that will not significantly affect an area. The percentage allowances are arbitrary but sensible. The severity of potential impacts increases in the following order: total business volume, total personal income, total employment, and total population. Business volume impacts can be absorbed by manipulation of factors such as inventory, new equipment, etc. Impacts on individual workers or proprietors are neither assured nor immediate. Changes in employment and income, however, are immediate problems. These impacts usually are accompanied by a corresponding fluctuation in personal income, which also directly affects individuals. Population, as an indicator, is extremely important and should be weighted to reflect this importance.



Note: The "average level of business volume" is predicted as a function of time, as are the average levels of personal income, employment, and population.

Figure 7. Range of Significant Change in Business Volume.

* These percentages represent deviations from average yearly growth rate. The average yearly growth rate is calculated from census data from 1969 to present.

** No source with an adequate time series for business volume was available, so the nonfarm category of total personal income was selected as a measure of business volume fluctuation, based on the fact that a reduction in business volume tends to directly affect total personal income. At its worst, the historical fluctuation exhibited using this method would be less than that found in a true business volume measure, resulting in a conservative measure.

To adjust for inflation of the dollar values, the CPI is used for the appropriate years, and all dollar values are adjusted to 1987 equivalents. The data source selected was the BEA data series, which covers income, employment, and population. For more data information, see the discussion of the Detailed BEA Time series in the Data Profiles section of this manual.

RTV Example

The example that follows uses the same information entered earlier in the EIFS Standard Forecast Model example (this example is also used in the section discussing FSI).

Use the RTV profile (m3) to assess the significance of impacts on Champaign (IL) County. RTV is profile 3 under the Models (m) submenu of EIFS. Select section m (Models) to select the Models submenu, then select 3 (RTV). Alternatively, you may select m3 from the EIFS main menu.

The positive and negative RTVs are calculated by applying the percentages shown in Figure 8 to the maximum historic percent positive and negative deviations identified in the RTV profile output (Figure 8).

Next, compare these threshold values with the EIFS Forecast Model output. Following the inputs, the output illustrated in Figure 9 is displayed.

Percent Change in the Four Indicator Variables

The values on the right in parentheses (Figure 9) are the percent change in the four key indicator variables resulting from the proposed action. The percent change for each variable is calculated as follows:

1. Percent Change in Business Volume – The ratio of the change in business volume calculated by EIFS and total business volume (sales) in 1987.

2. Percent Change in Employment – The ratio of the change in employment calculated by EIFS and employment by place of work in 1987.

3. Percent Change in Personal Income – The ratio of the change in income by place of residence calculated by EIFS and personal income in 1987.

4. Percent Change in Population – The ratio of the change in population calculated by EIFS and total population in 1980.

Using the RTV for Impacts Assessment

The percent changes in business volume, personal income, employment, and population reported in the EIFS model (Figure 9) must be compared with the positive RTVs (Figure 8). This is shown in Table 1. In this case, none of the indicators exceed the positive RTVs indicating significant impacts.

To summarize, the RTV examines the historic deviations from an average annual growth curve for each of four key indicator variables: business volume, employment, personal income, and population. A maximum allowable deviation, which varies according to the relative importance of the indicator and whether the anticipated action results in a positive or negative change, is assigned to each indicator. If the proposed action results in changes that exceed the assigned maximum deviation, then significant impacts to the region are projected.

RATIONAL THRESHOLD VALUES

AREA: 17019 champaign, il

All dollar amounts are in thousands of dollars.
Dollar adjustment based on Consumer Price Index (1987=100).

BUSINESS VOLUME (using Non-Farm Income)

YEAR	Non-Farm income	adjusted income	change	deviation	%deviation
1969	469,760	1,389,823			
1970	484,464	1,353,251	-36,571	-61,178	-4.402 %

average yearly change:	24,607
maximum historic positive deviation:	151,036
maximum historic negative deviation:	-132,208
maximum historic % positive deviation:	9.288 %
maximum historic % negative deviation:	-8.256 %
positive rtv:	9.288 %
negative rtv:	-6.192 %

PERSONAL INCOME

YEAR	Personal income	adjusted income	change	deviation	%deviation
1969	569,013	1,683,470			
1970	588,315	1,643,338	-40,132	-79,264	-4.708 %

average yearly change:	39,132
maximum historic positive deviation:	131,322
maximum historic negative deviation:	-173,367
maximum historic % positive deviation:	6.119 %
maximum historic % negative deviation:	-8.305 %
positive rtv:	6.119 %
negative rtv:	-5.564 %

These are the "boundaries" needed to determine the impact significance of the proposed change.

EMPLOYMENT

YEAR	Employment	change	deviation	%deviation
1969	82,145			
1970	78,839	-3,306	-4,634	-5.641 %
			:	
			:	

POPULATION

YEAR	Population	change	deviation	%deviation
1969	160,700			
1970	163,300	2,600	1,995	1.242 %
			.	
			.	

Figure 8. RTV Output.

```
Change in expenditures for local services and supplies:  9780000
Change in civilian employment:  25
Average income of affected civilian personnel:  26500
Percent expected to relocate (enter <cr> to accept default):  (0.0)
Change in military employment:  63
Average income of affected military personnel:  27750
Percent of military living on-post:  65


**** STANDARD EIFS MODEL FORECAST FOR Standard Forecast Model Example  ****

Export income multiplier:                          2.2130
Change in local
  Sales volume ..... Direct:        $10,829,000
                     Induced:       $13,136,000
                       Total:       $23,965,000    (   0.560%)
  Employment ..... Direct:                  90
                       Total:              287    (   0.264%)
  Income ..... Direct:               $1,433,000
               Total (place of work):$5,583,000
          Total (place of residence):$5,467,000    (   0.177%)
  Local population ..................:       157    (   0.092%)
  Local off-base population .........:        55
  Number of school children .........:        26
  Demand for housing ......... Rental:        14
                       Owner occupied:         8
  Government expenditures............:   $303,000
  Government revenues ...............:   $442,000
  Net Government revenues ...........:   $139,000
Civilian employees expected to relocate:         0
Military employees expected to relocate:        63
```

Figure 9. Example of Standard Forecast Model Screen.

Table 1

Summary of RTV Example

	Max. Hist. Positive Deviation (RTV) (%)	% Change (EIFS)	Significant Change?
Business Volume	9.288	0.560	no
Employment	3.563	0.264	no
Personal Income	6.119	0.177	no
Population	1.833	0.092	no

The main strengths of the RTV are its reliance on local data that are readily available and its low cost of implementation. Critics of the RTV, however, have pointed to the apparently arbitrary selection of the maximum allowable deviations to indicate impact significance. The FSI profile, discussed in the next section, was developed in response to this criticism as an alternative to the RTV.

Forecast Significance of Impacts (FSI)

The goal of the FSI technique, similar to that of the RTV, is to determine appropriate threshold criteria for identifying significant economic impacts. However, unlike the RTV method, which defines a threshold for a specific indicator by arbitrarily assigning a fixed percentage of the maximum historical deviation from an average growth trend, the FSI approach defines impact thresholds using statistical procedures.

FSI Methodology

The FSI method is based on the following precepts. First, the concept of "significance" is relative, and always must be set in a context (Duinker and Beanlands 1986). For example, a county with a work force of 5,000 workers and losing 1,000 jobs as a result of an action is more likely to experience serious economic consequences than a county with 50,000 workers and losing 2,000 jobs. Therefore, the magnitude of impacts must be assessed in relationship to the relative hardship a county might experience as a result of changes affecting the local economic base. In this respect, the RTV and FSI techniques are similar because the RTV employs the percent historical deviation, a relative measure, to determine impact significance.

Second, future conditions resulting from a proposed action should be evaluated with respect to conditions expected from normal change. In other words, impacts resulting from an action should be compared to the *status quo* (Finsterbusch, Llewellyn, and Wolf 1986). This implies a different concept of significance than that used in the RTV technique. The RTV technique attempts to measure a community's capacity for adapting to changing economic conditions and identifies impacts as significant if they exceed this threshold. The FSI technique, on the other hand, does not presume to measure a community's ability to respond to economic change but only indicates when an activity results in changes that would not otherwise be expected in the context of historical trends. The latter approach seems preferable for two reasons. First, a community's ability to adapt to change is an extremely elusive characteristic, unlikely to be revealed by examination of data covering the most recent 20 year period. Second, the FSI technique, while using admittedly crude forecasting techniques, does provide some indication of how a project or action might affect future economic growth. This is important information for planners.

Procedurally, the first step is to forecast an indicator variable (e.g., employment, personal income, population). The FSI profile also calculates the standard error of the forecast by means of linear extrapolation, assuming no action occurs. This is carried out automatically by the program for a user-specified level of confidence. If, for example, a 90 percent confidence level is selected, there is a 90 percent probability that future socioeconomic activity will fall within the forecast margin of error. An action that would cause a level of change in excess of this probability whether positive or negative, is assumed to be significant (i.e., not otherwise expected as a result of normal growth). Note that as the level of confidence increases, the confidence band width also increases. Thus, the threshold for significance is higher for a 90 percent level of confidence than for a 60 percent level of confidence.

The remaining task is to compare the region's future under the *status quo* assumption to the levels of activity projected if an action takes place. Significant impacts for a region are indicated if either a

positive or negative change in a specific indicator variable falls outside the confidence region surrounding its forecast line.

While this procedure has the advantage of simplicity, it should be pointed out that linear extrapolation may not be an appropriate forecasting technique due to the nonlinearities in the historical trends of indicators. Moreover, this approach tends to penalize regions that have experienced wide fluctuations in growth over time, compared to regions that have had a history of steady growth (this shortcoming also applies to the RTV technique). The forecast's statistical error will be greater for a region with large historic swings in economic activity. Such a region will be less likely to be identified as receiving significant impacts than a county of similar size that has experienced steady growth.

FSI Example

This example follows the same scenario used in the RTV example. In this example the FSI profile will be used in conjunction with the EIFS forecast models (selection m1 from the main menu) to assess the significance of impacts on the area surrounding Champaign, IL.

When entering the FSI profile the user is asked to specify the year for which the projections are desired and the confidence level. The system's default is a 90 percent confidence level. In most cases, 90 percent will be sufficient to determine impact significance. To apply a stricter test of significance, select either a 95 percent or 99 percent confidence level. Similarly, a less strict test of significance may be selected by specifying either the 60 percent or 75 percent confidence level. Once you have responded to these questions, the output will be displayed on the computer monitor (Figure 10).

For each indicator variable (i.e., total employment, personal income, population, and business volume as estimated by nonfarm income) a graph of the regression line and forecast error bands is printed along with the actual and predicted values. The column labeled "err" is the standard error of the forecast—the difference between the predicted value and the forecast error for a given year. By default, the entire series of data is used to make a projection. If the user feels that a subset of the time series would be more representative of recent trends, he or she is given the option to select a subset of the data to generate the regressions.

Following the graphic output is a summary of information about the regression analysis. Of particular interest are the predicted value, percent forecast error, confidence interval, and R squared value. Using the output for total employment from Figure 8, the predicted value of 113,518 is the level of employment projected for Champaign County in 1992. This is the mean, or average value. The R squared value of 0.9515 indicates a reasonable fit. With a 90 percent confidence level the percent forecast error is calculated to be 3.0 percent. Thus, with a mean value of 113,518 for employment, the confidence interval (or range within which the actual level of employment for Champaign County in 1992 may fluctuate and still be considered normal variation) is 110,155 to 116,881 persons. If this is a reasonable estimate of the level of employment for Champaign County given the historical pattern of growth, then any activity or project that causes employment to fall outside this range should be regarded as potentially significant.

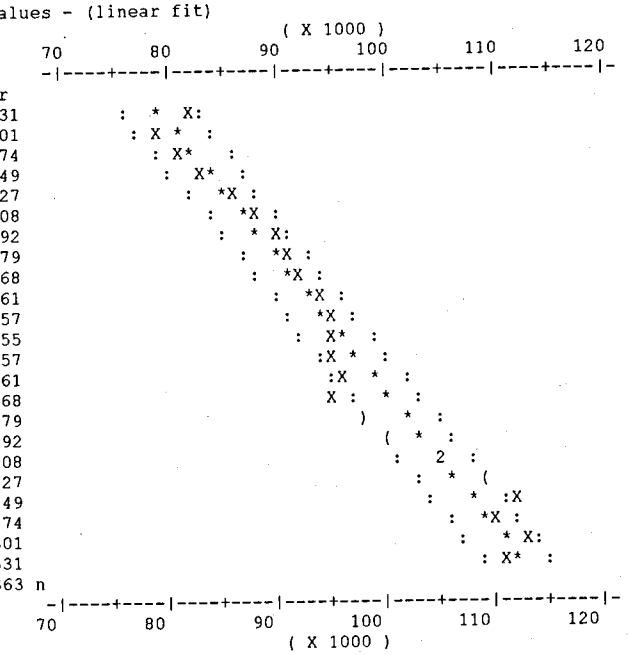
Using FSI for Assessing Impacts

As for the RTV, the output from the FSI profile may be used with the EIFS forecast models to assess the significance of impacts for a specific action. For example, to determine whether income impacts are significant using the FSI technique, just compare the percent change in total income by place of residence calculated by EIFS (Figure 8) to the percent forecast error for personal income (Figure 10). These comparisons are summarized for all four indicator variables in Table 2, which shows that the impacts estimated by EIFS are insignificant for all variables.

```
FORECAST SIGNIFICANCE OF IMPACTS
For which year do you want projections? ( ? for help ) : ?
   Choose a year between 1992 and 2016
For which year do you want projections? ( ? for help ) : 1992
What confidence level for t-test ( ? for help) :
   using default: 90

***** AREA:  17019    champaign, il *****

TOTAL EMPLOYMENT
Values and Predicted Values - (linear fit)
```



yr	act	pre	err
1969	82145	79264	3331
1970	78839	80754	3301
1971	81293	82243	3274
1972	82614	83732	3249
1973	86424	85222	3227
1974	87654	86711	3208
1975	89616	88200	3192
1976	91076	89689	3179
1977	92451	91179	3168
1978	93579	92668	3161
1979	95207	94157	3157
1980	94809	95647	3155
1981	95366	97136	3157
1982	95655	98625	3161
1983	95116	100115	3168
1984	97673	101604	3179
1985	100387	103093	3192
1986	105292	104582	3208
1987	108809	106072	3227
1988	111507	107561	3249
1989	110399	109050	3274
1990	112606	110540	3301
1991	111356	112029	3331
1992	0	113518	3363 n

70
80
90
100
110
120
(X 1000)

```
Prediction years   :   1969 - 1991
Year of estimate   :   1992
Confidence Level   :   90
Predicted Value    :   113,518
% Forecast Error   :   3.0 %
Confidence Interval:   110,155 to 116,881

Degrees of Freedom :   21
X intercept (b0)   :   -2,853,146.61
Std Err of b0      :   145,306.42
Slope (b1)         :   1,489.29
Std Err of b1      :   73.39
R squared          :   0.9515

 Source:  Bureau of Economic Analysis

Enter:
  c     to redo table
  f     to see footnotes and graph key
  q     to return to EIFS menu
  r     to return to FSI menu
  ?     for help
RETURN  to continue :

Data Key:
 M   some data was missing for this year - not included in prediction
 m   data in some of aggregated counties was missing (not included)

Graph Key:
 X   Actual value
 *   Predicted value
 2   Actual and Predicted values are both in the same graph interval
 :   Confidence interval delimiter
( )  Confidence interval delimiter when  X  is in the same graph interval
        translates into  X)  or  (X   within the graph interval
 n   data for this year was not used in fitting the prediction line
```

Figure 10. Champaign County FSI Example.

Table 2

Summary of FSI Example

FSI Estimated	% Forecast Indicator Error	% Change (EIFS)	Significant Change?
Business Volume	7.8	0.560	no
Employment	3.0	0.264	no
Personal Income	5.7	0.177	no
Population	1.3	0.092	no

When the Impact is Significant: The Two-Tier Concept

Suppose the RTV or FSI model indicate that the impact is significant· what is the next step? You may need a more detailed analysis than the forecasting models provide when the impacts are either controversial or significant. Using the *two-tier concept*—which employs EIFS and the RTV/FSI methodologies in the first tier, and AIMS* in the second tier—the second tier permits this greater degree of analysis.** Figure 11 depicts this methodology. While two factors—controversy and significance—can trigger a more detailed economic analysis, the question of significance can be addressed through the use of the RTV/FSI concept. Analyzing regional historical trends and comparing the results of EIFS outputs can aid in determining significance.

Early in the decisionmaking process—within the "first tier"—the proponent of a project is charged with the analysis of various alternatives. This is the what-if stage of a project. The analyst must consider the impacts of the various alternatives. At this stage, the proponent of the action must be fully versed in the use of EIFS and RTV/FSI profiles to adequately consider all alternatives. Such involvement may help the proponent identify additional alternatives and minimize adverse impacts.

Following this first-tier analysis, the analyst must determine whether or not to conduct a second-tier analysis. To determine this, a review of the impacts of the alternatives and their relation to the RTVs forms the basis for deciding the significance of the impacts. If the impacts of various alternatives are determined insignificant, no second-tier analysis is required, and the analyst must document this information for interest groups or individuals who request it. If the review yields significant new information, or if considerable controversy results, a more detailed analysis (the second tier) may be necessary. However, historically, such cases have been rare.

If the significance test implies no need for further analysis, the documentation of potential project input may be complete. If the test indicates a need for a detailed (second-tier) analysis, the analyst should conduct an I-O analysis using AIMS, as discussed in Chapter 6. (It should be noted that this second tier of analysis may be conducted by methods other than AIMS—methods tailored to specifically address the environment are under study.) After this second-tier analysis, documentation can be completed and incorporated into the project's records. If used appropriately, the two-tier process can minimize the costs of this type of study and ensure adequate consideration of local economic impacts.

*AIMS: Automated Input-Output Multiplier System. See Chapter 6 for detailed discussion.

**The user may also turn to other software programs, models, or qualitative interviews for the second-tier analysis, instead of AIMS.

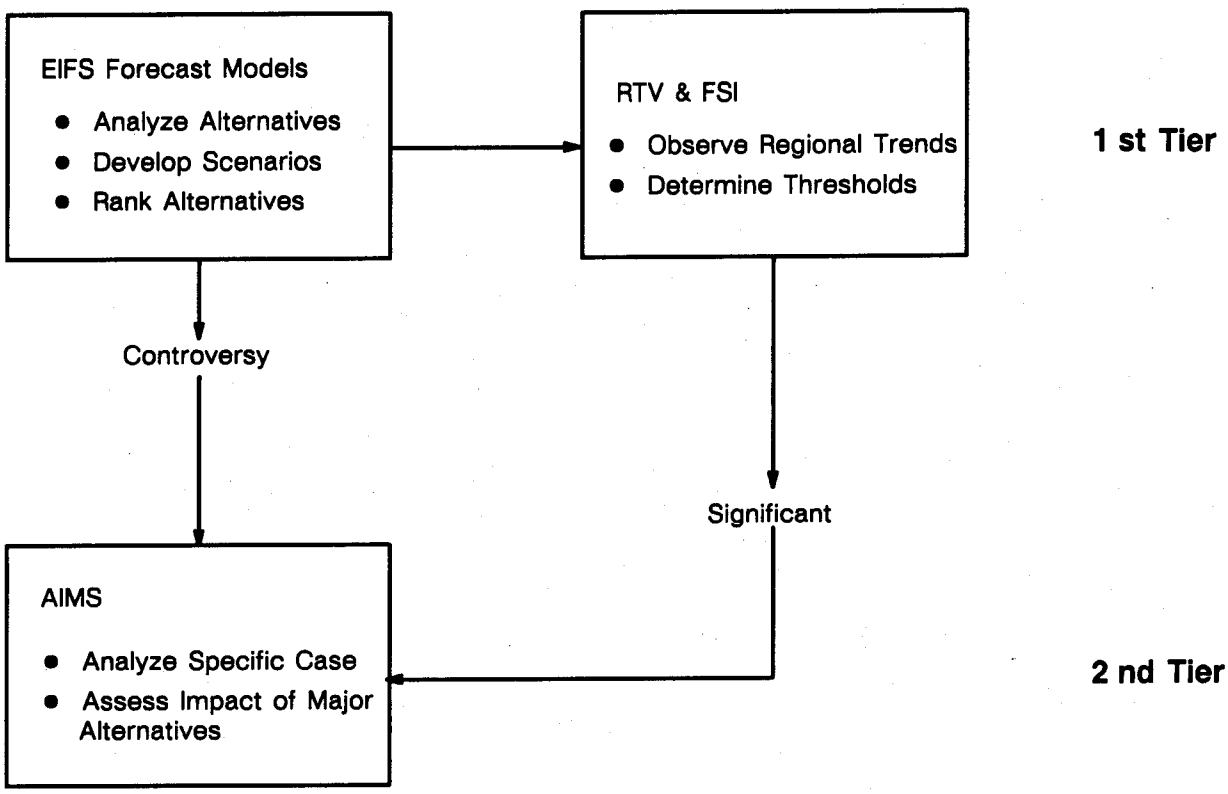


Figure 11. Two-Tier Concept.

The following chapter presents a detailed discussion of AIMS.

6 THE AUTOMATED INPUT-OUTPUT MULTIPLIER SYSTEM (AIMS)

AIMS enables the analyst to generate I-O multipliers for any county or group of counties in the U.S. It also helps to execute the second tier in the two-tier concept discussed in Chapter 5 and shown in Figure 11. AIMS estimates industry-specific multipliers for assessing the economic impacts of proposed activities such as military base realignments or private industry plant closures. Using the latest national I-O table available from the BEA, AIMS pulls in current multipliers. Detailed AIMS instructions are available at the Planning Information Program (PIP) Office, ETIS Support Center.

AIMS estimates industry-specific gross output multipliers using a short-cut nonsurvey technique originally developed by Drake (1976). This procedure relies on the view that multipliers can be decomposed into three components: the *initial effect*, the *direct effect*, and the *indirect effect*. The *initial effect*, always equal to 1.0, represents the initial final demand change. The direct effect is the sum of the first round of interindustry sales—the sum of the regional direct requirements for inputs for the industry experiencing the initial final demand change. The *indirect effect* is the sum of all other rounds of expenditures. (Here, the term *indirect effect* also encompasses induced effects.)

The inherent compatibility between the economic base and I-O models makes AIMS an appropriate tool for use in continuing the impact analysis after (or instead of) using the forecast models. This compatibility provides the initial forecast (using the forecast models) with analytical substance. Billings (1969), Garnick (1970), and Merrifield (1987) demonstrated the mathematical equivalence of I-O and economic base multipliers, when I-O models are aggregated to basic and service sectors (described in Chapter 3), or two industries.

Choosing an I-O approach (AIMS) over the economic base method (EIFS forecast models) is advisable for one or more of the following reasons:

1. To provide industrial detail in your impact analysis is required. For example, a further analysis of the impact results stemming from particular sectors, such as computing the change in sales tax receipts due to an action or project, may be necessary. Economic base models produce only aggregate impact results for the region. AIMS also produces aggregate regional impacts, but they are due to industry-specific causes. Use of a fully configured I-O model to estimate industry-specific impacts would solve this.

2. The project or action being examined is industry-specific in nature or the subsequent expenditure pattern is too skewed industrially to apply average impact multipliers (i.e., economic base multipliers). As an example, the proposed action may be establishing a contract for audio-visual services or the closure of a ship yard.

3. The expenditure data are readily available; they are appropriately detailed by industry and have sufficient accuracy to reflect the actual operation of a facility or activity.

To analyze diverse impacts using AIMS, it is important to make specific efforts to acquire accurate expenditure data with the appropriate industrial detail. Without this, an analysis using finely honed multipliers only gives the perception of refinement.

Using AIMS

To use AIMS effectively, you need to: (1) identify the industries affected by a project, (2) estimate an industry's or industries' change in final demand, and (3) correctly apply the multipliers provided by AIMS.

Identify Impact Industries

The purpose of an economic impact study is to quantify the effects of a change affecting a region's economy. While measuring the effects on industrial output, income, and employment is frequently the end goal, the analysis of change can generally be expressed as a change in *output* in a given industry or set of industries. An increase in the output of coal, for example, might lead to an increase in the production of steel. Higher levels of production in primary metals might result in greater production of corrugated metal stampings or some other commodity. Whatever the economic change, for the purposes of an impact study, it is represented in the form of a change in final demand (e.g., sales to end users). This means that from the sale of a commodity to final demand, there is no further local processing of the commodity.

In an I-O methodology, final sales are identified as direct sales to persons or industries outside the region, sales to governments, and investment activities. Thus, the impacted industries are those that experience some change in their volume of sales to exports, state, local, and Federal governments, or sales due to changes in inventory, equipment, building investment, etc.

In identifying initial impact industries, what constitutes an impacted sector can be unclear. If increased output of coal in Illinois facilitates greater output of steel to be exported to Missouri, is the coal sector the impacted industry or steel, or both? Both industries are now producing greater output. If the extra coal produced is used *solely* as an input to the production of steel, and steel is exported, then only the steel industry has experienced a final demand change. However, if some of this coal is exported to Wisconsin for use in home stoves, then part of the output in the coal industry is due to changes in final demand. If the extra steel produced is bought as a finished product by a local government, there is still a change in final demand even though nothing has been exported. As the chosen level of aggregation decreases, and the number of impacted sectors increases, the situation can become more complex.

The appropriate identification of impact industries is facilitated through the consideration of backward and forward linkages, or interdependent connections among industries. I-O type multipliers, like those estimated in AIMS, account for backward linkages. This means that AIMS multipliers estimate the total increase or decrease in regional economic activity as a result of a final *demand* change experienced by a single industry. For example, if the motor vehicles sector experiences a change in final demand (e.g., Michigan exports more cars to Florida), then the motor vehicles sector must purchase more fabricated metals, glass, rubber, etc. These industries must then purchase more of their inputs to meet the greater demand for their commodity. While there is, conceptually, an infinite number of spending rounds, this is an example of backward linkages. AIMS multipliers estimate this multiplying effect.

Conversely, forward linkages are *supply*-induced changes. They are increases or decreases in the processing of a commodity that occur because of fluctuations in the region's supply of the commodity. If, for example, higher levels of rubber production for the motor vehicles sector cause some other industry to increase its use of rubber as an intermediate input, then the sale of rubber to the other industry represents a forward linkage.

Estimate Change in Final Demand

To accurately estimate the impacts of a project on a regional economy, the magnitude of the final demand change to be used in conjunction with the AIMS multipliers must be researched. This information is often available through department reports, the media, etc. If a manufacturing plant invests $5 million in new construction, for example, then the construction industry will experience a change in final demand of $5 million. If this investment also means that the industry will increase its sale of exports by $20 million, then there is a change in final demand of $5 million in the construction sector and $20 million in manufacturing. Similarly, in the case of a military base closure, there will be a change in final demand in one or more industries having economic ties to the base to which AIMS multipliers can be applied.

Problems sometimes arise in cases where the impacted industries are not those experiencing the final demand change. In cases where forward linkages are present, the final demand change will occur in industries other than those directly experiencing the effects of a project or action. If this is the case, the disposition of output should be considered to determine where the final demand change will occur. If a water resource project results in increased grain production, part of the new output may be sold to livestock and grain processing industries, and some exported as a commodity. Once the flows to other industries in the region have been identified, the appropriate change in these industries can be estimated. The best procedure for this estimation is to use technical relationships, such as tons of feed per ton of beef or bushels of wheat per pound of flour, to estimate the value of output in a forwardly linked industry associated with the quantity of commodity input (U.S. Department of Commerce, Bureau of Economic Analysis, 1977).

Another potential area of confusion in I-O analysis relates to the division of the wholesale and retail trade sectors. For many industries (e.g., service industries, described in Chapter 3), final demand changes are identical to sales. This is not true for the trade industry. In the system of national income and products accounts used to construct the national I-O model (on which AIMS is based), the trade sectors are treated on a marginal basis. Correct final demand changes for the trade sector can be estimated by factoring out the portion of retail and wholesale trade sales that represents the trade margin. The resultant gross trade margin is defined as the total sales minus the cost of goods sold. The case study discussed in the next section shows how this adjustment is carried out.

Apply The Multipliers

AIMS multipliers are a convenient way to summarize the chain of reactions that are set in motion through changes in final demand. The output multipliers relate the dollar value of additional output that results from a $1 change in the final demand of a given industry. Thus, if the durable manufacturing sector has an associated output multiplier of 1.7, and it experiences a final demand change of $100,000, then the total effect of this change on regional output is calculated as $100,000 + $70,000, or $170,000. Income multipliers relate the dollar value of additional income that results from a unit change in final demand. Employment multipliers work the same way. These are frequently estimated as the number of units of employment per million dollars of output. This is done because the employment embodied in $1 of output is generally minuscule.

Do not confuse large multipliers with large impacts. An industry with annual sales of $100 million and an output multiplier of 1.2 has a larger impact on a region than an industry with an output multiplier of 2.5 and annual sales of $10 million.

Case Example*

A military installation in Lake County, IL employs 1,500 civilian and 1,200 military personnel with average annual incomes of $12,000 and $10,500 (1977 dollars**), respectively. The installation spends an additional $3.5 million annually (1977 dollars) for local goods and services for its operation. What would be the economic impacts on the local economy of closing this installation?

Identify Industries and Calculate Final Demand Changes

Personal Income Expenditures. Assume that the civilian employees spend 80 percent of their gross income in the local economy while military personnel spend only 30 percent of their income locally.*** Further assume that for every dollar of civilian income spent locally, $0.50 goes to purchase retail goods, $0.40 to finance, insurance, and real estate (FIRE), and $0.10 to entertainment. However, military personnel divide their purchases exclusively among retail goods ($0.75) and entertainment ($0.25). This information is summarized in Table 3.

The expenditures for retail goods, FIRE/personal services, and entertainment are changes in final demand. However, the expenditure for retail goods includes charges for the output of retailers, wholesalers, transporters, and manufacturers. Assume that the wholesalers, retailers, and transporters are located in Lake County, but that the manufacturers are located elsewhere. Then, the charges for wholesale, retail, and transportation (but not manufacturing output) are changes in final demand in Lake County. (In I-O terms, wholesale and retail output, referred to as "margin," consists of operating expenses, profits, sales taxes, and excise taxes.) Estimate these final demand changes by *multiplying the total expenditure for retail goods by all personnel ($10,035 million) by the percentage shares of national personal consumption expenditures in the category "total personal consumption expenditures"* that are accounted for by the wholesale and retail trade industry (17.9 percent) and the transportation industry (0.8 percent) (*Survey of Current Business* 1984). The resulting estimates are shown in Table 4.

Table 3

Personnel Earnings and Expenditure Data
Lake County, IL

	($1,000s of 1977 dollars)		
	Civilian	Military	Total
Net Earnings	18,000	12,600	30,600
Local Expenditures	14,400	3,780	18,180
Retail Goods	7,200	2,835	10,035
FIRE/Personal services	5,760	0	5,760
Entertainment	1,440	945	2,385

* The example in this section is drawn from the Office of Economic Adjustment, *The Regional Economic Impact of Military Base Spending*, Washington, D.C., 1980.

** Since AIMS uses the 1977 national input-output table and income/output and employee/output ratios, convert current dollar expenditure changes into 1977 dollar equivalents for use with AIMS. See Chapter 4, which discusses deflating monetary values, for details.

*** Military personnel are assumed to reside on post and are allowed to purchase consumer items at the Post Exchange (PX). The 20 percent of gross income not spent locally by civilians is mainly accounted for by taxes and savings.

Table 4

Final Demand Changes From Personnel Expenditures
Lake County, IL

Industry Name	Change in Final Demand ($1,000s of 1977 dollars)	Industry Code(s)
Wholesale and retail trade	1,796	690100-690200
Transportation	80	650100-650702
FIRE/Personal services	5,760	700100-720300,750001-750003 770100-770900
Entertainment	2,385	740000,760100-760206
TOTAL	10,021	

Installation Expenditures for Goods and Services. Suppose the installation expenditures are distributed among industrial sectors as shown in Table 5. The expenditures for maintenance and repair construction, communication, and business services are changes in final demand. However, the expenditures for manufactured goods also include charges for the output of wholesalers and transporters, as well as manufacturers. Assuming that the wholesalers, transporters, and manufacturers are all located in the study area, charges for these sectors are changes in final demand in Lake County. These final demand changes can be estimated by *multiplying the expenditure for each manufactured good by the percentage shares of the price paid for the good* (based on the Federal Government's defense budget) that

Table 5

Military Installation Expenditures
Lake County, IL

Industry Name	Change in Expenditures ($1,000s of 1977 dollars)	Industry Code(s)
Maintenance and repair construction	322	120212
Manufacturing	1,671	
Food and kindred products	1,096	140102-143200
Fabricated textile products, nec	3	190306
Commercial printing	2	260501
Chemicals and allied products	53	270100-280100
Office machinery	177	510101-510400
Motor vehicles and parts	331	590302
Miscellaneous manufacturing	9	641200
Communications	1,126	660000
Business services	401	730101-730303
Total	3,520	

are accounted for by wholesale and retail trade margins, transportation costs, and producers' prices. For example, the final demand changes associated with the expenditure for office machinery can be estimated by multiplying the expenditure ($177,000) by the shares of the price paid for office machinery that are accounted for by wholesale and retail trade margins (9 percent), transportation costs (0 percent), and producers' prices (91 percent) (*Survey of Current Business* 1984). These estimates are shown in Table 6.

Generate Multipliers

To generate the industry-specific multipliers, use AIMS. If you need details on the mechanics of running AIMS, refer to the AIMS section of Appendix A for further details.

Generate multipliers for one industry (or group of industries) at a time. Thus, the food and kindred products sector is aggregated and the associated multipliers retrieved, before the chemical and allied products sector (although industries may be aggregated in an arbitrary order).

To illustrate, the output for chemical and allied products (industry codes 270100 to 280100) is shown in Figure 12, which indicates there are 11 industries within our range, only three of which exist in Lake County. This, however, does not create much of a problem. If none of the industries exist in Lake County, these goods and services must be imported. As such, they are final demand changes in

Table 6

Final Demand Changes From Installation Expenditures
Lake County, IL

Industry Name	Change in Final Demand ($1,000s of 1977 dollars)	Industry Code(s)
Maintenance and repair construction	322	120212
Manufacturing	1,495	
Food and kindred products	964	140102-143200
Fabricate textile products, nec	3	190306
Commercial printing	2	260501
Chemicals and allied products	50	270100-280100
Office machinery	161	510101-510400
Motor vehicles and parts	308	590302
Miscellaneous manufacturing	7	641200
Transportation	34	650100-650702
Communications	1,126	660000
Wholesale and retail trade	142	690100-690200
Business services	401	730101-730303
Total	3,520	

some other region(s) and not Lake County. Knowing what portion of this expenditure goes to explosives (not found in our region) as opposed to chemical preparations, nec* (which do exist in Lake County), subtract the share of expenditures for explosives from the change in expenditures for chemical and allied products in general. The assumption is that the $53,000 change in Chemical and Allied Products does occur in Lake County.

After the user selects and verifies the applicable industries, AIMS immediately generates the output shown in Figure 12. The program output not only shows the multipliers, but also allows the analyst to follow the intermediate steps used in the calculations.

Results

These multipliers are used in conjunction with the change in final demand by industry presented in Tables 4 and 6. This information is summarized in Table 7, and the impacts by industry are presented in Table 8. Table 8 shows that from an initial final demand change of $13.54 million for all industrial sectors, the total impacts are: industry output ($25.9 million), household income ($9.1 million), and employment (875 jobs).

For comparison purposes, the standard EIFS forecast model estimated employment impacts of 804 jobs using the same set of inputs, inflating the 1977 dollars to 1987 levels using the Consumer Price Index for wages and Producer Price Index for expenditures.

Compared to other methods of obtaining industry-specific multipliers, AIMS provides an expedient and relatively inexpensive method of determining local economic impacts on an industry-by-industry basis. It was shown (Bloomquist, Webster, and Robinson 1987) that AIMS multipliers are consistent with other partial and nonsurvey I-O models that are frequently cited as reliable models of regional economies.

*The abbreviation (nec) stands for Not Elsewhere Classified.

```
AIMS - Automated Input-Output Multiplier System
       .
       .
 Enter IO code or IO code range ( ? for help ): 270100-280100
   11 IO codes occur between 270100 and 280100.
   Do you wish to add these codes to your list (n/<cr>) ?
 270100  Industrial Inorganic & Organic Chemicals  (SICs 2810 2865 2869)
 270201  Nitrogenous & Phosphatic Fertilizers  (SICs 2873 2874)
 270202  Fertilizers, Mixing Only  (SIC 2875)
 270300  Agricultural Chemicals, nec  (SIC 2879)
 270401  Gum & Wood Chemicals  (SIC 2861)
 270402  Adhesives & Sealants  (SIC 2891)
 270403  Explosives  (SIC 2892)
 270404  Printing Ink  (SIC 2893)
 270405  Carbon Black  (SIC 2895)
 270406  Chemical Preparations, nec  (SIC 2899)
 280100  Plastics Materials & Resins  (SIC 2821)

 Enter IO code or IO code range ( ? for help ):
       .
       .

 Only 5 of 11 codes exist in the area
     Do you wish to continue (n/<cr>) ?
 Codes which do not exist in area will be weighted 0.
 IO: 270100    Weight: 0.405896
 IO: 270201    Weight: 0.006803
 IO: 270202    Weight: 0.002268
       .
       .
 IO: 270406    Weight: 0.390023
 IO: 280100    Weight: 0.195011

 ******* AIMS Multiplier Computations (1977 IO table)  -  11 IO Codes ******

                                                                    0.516671
 Direct Effect (DE)
   Goods and Services Purchased Locally                  0.337796
   Labor Hired Locally                                   0.178875

                                                                    0.326691
 Indirect Effect (IE)
   Agr Share of Local Non-Govt Earnings (P1)             0.001509
   Mfg Share of Local Non-Govt Earnings (P2)             0.293890
   Local Share of US Non-Govt Earnings (S2)              0.002088
   ln(IE) = 0.65 - 0.79*P1 - 0.13*P2 + 0.17*ln(S2) + 1.03*ln(DE)
   ln(IE)                                               -1.118740

 Output Multiplier (Mq) = 1 + DE + IE                               1.843362(a)

                                                                    0.515370(b)
 Income Multiplier (Mi) = Ij + (Mq - 1)*I.
   Income per Output - Selected Industries (Ij)          0.178875
   Income per Output - Avg (I.)                          0.398992

                                                                   40.165442(c)
 Employment Multiplier (Me) = Ej + (Mq - 1)*E.
   Employment per Output - Selected Industries (Ej)      8.174817
   Employment per Output - Avg (E.)                     37.932262
       .
       .
```

Figure 12. AIMS Output.

Table 7

Output, Income, and Employment Multipliers for Defense-Related Industries
Lake County, IL

Industry	Total Change in Final Demand ($1,000s)	Multipliers		
		Output a	Income b	Employment c
Maint. and repair construction	322	2.181	0.855	70.378
Manufacturing	1,495			
Food and kindred products	964	1.800	0.534	44.262
Fabricated textile products, nec	3	1.651	0.529	52.072
Commercial printing	2	1.911	0.703	57.664
Chemicals and allied products	50	1.843	0.515	40.165
Office machinery	161	2.186	0.814	63.435
Motor vehicles and parts	308	1.901	0.679	47.500
Misc. manufacturing	7	2.068	0.738	65.516
Transportation	114	2.061	0.858	66.076
Communications	1,126	1.769	0.654	46.148
Wholesale and Retail Trade	1,938	2.041	0.853	82.492
FIRE/Personal services	5,760	1.865	0.601	55.046
Business services	401	1.993	0.822	70.388
Entertainment	2,385	1.962	0.685	90.543
Total	13,541			

a Represents the total dollar change in output that occurs for each additional dollar of output delivered to final demand.

b Represents the total dollar change in household income for each additional dollar of output delivered to final demand.

c Represents the total change in number of jobs for each additional $1 million of output delivered to final demand.

Table 8

Output, Income, and Employment Impacts From the Closure of a Military Installation in Lake County, IL

Industry	Impacts		
	Output ($1,000)	Income ($1,000)	Employment (Jobs)
Maintenance and repair construction	702	275	23
Manufacturing	2,788	889	71
Food and kindred products	1,735	515	43
Fabricated textile products, nec	5	2	0
Commercial printing	4	1	0
Chemicals and allied products	92	26	2
Office machinery	352	131	10
Motor vehicles and parts	586	209	15
Misc. manufacturing	14	5	1
Transportation	235	98	8
Communications	1,992	736	52
Wholesale and Retail Trade	3,956	1,653	160
FIRE/Personal services	10,742	3,462	317
Business services	799	330	28
Entertainment	4,679	1,634	216
Total	25,893	9,077	875

7 DOWNLOADING DATA AND DATABASE UPDATES

EIFS socioeconomic data are useful to analysts both as input to EIFS forecast models and as output to be used in subsequent analyses and presentations. This chapter presents selected data, provides instructions for downloading data onto your micro-computer, and gives information regarding data updates.

A Demonstration of Selected EIFS Data

Selected EIFS data screens are presented below.

```
                EIFS v5.0 Main Menu

Type:  For Section Menu:
  d     Demographic Data
  e     Economic Data
  m     Models
  x     Additional profiles

Type:  For:
  1     EIFS messages
  2     List of contact people
  3     Description of the differences between v4.1 and v5.0
  4     List of changes to FIPS lists
  5     Help with downloading to PC's
  6     Database Information - including upgrade schedules

Type:  To:                                  Type:  For:
  -     return to EIFS main menu              ?     a list of valid responses
  f     change output Format options         ??     more detailed help
  r     Review your county list             quit    exit to EIFS
```

```
EIFS v5.0 - What Section?  (<cr> to see list): d

                Demographic Data Profiles  (d)

Type:  For Data:
  1     Census overview - 1980
  2     Census overview - 1970
  3     Sub-county Demographic Update - Population, Housing, Wealth -1989
  4     Census of Housing and Population - 1980  (STF3A) - SUB-COUNTY LEVEL
  5     Population Pyramids - 1970, 80, 82, 84
  6     Sub-county Consumer Spending Patterns -1989
  7     Sub-county profile - d3 & d6
  8     Census - 1990

Type:  To:                                    Type:  For:
  -     return to EIFS main menu                ?     a list of valid responses
  f     change output Format options           ??     more detailed help
  r     Review your county list              quit     exit to EIFS

by us       is available for:  3 4 6 7 8
by county   is available for:  1 2 3 4 5 6 7 8
spreadsheet options are available for:  1 2 3 4 5 6 7 8
```

EIFS v5.0 (d) - What profile? (<cr> to see list): 1

1980 CENSUS OVERVIEW

AREA: 17019 champaign, il

HOUSING and POPULATION TOTALS

168,392	Population
37,105	Families
58,405	Households
62,494	Housing Units *

* (year-round units)

URBAN vs RURAL

Total	Urban Area	Other Urban	Rural	
168,392	109,278	20,161	38,953	Population
62,518	41,422	6,377	14,719	Housing Units *

* (incl. vacant seasonal & migratory units)

POPULATION by AGE

Total	Male	Female	
168,392	86,234	82,158	Total
2,477	1,302	1,175	Under 1 year
4,495	2,313	2,182	1 - 2 years
3,955	2,018	1,937	3 - 4 years
2,006	1,021	985	5 years
1,874	936	938	6 years
6,234	3,177	3,057	7 - 9 years
7,998	4,147	3,851	10 - 13 years
1,979	990	989	14 years
2,139	1,086	1,053	15 years
2,251	1,179	1,072	16 years
2,677	1,419	1,258	17 years
6,871	3,894	2,977	18 years
8,832	5,004	3,828	19 years
8,577	4,790	3,787	20 years
8,160	4,566	3,594	21 years
15,756	8,558	7,198	22 - 24 years
18,292	9,561	8,731	25 - 29 years
12,557	6,531	6,026	30 - 34 years
15,396	7,646	7,750	35 - 44 years
12,863	6,369	6,494	45 - 54 years
5,948	2,817	3,131	55 - 59 years
2,202	1,042	1,160	60 - 61 years
2,794	1,329	1,465	62 - 64 years
7,054	2,948	4,106	65 - 74 years
3,710	1,264	2,446	75 - 84 years
1,295	327	968	Over 84 years
24.6	23.8	25.7	Median Age (yrs)

POPULATION by RACE

168,392	Total
148,445	White
14,661	Black
269	Indian, Eskimo, Aleut
262	Indian
5	Eskimo
2	Aleut
3,341	Asian and Pacific Islander
614	Japanese
1,135	Chinese
287	Filipino
558	Korean
466	Asian Indian
226	Vietnamese
33	Hawaiian
22	Guamian
0	Samoan
1,676	Other

POPULATION by MARITAL STATUS (age 15 and over)

Total	Male	Female	
137,374	70,330	67,044	Total
56,471	32,838	23,633	Single
65,083	32,734	32,349	Now Married
1,576	674	902	Separated
6,457	945	5,512	Widowed
7,787	3,139	4,648	Divorced

HOUSING UNITS - (Year-round)

Total	Occupied	Vacant	Persons	
62,494	58,405	4,089	147,064	Total
32,220	31,468	752	86,821	Owned
28,955	26,937	2,018	60,243	Rented
1,319	0	1,319	0	Other

HOUSING VALUE (Owner-Occupied Noncondominium)

330	less than $10,000
410	$10,000 to $14,999
710	$15,000 to $19,999
1,153	$20,000 to $24,999
1,348	$25,000 to $29,999
2,016	$30,000 to $34,999
2,350	$35,000 to $39,999
4,338	$40,000 to $49,999
8,686	$50,000 to $79,999
1,995	$80,000 to $99,999
1,129	$100,000 to $149,999
216	$150,000 to $199,999
138	$200,000 or more
49,400	Median Value ($)

NONCONDOMINIUM UNITS (owner-occupied or vacant-for-sale)

Total	Occupied	Vacant	
1,391,390	1,363,536	27,854	Aggregate Value (thousands of $)
25,303	24,819	484	Units
54,989	54,939	57,549	Mean Value ($)

CONDOMINIUM UNITS (owner-occupied or vacant-for-sale)

Total	Occupied	Vacant	
41,541	37,800	3,741	Aggregate Value (thousands of $)
736	656	80	Units
56,442	57,622	46,766	Mean Value ($)

CONTRACT RENT (renter occupied units) *

710	No cash rent
381	Less than $50
1,040	$50 to $99
901	$100 to $119
1,770	$120 to $139
931	$140 to $149
1,762	$150 to $159
1,711	$160 to $169
4,502	$170 to $199
6,183	$200 to $249
2,836	$250 to $299
1,796	$300 to $399
512	$400 to $499
384	$500 or more
196	Median Rent ($)

* (except single family units on > 10 acres)

RENTAL UNITS (renter-occupied-paying-cash-rent or vacant-for-rent)

Total	Occupied	Vacant	
5,544,512	5,155,913	388,599	Aggregate Rent ($)
26,702	24,709	1,993	Units
208	209	195	Mean Rent ($)

Source: Bureau of the Census, Census of Population and Housing (STF1A), 1980

```
EIFS v5.0 - What Section?  (<cr> to see list): e

                Economic Data Profiles  (e)

Type:  For Data:
  1     Census of Governments, Government Finance - 1987
  2     Economic Censuses - 1987 (Wholesale, Retail, Services, Manufactures)
  3     Census of Agriculture - 1987, 1982, 1978
  4     BEA employment/income timeseries - Short
  5     BEA employment/income/transfer payments timeseries - Detailed
  6     BLS labor force timeseries  - 1988-1991 (Aug)
  7     County Business Patterns - 1982, 1987, 1990
  8     Export employment profile (1982, 1987, 1990 County Business Patterns)
  9     BEA Regional Projections - (OBERS) - for selected states only:
                AL, FL, GA, IL, IN, KY, MS, NC, OH, PA, SC, TN, VA, WV

Type:  To:                                  Type:  For:
  -     return to EIFS main menu              ?     a list of valid responses
  f     change output Format options         ??     more detailed help
  r     Review your county list            quit     exit to EIFS

by us      is available for:  2 3 4 5 7
by county  is available for:  1 2 3 4 5 6 7 9
spreadsheet options are available for:  1 4 5 6 7 9
```

```
EIFS v5.0 (e) - What profile?  (<cr> to see list): 1

1987 CENSUS OF GOVERNMENTS
GOVERNMENT FINANCE - Which table(s)? (type  ?  for help): ?

Type  For
  r     Revenue
  d     Debt
  e     Expenditures
  a     All: Revenues, Expenditures, and Debt

  q   To return to EIFS

GOVERNMENT FINANCE - Which table(s)? (type  ?  for help): a


1987 CENSUS OF GOVERNMENTS - Government Finance



AREA:  17019    champaign, il  ** 1987 population = 171,100

REVENUE:                                  (Thousands)
Total Revenue                               $251,089
 Intergovernmental Revenue                   $65,571
  From Federal Government                    $15,969
  From State Government                      $49,602
 Own Source Revenue                         $172,856
  Tax Revenue                                $92,158
                      .
                      .
                      .
 Liquor Store Revenue                             $0
 Insurance Trust Revenue                      $3,366

DEBT and ASSETS:                          (Thousands)
Indebtedness                                $105,628
 Long-Term Indebtedness                     $105,576
                      .
                      .
Cash & Securities                           $176,845

                                                                          Fed
EXPENDITURES:  (Thousands)          Total        Current      Capital     Asst
Total Expenditures                $247,406       $218,953     $28,453      $0
 Intergovernmental Expend.            $142           $142          $0      $0
 Total Direct Expenditures        $232,874       $205,078     $27,796      $0
  Education Expenditure            $99,410        $93,045      $6,365      $0
   Elementary & Secondary          $74,741        $68,950      $5,791      $0
   Higher Education                $21,668        $21,240        $428      $0
   Libraries                        $3,001         $2,855        $146      $0
                                       .
                                       .
                                       .
  Federal Activities                    $0             $0          $0      $0
 Utility Expenditures              $13,077        $12,420        $657      $0
 Liquor Store Expenditures             $0             $0          $0      $0
 Insurance Trust Expend            $1,313         $1,313          $0      $0


                        Source:
                            Bureau of the Census
                            Census of Governments, Finance File B, 1987
```

Downloading Database and Output Data

Instead of looking at data on your terminal, you may download the data to view on your micro-computer.

Using Communications Software: The "Capture" Command

You may use the "capture" feature, available in most communications software. This is the easiest option. This feature enables the analyst to transfer what is being seen on the screen directly into a file on a personal micro-computer. Consult your communications software user's manual for the best method of downloading.

Using the Mainframe: Saving Output Into a File

A downloading alternative is to save the EIFS database and output data into a file on the mainframe (OSIRIS) where EIFS resides in order to download it to a PC. Once saved, download the file using the communications software package.

To save EIFS output in a file, select the option from any EIFS menu and follow it with `> filename` to tell EIFS to save that data in a file named filename. Once at the Economic Data menu, enter:

```
1 > censgov      or, from any menu:      e1 > censgov
```

This will put the data from profile e1 into a file named censgov. Any questions the profile needs to ask will show up on the screen, but the rest of the data will be put into the censgov file and will NOT show up on the screen; ALL OTHER OUTPUT WILL GO INTO THE FILE THE USER DESIGNATES. When quitting the profile, a message will remind the user of the created file. To add the output to an already existing file, enter the profile followed by `>> filename` (e.g., `e2 >> filename`).

Saving Output Into a Spreadsheet File

Many users download EIFS data in order to "import", or transfer, that data into spreadsheet programs. Programs requiring labels to be surrounded by quotes will benefit from the EIFS spreadsheet options (available in designated EIFS data profiles) or from an Osiris utility (format 123) which will do much of the formatting for the user. When creating a formatted spreadsheet file from one of the profiles with that option, download that file directly. For files saved using the `> filename` redirection command, use format 123 to create a second file which will be a formatted version of the original. In the case of the censgov file created above, entering:

```
format123 censgov.prn
```

This will create censgov.prn which is the file to download. Once the file has been downloaded and imported to a spreadsheet program, some editing may be necessary to change some column widths and labels.

After successfully downloading the file to a PC, use the UNIX rm command to remove the files you have just created in Osiris to avoid clutter. Using the above example type:

```
rm censgov censgov.prn
```

Database Updates

EIFS provides an analyst with data update information when he/she first logs into EIFS. More update information is available by entering 6 from the main menu. This menu item is labeled: Database Information - including upgrade schedules.

Most data are aggregated at the county level. The profile menus let you know what data are aggregated at the sub-county level. These are the data labeled: Consumer Spending Patterns and Demographic Update and STF3A; the menu lists them as d3 and d4 and d6. A few profiles only show state-level; these are on the x menu. Data now used and the update schedule are shown in Table 9.

Table 9

EIFS Database Sources and Update Schedule

Source File	Data Years Currently in EIFS	Frequency Publ/Purch	UPDATE Last Purch	Next Avail
U.S. Bureau of the Census:				
Population and Housing (STF1A)	1970,80 ++	10 / 10	1992	2001
Population and Housing (STF1C)	1990	10 / 10	1992	2001
Population and Housing (STF3A)	1980 ++	10 / 10	1982	93
Master Area Reference File	1980	10 / 10	198?	91
Government Finance	1987	5 / 5	1993	97
Wholesale Trade	1987	5 / 5	1993	97
Retail Trade	1987	5 / 5	1993	97
Service Industries	1987	5 / 5	1993	97
Manufactures	1987	5 / 5	1993	97
Agriculture	1982 **	5 / 5	1993	93
County Population Estimates	1970,80,82,84	? / 2	1989	91
U.S. Bureau of Economic Analysis				
Employment	1969-90	1 / 1	1992	93
Earnings	1969-90	1 / 1	1992	93
Farm Income and Expenditures	1969-90	1 / 1	1992	93
Transfer Payments	1969-90	1 / 1	1992	93
Commuters' Income	1980 **	? / 10	1992	2002
Regional OBERS Projections (selected states, only)	1969,73,78,83, 90,95,2000,05, 15,35 ##	? / 5	?	?
U.S. Bureau of Labor Statistics:				
Workforce & Unemployment (#1)	1/88-6/90	1 / 1	11/90	91
National Planning Data Corporation:				
Population, Households, Income(#2)	1960,70,80,91,96	1 / 5	11/91	91
Enhanced County Business Patterns	1982,87,90	1 / 1	9/93	94
Consumer Spending Patterns (#3)	1989	-	9/89	-

** data is currently being added for 1987 or 1990
data is here for the whole country, and will be up soon.
++ subcounty STF1A data will be added, and 1980 subcounty STF3A will be deleted.
#1 BLS Data is available monthly. We purchase it yearly. We do not keep older data, as BLS "Benchmarks" are revised yearly, making timeseries comparisons invalid.
#2 This sub-county data is only updated every 5 years because of costs.
#3 The Consumer Spending Patterns was a special purchase. It is not currently scheduled for update.
County Business Patterns is available for the "Forecast Models" Base year (currently 1987) and for the most current year. We do not keep more years because of limitations on computer disk space.

For further information regarding EIFS database updates, contact the ETIS Support Office.

8 AIR FORCE REGION OF INFLUENCE MODEL (AFROI)

This chapter provides information on how to use the AFROI model. AFROI identifies geographic areas that would undergo significant economic impacts following a realignment action. This model helps define Regions of Influence (ROIs) for evaluating economic impacts of military programs and actions (including those outside the AF).

The AFROI method is an extension of the economic base analysis that EIFS is based on, incorporating a spatial interaction component to distribute employment and income impacts in a region. The AFROI Model also uses a statistical procedure for identifying the affected counties.

For instructions on the mechanics of how to enter and run AFROI, refer to the AFROI section of Appendix A. For more detailed instructions and information regarding the AFROI, please refer to the *Air Force Region of Influence Model (AFROI) User Manual* mentioned in Appendix C (Bloomquist et al. 1987).

Description of the Model

AFROI uses a modified economic base model which incorporates a gravity potential sub-model to determine the spatial distribution of direct expenditures generated by an activity. The primary steps carried out internally by the model are summarized here.

Step 1

The user selects a boundary region that encompasses most of the direct and indirect impacts from an action. The boundary region may be defined as the BEA economic area surrounding the installation or alternatively, a maximum commuting distance.

Step 2

The model calculates the change in direct expenditures from four sources: employees' wages and salaries, procurements, construction expenditures, and other programs.

Step 3

A generalized gravity-potential model underlies the entire ROI definition process. First, a gravity model estimates the initial distribution of direct expenditures from a military activity when actual data on the place of residence of employees and location of vendors or expenditure is not available. Second, the gravity model assesses how trading activity diffuses these direct expenditures to other counties in the boundary region. AFROI then uses a variant of the basic gravity model to determine indirect employment and income impacts by place of residence.

Step 4

Both place of work and place of residence impacts are estimated for total employment and income for each county. These impacts are adjusted, as necessary, to reflect total impacts for the entire boundary region. The additional impacts, if any, are distributed among all counties in proportion to the impacts already estimated for each county.

Step 5

Finally, AFROI uses a statistical test to determine which counties qualify for inclusion in the ROI or Area of Interest (AOI). The approach taken compares forecasted employment and income in each county (assuming no change in status of the installation) to the level of activity anticipated with the action. If the change due to the action falls outside a user-specified confidence interval, the county is included in the ROI or AOI.

Description of AFROI Options

Once inside, the initial prompt is "AFROI—Which option?" If the analyst chooses to see the menu, the following information will be printed out:

```
AFROI -- Which option? (Press RETURN for menu):

 TYPE:              TO:
   1 or print        Print a copy of the inputs questionnaire

Data-Related Commands
   2 or list         List existing data files
   3 or load         Load inputs from a data file
   4 or see          See the inputs you have loaded
   5 or eifsdata     How to load many AFROI inputs using EIFS
   6 or enter        Enter inputs
   7 or append       Append county inputs
   8 or delete       Delete county inputs
   9 or edit         Examine/Change inputs
  10 or save         Save inputs in a file
  11 or rm           Remove a data file

Model-Related Commands
  12 or run          Run the impacts estimation model
  13 or calibrate    Calibrate gravity model exponent

 ?opt                Get help on a menu option
 (q)uit              Exit program
```

Each option is described below. Additional information may be acquired from AFROI directly by typing "?" followed by the number of the option of interest.

Option 1—Print a Copy of the Input Questionnaire

By typing a number "1" the input questionnaire will appear on the screen. This is a listing of all the inputs required to run the ROI model. A hard copy printout of the input questionnaire can facilitate data collection and entry.

Option 2—List Existing Data Files

Once the user has entered data and begins to exit AFROI, the model gives the option of saving the data under a user-chosen file name. Upon reentering AFROI, the user may request Option 2 to obtain a listing of the files, and the times they were last modified or accessed. For example:

```
file name        last modified          last accessed
chanute          Feb 28 23:46 1985      Mar 4 22:07 1985
mthome           Mar 1 16:51 1985       Mar 1 16:51 1985
sample           Feb 8 22:16 1985       Feb 27 15:49 1985

3 file(s) total
```

Option 3—Load Inputs from a Data File

To review, modify, or otherwise use a data file first load it into the work area. Under option 3, the program will ask, `Which file?` Entering the name of the file causes the program to load the file contents into the work area. Any data previously contained in the work area will be destroyed. Pressing "RETURN" will abort the process and return the user to the main menu.

Option 4—View Loaded Inputs

After loading a file (see Option 3), it is possible to obtain a listing of all data in the work area or to create a file in the directory outside AFROI. The program will print the following message:

`Output file name?` (Type `RETURN` to print to a terminal)

By pressing "RETURN" the contents of the work space will be printed out on a user's terminal. By typing in the name of a file, the contents of the work space will be duplicated and placed in a file in the user's directory. This is useful for storing a copy of the file and transferring or modifying it outside of AFROI. Refer to a UNIX handbook for more information on these capabilities.

Option 5—Load AFROI Inputs Using EIFS

Much of the data required to run AFROI is available in EIFS and can be automatically transferred from EIFS to the work space. Option 5 prints out a message that describes which data is available in EIFS and how to effect its transfer. This is described later under "Retrieve EIFS Data."

Option 6—Enter Inputs

This option is used to enter inputs from a terminal. Upon requesting Option 6 (or enter) the following prompt (and menu by hitting RETURN) is given:

```
Enter data for which section? (Type RETURN for menu):
Type:            To Enter:
1       Regional Inputs
2       System Parameters
3       County Inputs
-       quit
```

The inputs for any section (or individual county) may be entered by typing the appropriate number command. The program will print a message identifying each variable and its current value in brackets

"[ ]." To leave this value unchanged, type RETURN. Otherwise, enter the new value. Type a dash "-" to exit this option.

Option 7—Append County Inputs

New counties may be added to an existing data file using this option. For example, it may be of interest to explore how other counties affect the distribution of employment and income impacts in an area. This option permits these data to be added easily to an existing file. Once the new county(ies) is (are) added, the user must adjust the regional inputs to reflect the enlarged area. In most cases, this means merely recalculating the employment and income multipliers for the boundary region.

When option 7 is requested the user is given the prompt:

```
Append which file?
```

After typing the name of an existing file (hitting RETURN aborts this option) the county inputs currently in the work space are appended to the named file. This file is then automatically loaded into the work space with the added county inputs. No check is made for counties entered more than once. Counties entered more than once must be removed (Option 8).

Option 8—Delete Inputs for a County

This option deletes inputs for a single county. Type the number (or name) of the county to be deleted from the work area when the program prompts with `Delete which county?` When done, the program prints the message: `(name) deleted` and returns to the main menu.

Option 9—Examine/Modify All Inputs

Option 9 allows the modification of data currently in the work area. Data inputs are grouped by section. Requesting Option 9 prompts this menu:

```
Type:  For:
  1      Regional Inputs
  2      System Parameters
  3      County Inputs

  -      Return to main menu

Edit which section?
```

Each of these sections contains a menu of entries. These are as follows:

```
Type:  For:
  1      Project name
  2      County where base or action is located
  3      Year of completion of action
  4      Regional employment multiplier
  5      Regional income multiplier
  6      Total number of affected personnel
  7      Number of affected personnel by class
  8      Average wages of affected personnel
  9      Dollar amount change in regional AF expenditures

  -      to quit editing "Regional Inputs"
```

Section 2 System Parameter

```
Type:  For:
  1      Working dependents full time equivalency factor
  2      Fraction of working dependents
  3      Fraction of AF employees living on-base
  4      Fraction of income spent in boundary region (both on and off-base)
  5      Fraction of income spent off-base by persons living off-base
  6      Fraction of income spent off-base by persons living on-base
  7      Fraction of construction expenditures for labor & materials
  8      Fraction of contracted service expenditures for labor & materials
  9      Fraction of BX sales from local suppliers
 10      Gravity model exponent
 11      Forecast confidence level
 12      CPI price deflators

  -      to quit editing "System Parameters"
```

Section 3 County Inputs

```
Type:  For:
  1      County name
  2      Total population
  3      Employment multiplier
  4      Income multiplier
  5      Number of affected personnel by class
  6      Dollar amount change in expenditures
  7      Trade and service employment
  8      Trade and service sales per worker
  9      Trade and service income per worker
 10      Service income per worker
 11      Construction income per worker
 12      Distance from installation to county
 13      Inter-county distances
 14      BEA employment by place of work
 15      BEA total income by place of work
 16      BEA net income by place of residence

  -      to quit editing "County Inputs"
```

When an entry is selected, the existing values are printed followed by the question:

```
Do you want to change anything?  [No]
```

A response of no, n, or hitting RETURN will leave the value unchanged and return the user to the entry selection prompt. Answering in the affirmative will cause the program to prompt for new values for each entry item.

The inputs may be examined in any order. However, changes made in one section may require changes in other sections. For example, changing the number of military personnel in one county may necessitate changing the total number of military and civilian personnel at the boundary region level. The program checks for these possible inconsistencies prior to calculating impacts and reports likely errors.

Option 10—Save Inputs in a File

Store your inputs in a file using this option. The program will ask:

```
Save file name?
```

Typing RETURN will abort the process and revert to the main menu. If the name of an existing file is typed, the program will warn:

```
That file already exists.
Do you really want to over-write it?  [No]
```

Typing RETURN (or no) prevents the file from being overwritten. A response of y or yes overwrites the field with the current contents of the work area. File names consist of 1 to 12 letters, digits, and some punctuation marks; it is recommended that punctuation be limited to periods, commas, colons, dashes, sharps (#), pluses (+), and parentheses. Spaces between letters are discouraged. Once the program

determines the name of the file in which the inputs are to be stored, the contents of the work area are written to the file, and the program returns to the main menu.

Option 11—Remove a Data File

Remove old data files using this option. The program asks:

```
Remove which file?
```

Typing the name of a file that does not exist prompts the program to print the message:

```
filename: can't access file.
Try again or type RETURN to abort.
```

Otherwise, if the file is found it is removed silently and the user is returned to the main menu.

CAUTION: Once a file is removed it is gone forever. Therefore, make sure the file is no longer needed before removing it.

Option 12—Run the Impacts Estimation Model

This option will execute the impacts estimation model on the set of inputs currently loaded in the work area. First specify if the action represents an increase or decrease in activity (This identifies the estimated impacts as positive or negative values). Indicate a decrease to determine the ROI. To specify the type of action, type a 0 or 1 (whichever is appropriate) to the following prompt:

```
Type '1' if action represents an increase in activity '0' otherwise:
```

If the county distribution of employee places of residence or base expenditures has not been specified, AFROI can be requested to do this. The program will give the prompt:

```
Do you want AFROI to allocate any unassigned employees or expenditures?
[Yes]
```

A response of y or RETURN will cause the program to automatically distribute any employees and/or expenditures that the user has not allocated to a specific county, and prints both the variable name and amount allocated. A response of n or no to the above question indicates a wish to manually specify the geographic distribution of these variables. If any variable is not completely allocated, the program will print a message identifying the variable and the amount not allocated, and will abort the run. Modifications to the input data can be made with Options 6 or 9.

When the input data set is complete, the model will run and print the message:

```
Doing calculations.  One moment please ...
```

The time required to complete a run will depend on the current system activity and the number of counties that make up the boundary region for the study. For studies with 10 or fewer counties and low system activity, AFROI should finish almost immediately. For boundary regions having more counties or when the program is used at times when user demand on the computer is heaviest, (9:00 a.m. to 4:00 p.m. Central) a run will require more time. However, for most runs, elapsed time should not exceed 30 seconds.

When finished, the program will print the message:

Type:	To Display:
1	Inputs
2	Outputs in table form
3	Time-series plots of significance of impact
-	Return to main menu

Which Option?

Menu Item 1

Typing "1" will yield the following message from the computer:

Output file name? (Type RETURN to print to terminal)

Inputs will be saved in the file the user designates (or printed on the terminal by hitting RETURN). This file is created in the current working directory.

After a file (or terminal) is specified, the user is presented with the next prompt:

Type:	For:
1	Regional inputs
2	System parameters
3	County inputs
*	All inputs
-	quit

Inputs you want to see or print to file?

Menu Item 2

Typing "2" will yield the following message:

Specify the output table(s) you wish to print
(Type RETURN for menu):

Hitting RETURN prints the menu:

Table:	Title:
1	Place of Residence of Base Personnel
2	Initial Distribution of Base Contracting Expenditures
3	Initial Distribution of Construction Expenditures

```
4       Initial Distribution of Other Expenditures

5       Change in Sales Volume, Employment, and Income

6       Change in Employment and Income by Place of Residence

7       Significance of Place of Work Impacts

8       Significance of Place of Residence Impacts

9       Installation-Specific Multipliers for Place of Work
        Impacts

10      Installation-Specific Multipliers for Place of
Residence Impacts

*           All tables

-           quit

Specify the table(s) you wish to print

(Type RETURN for Menu)
```

Again, any single table (or all tables) may be printed. Tables 7 and 8 of this menu will identify the counties in the ROI and AOI. After a table number is specified, AFROI will ask whether the output is to be placed in a file or printed on the terminal. Typing a dash "-" exits the print tables menu.

Menu Item 3

Typing "3" will yield the following prompt:

```
Type:       To Plot:

1       Employment by place of work

2       Income by place of work

3       Income by place of residence

-       quit

Plot which variable?
```

Through this menu the user can graphically display a regression plot, confidence bands and calculated impacts (employment or income) for a single county. This procedure may be repeated as often as desired by selecting the desired plot from the menu.

Option 13—Calibrate Gravity Model Exponent

This option is used to calibrate the gravity model exponent used in the ROI definition model. The user can use either the default exponent or can use option 13 to verify its appropriateness and/or identify a new exponent. The procedure adjusts the friction of distance exponent up or down to maximize total interaction in the region subject to constraints on both mean journey-to-work trip length and the "attractiveness" of competing destinations.

Inputs include:

- Total population—Used to measure the relative attractiveness of each county in the boundary region (supplied by program)

- Inter-county distances—Supplied by program

- An average trip length for the journey-to-work—If the place of residence of military employees is known, an average trip length is calculated for the region given the above information. Otherwise, the user must specify this item. The average length of journey-to-work trips for employees living off base was calculated from one source (Gunther 1982) to be approximately 9.5 mi. Typical values range from 6 to 15 mi.

How To Use AFROI

There are five steps in using AFROI:

Step 1—Collect Data

Data to run AFROI comes from three sources: EIFS, AFROI, and information collected in the field. The data parameters and sources are described in detail later in this chapter.

Much of the data is maintained in EIFS and can be acquired in the manner described in Option 5 of AFROI (see Step 3). Other inputs (such as the System Parameters described later) have been developed from AF surveys (Gunther 1982) and are housed in AFROI. These values can be accepted or overridden if better information is available (see Step 4).

The third category of data must be gathered by the user and manually entered via the interactive keyboard. The data should be obtained from the primary sources and entered on a hard copy of the data questionnaire (see Option 1 of AFROI). The data tables provide a useful format for organizing the county and regional inputs that are specific to the installation or action. The information required for the data tables should be available in the Environmental Impact Statement (EIS) that is prepared annually at major installations. After completion of the tables, transfer the data onto the data questionnaire with the other field information. The data questionnaire lists the information in the order in which it is to be entered into the program. Use it to facilitate data entry.

Step 2—Identify Boundary Region

The boundary region is the geo-economic unit in which the installation or activity being analyzed is located. This area is analyzed to determine the amount of county-specific socioeconomic change. The ROI and AOI will be subsets of the boundary region. Thus, the boundary region should include all counties that may potentially have significant economic interaction with the installation. Because the model considers the economic interaction between counties, the boundary region should be an economic unit with an important trade and service center.

The BEA region in which the base is located is recommended for use as the boundary region. If the base is on the fringe of a BEA region, the adjoining region(s) should also be included. A list of BEA regions and their constituent counties is available in EIFS by entering `?beas` after the prompt, `First county or region`. If the name of the BEA region is entered after the `First county or`

region prompt, the program will print a list of the counties in the BEA region, their population and areas.

For an existing activity, the field data will identify the counties affected by military payroll, construction, procurement, and other expenditures. Each county where this spending is not trivial should be included in the boundary region. This may necessitate the inclusion of counties and regions outside or perhaps noncontiguous with the BEA region of installation. For example, in Fiscal Year (FY)84, Robins Air Force Base (AFB), which is located in the Macon, GA, BEA region, had over $100 million in contracts 100 mi away in Atlanta, which is in the Atlanta, GA, BEA region. In this case, the boundary region should be comprised of both BEA regions.

Step 3—Enter Data

One way to enter the data is to first enter EIFS and transfer the data to AFROI. This will create data sets for each county. First, enter EIFS. Select the appropriate BEA regions or counties. Specify Profile x4 by typing "x4 by county." The program responds by listing the counties in the boundary region and their respective multipliers. Manually copy the multipliers on the input questionnaire or extracted in hard copy from the system. Later, enter them manually into AFROI via Option 6 or 9.

Next, enter the multipliers by specifying Option 9; then, Section 3, County Inputs; then, entry 3, Employment Multiplier. At this point, the program will prompt: "Which county (type RETURN for list):" By responding with a "*", the program will go through each county, allowing the user to enter the employment multipliers gathered. The same procedure should be used for entry 4, Income Multiplier.

Next, the user may modify or update the EIFS data using Option 9. For example, EIFS contains the most recent (1987) BEA estimate of county population; this can be updated if more current information is available. Similarly, the time series for county income and employment can be augmented with information for the most current years.

Finally, enter the questionnaire data. The information collected and manually entered into the questionnaire (see Step 1) should be entered via the interactive keyboard and Options 6 and 9.

Step 4—Confirm AFROI System Parameters

The values for several parameters have been preset. Review these to verify their appropriateness to the case being analyzed. Changes will not usually be necessary, except to Entry 3 (fraction of personnel living on base). Within Options 6 and 9, Section 2, there are 12 categories of entries. Entries 1 through 9 were developed from AF surveys of selected bases. Entry 9, the fraction of BX sales entering the local economy, is set at 5 percent and is a rough estimate. Entry 10, the gravity model exponent, is set at 2.00. It can be modified in accordance with Option 13. Entry 11, the forecast confidence level, defines the threshold at which a county is recommended for inclusion in the ROI or AOI. (Refer to Section 2 for more discussion). The confidence level is set at 90 percent. The threshold may be lowered by decreasing the confidence level. Entry 12 contains the CPI price deflators that are used to adjust all dollar figures to constant dollars. The price deflators will be updated periodically by USACERL, but can be modified by the user.

The menu within Option 9, Section 2 identifies the 12 entries. By typing the appropriate entry number, the user gains direct access to the entry of interest. The program will display the preset value and ask the user if it is to be changed. After responding in the affirmative, the new value can be entered. Changes can also be made using Option 6.

Step 5—Run AFROI

Option 12 is used to run AFROI. The tabular and graphic outputs of the program are described in detail later. The outputs are designed to provide several tools for analyzing and displaying the output. The counties recommended for inclusion in the ROI or AOI are identified with an "*" in tables 7 and 8 (generated and shown in the program).

Step 6—Obtain AFROI Maps

Computer generated maps depicting the ROI and AOI counties and other pertinent AFROI findings can be developed outside ETIS. This step is optional but highly recommended.

AFROI Inputs

The following describes each of the AFROI parameters in the order in which they appear on the data questionnaire and are entered into the program. The name of each parameter is followed by a brief description, a discussion of issues that are important to selecting the proper value for the parameters, and sources for each variable. The sources include EIFS, AFROI, and a variety of primary sources.

Regional Impacts

The regional inputs describe the total and regional (in the case of nonservice contracting) direct economic impact of the installation or activity. All of this data is to be collected in the field or from site-specific documents. The only exceptions are the regional multipliers which pertain to the boundary region and are found in the EIFS database.

Project. This is the project name. The project name should clearly describe the nature of the analysis, such as Tinker AFB ROI or Mountain Home AFB OTH-B Radar AOI. The project name will appear in the title of the AFROI output.

County Where Base or Activity is Located. Some bases or activities are located in more than one county. Only one county should be selected for this entry and it should reflect the place where the bulk of the economic activity occurs. If the activity is geographically separated, it may be necessary to develop AOIs for each center of activity.

Year of Completion of Action. AFROI forecasts employment, income, and sales volume of the year in which the action is completed—the significance of impacts will be determined for that year.

Regional Employment Multiplier. The regional employment multiplier relates a change in basic employment (employment in the basic sector generated by export industries) to the total change in employment in the boundary region. EIFS automatically transfers this to AFROI.

Regional Income Multiplier. The regional income multiplier relates a change in basic income to the total change in income in the boundary region. EIFS automatically transfers this to AFROI.

Total Number of Affected Personnel. The affected personnel are those directly affected by the action. The total number of affected personnel is the summation of the classes of personnel listed in the following sections. When identifying an ROI, this is equal to all persons assigned to the base. For an AOI, it is only the people affected by the activity under consideration. If there are personnel affected by the action that do not fall into the classifications provided, they should be combined with the most appro-

priate category. For example: foreign or non-AF military that are affected should be included in one of the two military categories. If there is a significant number of civilian contractors associated with the installation (e.g., on-site contractors working on the Space Shuttle Program at Vandenberg), they should be included in the Civil Service category.

Number of Affected Personnel: Permanent Military. Military permanent party are military personnel assigned to the installation for purposes other than to receive training.

Number of Affected Personnel: Military Trainees. Military trainees are personnel located at an installation to receive training.

Number of Affected Personnel: Civil Service. Civil service personnel are Federal employees working for the AF whose salary and wages are paid from Congressional appropriations.

Number of Affected Personnel: Nonappropriated Fund (NAF). NAF personnel support Morale, Welfare, and Recreation (MWR) activities and are paid from the operating revenues of those activities rather than through Congressional appropriations. Many NAF personnel work part time and some are military dependents.

Number of Affected Personnel: Base Exchange (BX). The BX system is an independent entity that serves Army and AF installations and pays its employees from operating revenues. Like NAF employees, many BX employees work part time and are military dependents.

Average Wages of Affected Personnel. The average wage is the total annual payroll for each of the categories of personnel divided by the average annual number of personnel in that classification. Payroll is defined as gross income, which is pay before deductions for income tax withholding and social security tax, but does not include retirement and other benefits that are not received directly by the payee. The permanent duty station of trainees will vary according to the length of stay at the installation where they are receiving training. If the training period is to exceed 6 months, trainees will be assigned to the training base. Otherwise, they will be on temporary additional duty (TDY) status, and their permanent duty station will be other than the training base. This can complicate gathering data on payroll because trainees on TDY will be paid by their home bases and records at the training base may not reflect this transaction. If this applies, the payroll for all trainees is estimated by applying the average pay for non-TDY trainees to the TDY trainees.

Nearly all major installations have USACE representatives to administrate the Military Construction Program (MCP). Some bases, particularly those with training activities, have contingents from the other services and foreign countries. In some cases, payroll for military branches other than the AF is handled by the host installation. Care must be taken to identify the entities that distribute payroll for non-AF military. Include the payroll for these individuals with the appropriate category of military personnel.

Dollar Amount Change in Regional Military Expenditures. This is the total annual change in expenditures due to the action. When identifying an ROI, the change is equal to the total annual amount of expenditures in the region at an installation under normal operating conditions. For the AOI, the annual change is that which is associated with the action itself. If the action occurs over a period in excess of one year, the inputs should be put in annual terms. For a major new program, it may be desirable to determine the AOI for the year in which the maximum amount of construction occurs and a separate AOI for a post-construction normal state of operation. Similarly, for a personnel realignment use the year in which the maximum amount of change will occur.

Dollar Change; Base Contracting (Services). This category is the dollar-amount change in contracts for services (rather than goods) that are provided locally. Service contracts are distinguished by the high labor component. Major service contracts typically include janitorial, grounds maintenance, and food services. Construction services should be included under construction, not services. The total amount of service contracts, regardless of the location of the vendor, should be used. In addition to service contracts, this category can include expenditures in the local economy by personnel on TDY when deemed significant and not included in other model parameters.

Dollar Change; Base Contracting (Total). Total contracting is the dollar amount change in all service (see above) and nonservice contracts such as supplies, equipment, utilities, and transportation. The dollar change in nonservice base contracting should include only the change expected to occur in the boundary region. This is achieved by including only vendors located in the boundary region.

Dollar Change, Military Construction Program. MCP includes large scale (usually over $500,000) construction for mission support. The MCP is administered by USACE. Each construction project must receive Congressional approval and appropriations. MCP expenditures may vary radically from year to year. Therefore, when identifying the ROI for a base, use an amount for MCP that reflects the anticipated level of expenditures based on program estimates and historic (5 year) spending levels. When identifying an AOI, use the engineering cost estimates for the MCP portion of the job. The dollar change in contracting should equal the total change regardless of location of contractor.

Dollar Change, Operations and Maintenance (O&M) Contract Construction. O&M construction includes minor repairs, modifications, and maintenance. O&M construction is funded at the base level and the amount expended remains relatively constant compared with other construction programs.

Dollar Change Nonappropriated Fund (NAF) Construction. NAF construction includes new construction, repairs, and modifications of NAF facilities. Funds are obtained from the proceeds of NAF activities. NAF expenditures may vary radically from year to year. Therefore, estimate spending using the methods suggested for MCP.

Dollar Change, Military Family Housing (MFH) Construction. MFH construction includes projects to renovate or upgrade military family housing (the construction of new housing is usually administered by the MCP). Spending for MFH can also vary considerably from year to year. Therefore, estimate MFH expenditures using the methods suggested for MCP.

Dollar Change, Other Construction. Other construction activities are carried out as part of special programs such as the Space Shuttle and Over the Horizon Radar. Usually these programs are funded and administered by outside sources not associated with the host base. However, the conventional construction portion of such programs may be conducted through the MCP and therefore should be included in the MCP onbase category. These are typically one time programs with the bulk of funds expended over a defined time period.

Dollar Change, PL 81-874, Public School Program. Payments to school districts are comprised of Public Law 81-874 funds provided to public schools. Most public school districts derive a significant proportion of their revenues from property taxes. Because Federal facilities are not subject to local property taxes, PL 81-874 funds are provided to public school systems, based on average daily attendance. Total funds equals the summation of funds received by each eligible district. Where a district serves more than one military facility, take care to estimate the funds attributable to the installation of interest.

Dollar Change, CHAMPUS and Supplemental/Cooperative Care. These categories include payments to physicians and medical facilities through the Civilian Health and Medical Program of the Uniformed

Services (CHAMPUS) and the Supplemental/Cooperative Care programs. These programs permit active duty military, military retirees, and dependents to seek medical care when the required services are not available from a military medical facility or when travel to that facility creates a hardship. The precise geographic distribution of these expenditures is generally unavailable. Therefore, the distribution should be estimated based on the location of major medical facilities.

Education Programs. These programs are comprised of expenditures by the Federal government to defray the tuition expense of military personnel attending private educational institutions. The location of tuition expenditures should be estimated. Tuition of national schools that provide instruction on base should be attributed to the place of instruction. Assistance payments for local schools and colleges should be attributed to the location of the institution.

System Parameters

Working Dependents Full-Time Equivalency Factor. This factor describes the average amount of time spent on the job by dependents of military employees. The default value is 0.5 or half time.

Fraction of Working Dependents. The fraction of working dependents is that fraction of military dependents that are employed. The default values by category of military employee are as follows: permanent military, 0.25; military trainee, 0.25; civil service, 0.37; and NAF and BX, 0.37.

Fraction of Employees Living On Base. This is the fraction of military employees by category that reside in base housing. This fraction can vary considerably from base to base because it is a function of the number of military, the number of civilians, and the amount of occupied base family and bachelor housing units. There are two approaches to identifying the fraction. The preferred approach is to derive the fraction by dividing the number of personnel in each category living on base by the total number of employees in the respective category. If data is lacking, it may be necessary to estimate the fraction of civil service and NAF/BX employees living on base. Both of the following methods should be used and the results compared to judge which is most applicable.

Fraction of Civil Service Living On Base =

$$\frac{\text{(Total No. of Military Living On Base) x (0.038)}}{\text{(Total No. of Civil Service)}} \qquad \text{[Eq 16]}$$

Fraction of NAF/BX Living On Base =

$$\frac{\text{(Total No. of Military Living On Base) x (0.025)}}{\text{(Total No. of NAF/BX)}} \qquad \text{[Eq 17]}$$

and

Fraction of Civil Service Living On Base =

$$\text{(Total No. of Civil Service) x (0.047)} \qquad \text{[Eq 18]}$$

Fraction of Military Living On Base =

$$\text{(Total No. of NAF/BX) x (0.158)} \qquad \text{[Eq 19]}$$

Fraction of Income Spent in Boundary Region. This is the fraction of disposable income that is initially spent by military personnel in the boundary region. The default values by category of personnel are: permanent military, 0.677; military trainee, 0.582; civil service, 0.671; and NAF/BX, 0.815.

Fraction of Income Spent Off Base by Persons Living Off Base. This is the fraction of disposable income spent off base by military personnel and their dependents living off base. The default values by category of personnel are: permanent military, 0.491; military trainee, 0.378; civil service, 0.618; and NAF/BX 0.693.

Fraction of Income Spent Off Base by Persons Living On Base. This is the fraction of disposable income spent off base by military personnel and their dependents living on base. The default values by category of personnel are: permanent military, 0.491; military trainee, 0.378; civil service, 0.618; and NAF/BX, 0.693.

Fraction of Construction Expenditures for Materials and Labor. These factors describe the average fraction of construction contract amount spent by the contractor for materials and labor. The default values are materials, 0.60 and labor, 0.384.

Fraction of Contracted Service Expenditures for Materials and Labor. These factors describe the average fraction of contracted service that is spent by the contractor for materials and labor. The default values are materials, 0.183; and labor, 0.524.

Fraction of BX Sales from Local Suppliers. This describes the amount of purchases by the BX in the ROI as a fraction of BX gross sales. The default is 0.05, a rough estimate based on anecdotal information (Pierce 1985 and 1986).

Gravity Model Exponent. This is the exponent for the gravity model within AFROI that is used to geographically distribute employment and spending. In most cases, the exponent will equal the default value of 2.00. This can be verified using Option 13.

Forecast Confidence Level. The forecast confidence level is the level of confidence expressed in the percent that a given forecasted value will fall within a standard deviation of the projected value. The default confidence level is 90 percent. This default value is typical for statistical analysis and its use in field tests of AFROI has produced reasonable results.

CPI Price Deflators. The CPI price deflator is the ratio of the costs of a given set of goods referenced against a base year. The CPI price deflator is used to convert income and expenditures to a common base, thus isolating the effects of inflation. The price deflators in AFROI will be updated by USACERL periodically. The CPI indices can be replaced by others as appropriate. For example, if an activity primarily involves construction, the most current construction cost index could be used.

County Inputs

County inputs are county-specific information that should be entered for each county in the boundary region. Much of the general county information is available in EIFS (see Option 5) and the information about the base or action should be collected and entered by the user.

Population for County. Enter the total population in the county.

Employment Multiplier for County. The county employment multiplier relates a change in basic employment to the total change in employment in the county. EIFS data manually transfers this to AFROI.

Income Multipliers for County. The county income multiplier relates a change in basic income to the change in total income in the county. EIFS data manually transfers this to AFROI.

Number of Affected Personnel By Class in County. If there are no persons within a particular class living in the county, enter zero.

Changes in Expenditure for County. If there are no expenditures within a particular category, enter zero.

Trade and Service Employment in County. This is the employment within the trade and service sectors of the economy of the county.

Trade and Service Sales per Worker in County. This is the average gross sales per worker in the trade and service sectors. Sales per worker is calculated by dividing total sales by total number of workers in the trade and service sectors.

Trade and Service Income per Worker in County. This is the average income per worker in the trade or service sector in the county. Income per worker is calculated by dividing total income in both the service and trade sectors by the total number of workers in those sectors.

Service Income per Worker in County. This is the average income per worker in the service sector only in the county. Income per worker is calculated by dividing total income in the service sector by the total number of workers in the service sector.

Construction Income per Worker in County. This is the average income per worker in the construction sector in the county. Income per worker is calculated by dividing total income in the construction sector by the total number of workers in the sector.

Distance from Installation to County. This is the road distance in miles from the population center of the county to the installation or center of activity being analyzed. The above description also pertains to the county in which the installation or activity is located.

Distance Between County and Other Counties in Boundary Area. This is the road distance in miles from the population center of the county being analyzed and all other counties in the boundary area. The distance between the county and itself is defined as one-half the distance to its nearest neighboring county. EIFS provides this.

BEA Employ by Place of Work for County. This is the total employment in the county. This parameter contains a time series starting in 1969. EIFS automatically provides this. The user may augment with data for the most recent years.

BEA Total Income by Place of Work for County. This is the total personal income of persons working in the county. The parameter contains a time series starting in 1969. EIFS provides this. The user may augment with data for the most recent years.

BEA Net Income by Place of Residence for County. This is the total personal income of persons residing in the county. The parameter contains a time series starting in 1969. EIFS provides this. The user may augment with data for the most recent years.

AFROI Outputs

The outputs of AFROI include a set of the inputs as well as tables of outputs that display the following: (1) geographic distribution of personnel and expenditures including those not allocated by the user to specific county, (2) the total direct and induced change in sales employment and income by county, (3) the significance of the change in employment and income by county, and (4) the Installation-specific multipliers by county. The program will also provide time series graphs of the employment and income for counties in which there will be significant change.

Place of Residence of Base Personnel

AFROI table 1 identifies by county and category of personnel where each person assigned to the base resides. The table displays the information input by the user as well as the allocation of persons whose place of residence was not identified by the user.

Initial Distribution of Expenditures

AFROI tables 2, 3, and 4 (not located in this document) identify the expenditures by county for contracting (i.e., procurement), construction, and other activities, respectively. The tables indicate the county data provided by the user and the distribution of AF expenditures that were not allocated by the user to a specific county. These tables address direct AF expenditures, not secondary effects.

Change in Employment, Income, and Sales Volume

AFROI tables 5 and 6 identify the direct and induced dollar change due to the action. Table 5 shows this change for sales volume, employment, and personal income by place of work. Table 6 shows the change in income and employment, including working dependents by county of residence.

9 SMALL AREA ASSESSMENT MODEL (SAAM)

Description of SAAM

The IWR and USACERL Small Area Assessment Model (SAAM) is an interactive, computer-based system for rapidly assessing the local area income and employment impacts associated with water resource projects. This feature is useful when assessing impacts of a project on a large metropolitan region. These regions are complex, with many activities. Breaking the area down into smaller, simpler pieces enables the user to more accurately assess the impacts. SAAM can enhance the use of EIFS by enabling the user to predict impacts more accurately than EIFS forecast models for large metropolitan regions.

This chapter describes SAAM and provides instructions on how to use it. For more comprehensive information on SAAM (technical description and example applications illustrating the use of SAAM) please refer to the *Small Area Assessment Model (SAAM): User Manual* listed in Appendix C (Bloomquist 1988).

SAAM is an interactive computer-based system for rapidly assessing the local area income and employment impacts associated with water resource projects. SAAM is a multi-region economic base model that provides a mechanism to account for inter-regional feedback effects. This feature allows for the more accurate estimation of county-level impacts that occur within a larger region. The model has been developed as a profile of EIFS, thus providing the user automatic access to county-level socioeconomic information for any region in the nation.

Although intended primarily to assess the economic impacts of USACE water resource development projects, the model's generic design allows for analysis of other types of activities as well. In this regard (as well as in regard to other aspects such as equation structure and data requirements) SAAM bears close resemblance to the EIFS forecast models.

The SAAM model estimates the local economic effects of a project or activity on three key variables: sales volume, employment, and income. These variables often indicate trends in other factors of interest in impact analysis such as local government revenues and expenditures, the local housing market, population, number of school-age children, welfare dependency, etc. While explicit consideration of these factors is beyond the scope of SAAM, it is hoped that providing estimates of the changes in sales, employment, and income will aid the analyst in gauging the relative impact of these other variables.

The total change in each of the three indicator variables is calculated as the sum of separately determined effects: the initial, direct, induced, and feedback effects. The initial, direct, and induced effects are similar to EIFS forecast models' initial, direct, and induced effects. The *initial effect* is the change in economic activity associated with the project or action (e.g., initial outlays to hire construction labor). *Direct effects* are those associated with the first round of spending. For example, if construction workers are paid a total of $1 million in wages and the average propensity to consume (APC) is 0.80, then the direct effect is equal to $1,000,000 * 0.80, or $800,000. *Induced effects* are the additional or subsequent changes in local economic activity captured by the multiplier process. For example, if the gross sales multiplier of county X equals 2.5, then the induced effect in county X from an $800,000 direct change in sales equals $800,000 * (2.5 - 1.0), or $1.2 million.

After initial, direct, and induced impacts have been estimated for each county in the study area, an adjustment is made to account for feedback effects. Feedback effects occur, for example, when two counties, i and j, export goods to each other. If an economic disturbance in county i increases the demand

for goods produced in county j, the rise in j's income may result in greater imports from i. This, in turn, leads to additional repercussions in j. Impacts from this second source are known as feedback effects.

The adjustment procedure consists of applying regional multipliers to the direct change in income and employment calculated for the entire study area and comparing these total regional changes to the sum of the individual county (total) impacts. If the former is greater, county impacts are upwardly adjusted in proportion to the impacts already calculated for each county. If the sum of the county-level impacts exceeds the total for the study area, no adjustment—either upward or downward—is made. The likelihood of this latter situation occurring is small since larger and more economically diverse regions tend to have larger multipliers. However, even when this is not the case, presenting a worst-case scenario is preferable than assuming impacts are less simply because of empirical difficulties in estimating the multipliers.

Getting Into SAAM

You will find SAAM in the `Models Profiles` (choose m) section of the EIFS Main Menu. SAAM is menu item 6. These menus are illustrated below.

```
                Models Profiles  (m)

Type:  For EIFS Models:
  1     Forecast Models
  2     AIMS (Automated Input-Output Multiplier System)
  3     RTV (Rational Threshold Value)
  4     Forecast Significance of Impacts

Type:  For CEAS Models:
  5     AFROI (Air Force Region of Influence) Model
  6     Small Area Assessment Models (SAAM)

Type:  To:                                  Type:  For:
  -     return to EIFS main menu              ?    a list of valid responses
  f     change output Format options         ??    more detailed help
  r     Review your county list            quit    exit to EIFS

by us       is available for:  3 4
by county   is available for:  3 4 6


EIFS v5.0 (m) - What profile?  (<cr> to see list): 6
```

Once inside SAAM, the initial prompt is `SAAM-Which option?` If you choose to see the menu, the information shown below will be printed out:

```
SAAM -- Which option? (Press RETURN for menu):

 TYPE:              TO:
   1 or print        Print a copy of the inputs questionnaire
   2 or list         List existing data files
   3 or load         Load inputs from a data file
   4 or see          See the inputs you have loaded
   5 or enter        Enter inputs
   6 or edit         Edit inputs
   7 or delete       Delete county inputs
   8 or save         Save inputs in a file
   9 or rm           Remove a data file
  10 or run          Run the impacts estimation model
  11 or review       Review your county list and messages
 ?opt                Get help on a menu option
 !cmd                Escape temporarily to system level and execute cmd
   q                 Return to EIFS
  quit               Leave EIFS
```

Each of these options is described below. Additional information may be acquired from SAAM directly by typing ? followed by the number of the option of interest.

Option 1—Print a Copy of the Inputs Questionnaire

By typing a number 1, the input questionnaire will appear on the terminal screen. This a listing of all the inputs required to run the SAAM model. This listing may be useful as a shopping list when you are in the process of collecting your data, and as a data entry form when entering inputs from your terminal. A copy of this questionnaire also appears later in this chapter.

Option 2—List Existing Data Files

After entering data into SAAM, the user will probably want to save this information for future work. SAAM data files are created using menu option 8. A listing of the data files created and saved is obtained by specifying option 2 or typing `list`. An example is:

```
SAAM -- Which option? (Press RETURN for menu): 2

file name            last modified          last accessed
test            Jun 10 11:53 1993      Jun 10 11:53 1993
test2           Jun 10 11:53 1993      Jun 10 11:53 1993

2 file(s) total
```

The entries under the column labeled `file name` are the names of data files the user has created. The entries shown under the columns labeled `last modified` and `last accessed` are the times each file was last edited and last used, respectively. It is a good idea to remove files which have not been accessed for a long period of time (see option 9).

Option 3—Load Inputs From a Data File

To review, modify, or otherwise use a data file first load it into the work area. Under option 3, the program will ask, `Load which file?` Entering the name of a file causes the program to read the contents into the program's work area. Any data previously contained in the work area is overwritten. Typing `RETURN` will abort the process and return the user to the main menu.

Option 4—Review Loaded Inputs

After loading a file (see option 3), the user may obtain a listing of all data in the work area or create a file in the directory outside SAAM. The following menu is printed after specifying this option:

```
SAAM -- Which option? (Press RETURN for menu): 4

Type:  For:
  1     Regional Inputs
  2     System Parameters
  3     County Inputs

  *     All Inputs
  s     Save to file
  -     Return to main menu
```

The inputs for any section (or individual county) may be printed by typing the appropriate number command or * to print all inputs.

All inputs will be saved in a file the user designates by typing `s`. The file is created in the current working directory unless the file name begins with a / (slash), in which case it is assumed the full path name is given. This is useful for storing a copy of the inputs file and transferring or modifying it outside of SAAM. Refer to a UNIX handbook for more information on these capabilities.

Option 5—Enter Inputs

This option is used to enter inputs from a terminal. Upon requesting option 5 (or `enter`) the following prompt (and menu by hitting RETURN) is given:

```
SAAM -- Which option? (Press RETURN for menu): 5

Type:  To Enter:
  1     Regional Inputs
  2     System Parameters
  3     County Inputs

  -     Return to main menu
```

The inputs for any section (or individual county) may be entered by typing the appropriate number command. The program will print a message identifying each variable and its current value in brackets `[ ]`. To leave this value unchanged, type RETURN. Otherwise, enter the new value. Type a dash - to exit this option.

Option 6—Examine/Change Inputs

This option allows the user to modify the inputs currently in the work area. Data inputs are grouped by section. Requesting option 6 will prompt this menu response:

```
Edit which section?

Type:  For:
  1      Regional Inputs
  2      System Parameters
  3      County Inputs

  -      Return to main menu
```

Typing a - will return the user to the main menu level. Selecting one of the three sections prompts a move to the next level. Each section contains different menus of entries. However, a response of - will return the user to the `select-a-section` level.

The section menus are:

Section 1 Regional Inputs

```
Type:  For:
  1      Project name
  2      County where activity is located
  3      Regional multipliers
  4      Number of affected employees by type
  5      Average wages of affected employees
  6      Dollar amount change in regional expenditures

  -      to quit editing "Regional Inputs"
```

Section 2 System Parameters

```
Type:  For:
  1      Fraction of military personnel living on-base
  2      Average propensity to consume
  3      Price deflators
  4      Trade and service sales per worker
  5      Trade and service income per worker
  6      Construction income per worker

  -      to quit editing "System Parameters"
```

Section 3 County Inputs

```
Type:  For:
  1      County name
  2      Multipliers
  3      Number of affected employees by type
  4      Dollar amount change in expenditures
  5      Trade and service employment

  -      to quit editing "County Inputs"
```

When an entry is selected, the existing values are printed followed by the question:

```
Do you want to change anything? [No]
```

A response of no, n, or simply RETURN will leave the values unchanged and return the user to the entry selection prompt. Answering in the affirmative will cause the program to prompt the user for new values for each entry item.

The user may examine inputs in any order. However, he or she should keep in mind that changes made in one section may require changes in other sections. The program checks for these potential inconsistencies prior to calculating impacts and reports likely errors.

Option 8—Save Inputs in a File

Store your inputs in a file using this option. The program will ask:

```
Save file name?
```

Typing RETURN aborts the process and returns the user to the main menu. If the user types the name of an existing file the program will warn:

```
That file already exists.
Do you really want to over-write it?  [No]
```

Typing RETURN (or no) prevents the file from being overwritten. A response of y or yes overwrites the file with the current contents of the work area. File names consist of 1 to 12 letters, digits, and some punctuation marks; it is recommended that punctuation be limited to periods, commas, colons, dashes, sharps (#), pluses (+), and parentheses. Once the program has determined the name of the file in which the inputs are to be stored, the contents of the work area are written to the file, and the program returns to the main menu.

Option 9—Remove a Data File

Remove old data files using this option. The program asks:

```
Remove which file?
```

If the user types the name of a file that does not exist, the program prints the message:

```
filename: can't access file.
Try again or type RETURN to abort.
```

Otherwise, if the file is found it is removed silently and the user is returned to the main menu. CAUTION: Once a file is removed it is gone forever. Therefore, make sure the file is no longer needed before removing it.

Option 10—Run the Impacts Estimation Model

This option will execute the impacts estimation model on the set of inputs currently loaded in the work area. If the program detects any input data items that have suspect values, a message will be printed identifying the variable(s) and the run will be aborted. Modifications to the input data can be made using options 5 or 6.

When the input data set is complete, the model will run and print the message:

```
Doing calculations.  One moment please ...
```

The time required to complete a run will depend on current system activity and the number of counties that make up the region for the study. For studies with 10 or fewer counties and low system activity, SAAM should finish almost immediately. For regions having more counties, or when the

program is used at times when user demand on the computer is heaviest (10 a.m. to 4 p.m. Central) a run will require more time. However, for most runs, elapsed time should not exceed 30 seconds.

When finished, the program will print the menu:

```
Type:       For Outputs:

1             Aggregated

2              By County

3                   Both

s           Save to file

-    Return to main menu
```

Menu item 1 will print the total impacts for the entire study area. Specify menu item 2 to print impacts for individual counties within the study area. Menu item 3 prints both aggregated and county impacts. Typing `s` will save the aggregated and county impacts in a specified file. Typing a dash - returns the user to the SAAM main menu.

Option 11—Review the County List

Review the study area by typing `11` or `review`. This option will report the number of counties in the study area and list their names. If the data has been transferred from EIFS, this option will also report any counties that have missing data.

!—Escape Character

This option allows a user to temporarily escape from SAAM to run a system-level command. For example, to determine the present working directory type: `!pwd`

Quit—Exit Program

The user may exit SAAM at any time by typing `quit`. The program will ask:

```
Do you really want to quit? [No]
```

Typing `y` or `yes` will indicate that it is time to exit. A negative response (or RETURN) will allow the user to continue.

If changes have been made to the current set of inputs, the program will ask:

```
You have made changes to the current set of inputs.
Do you wish to save the changes you made? [Yes]
```

If the contents of the work area have already been saved in a file, typing `n` or `no` will immediately allow the user to exit the program. If, however, changes have been made that the user wants to save and had forgotten to do so, typing `y` or `RETURN` will save the work area contents in a user-designated file.

Using SAAM

Step 1–Collect Data

Obtain data used to run SAAM from three sources: EIFS, SAAM, and the field. Much of the data are available in EIFS and can be acquired in the manner described in option 5 of SAAM (see Step 3). Other inputs (e.g., average propensity to consume) have been developed from Bureau of the Census data and other sources and are preset in SAAM. These values can be accepted or overridden if better information is available (see Step 4).

Gather and manually enter the third category of data. These data relate to project-specific expenditures and labor requirements and should be obtained from primary sources and entered onto a hard copy of the data questionnaire (see option 1 of SAAM; also see sample printout below). The data questionnaire lists the information in the order in which it is to be entered into the program. Use it to facilitate data entry.

```
****************************** REGIONAL INPUTS ************************

Project: _____________________________________________

County where activity is located: _____________________________

Regional multipliers
  Employment: _____________
      Income: _____________
       Sales: _____________

Number of affected employees by type
  Military : _____________
  Civilians: _____________

Average wages of affected employees
  Military : _____________
  Civilians: _____________

Dollar amount change in regional expenditures
  Goods and Services     : _________________
  Construction Labor     : _________________
  Construction Materials: _________________

****************************** SYSTEM PARAMETERS ************************

Fraction of military personnel living on-base: ________

Average Propensity to Consume
  Civilians                    : ________
  Military (Living on-base)  : ________
  Military (Living off-base): ________
```

```
Price deflators for
  Wages and salaries: _________
  Goods and services: _________
  Construction      : _________
  Outputs           : _________

Trade and service sales per worker: _________

Trade and service income per worker: _________

Construction income per worker: _________

********************* COUNTY INPUTS for >> _____________ << *************

Multipliers for _________________
  Employment: _______
      Income: _______
       Sales: _______

Number of affected employees in _________________
  Military : ____________
  Civilians: ____________

Change in expenditures for _________________
  Goods and Services    : _________________
  Construction Labor    : _________________
  Construction Materials: _________________

Trade and service employment in _____________: _________
```

Step 2–Select Study Area

The study area should include all counties that may experience significant economic change from a project. The major sources of economic impact stem from work force consumption expenditures and project-related procurements (i.e., goods and services). This suggests that a study area should be large enough to contain the places of residence of nearly all the labor force and any important regional trade and service centers.

Often, the BEA region in which the project is located is the most appropriate selection for the study area. If the project is on the fringe of a BEA region, include the adjoining region(s). You will find a list of BEA regions and their constituent counties in EIFS.

Step 3–Enter Data

One way to enter the data is to first enter EIFS and transfer the data to SAAM as described in Steps 3a through 3e. This will create data sets for each county. Following this, the information collected in the field (Step 1) can be entered via options 5 and 8.

Step 3a, Access EIFS: Enter EIFS. Following any system messages the program will prompt:

```
First county or region (type ? for help):
```

Type in the name of the BEA region (do not forget to identify the state) and the program will prompt:

```
Next county or region (type RETURN if done):
```

Enter any other BEA region or county. Once the region has been specified the program will state `You have selected:` and will list the names of the counties and states, their 1990 population, and area in square miles. The program will then prompt:

```
EIFS v5.0 - What profile? (<cr>) to see list:
```

There are two profiles of interest: x4 which generates income and employment multipliers and m6 which transfers EIFS data to SAAM.

Step 3b, Run EIFS Profile x4: It is necessary to execute EIFS profile x4, `See the Multipliers` before running SAAM. This is so that the county-specific income and employment multipliers can be transferred automatically from EIFS to SAAM. First specify profile x4 by typing `x4 by county`. EIFS will respond by listing the counties in the study area and their respective multipliers.

Step 3c, Run EIFS Profile m6: By specifying profile m6, the program will automatically gather the data identified in option 5, transfer it to SAAM, identify data deficiencies, and move the user into the SAAM program. This will occur within seconds for study areas containing less than 15 counties.

Step 3d, Save EIFS Data: Once in SAAM, it is advisable to elect option 8 and create a file to store the EIFS data.

Step 3e, Modify EIFS Data (Optional): Although it is not necessary, the user may modify or update the EIFS data via option 6. For example, EIFS contains data on county employment in the trade and service sector taken from the Census Bureau's economic censuses. While this information is updated every 5 years, more current data from state or local sources may be substituted, if available.

Step 3f, Enter Project Data: The information that has been collected and manually entered into the questionnaire (see Step 1) should be entered from the keyboard using options 5 and 6.

Step 4–Confirm SAAM Model Parameters

The values for several parameters have been preset. These should be reviewed to verify their appropriateness to the project being analyzed. Usually changes will not be necessary, with the exception of entry 1, `fraction of military personnel living on base`. Entry 3, the CPI price deflators, are used to adjust all dollar figures to constant dollars. The price deflators will be updated periodically by USACERL, but can be modified by the user. The menu within option 6, section 2 identifies the 7 entries and by typing the appropriate entry number, the user gains direct access to the entry of interest. The program will display the preset value and ask the user whether it is to be changed. After responding in the affirmative, the new value can be entered. Changes can also be made using option 5.

Step 5–Run SAAM

Use Option 10 to run SAAM. The inputs and outputs of the program are described in detail below.

Description of Data Inputs

The discussion that follows describes each of the parameters that is used by SAAM in the order in which they appear on the data questionnaire and are entered into the program. The name of each parameter is followed by a brief description, a discussion of issues that are important to selecting the proper value for the parameters, and sources for each variable. The sources will include EIFS, SAAM, and a variety of primary sources.

Regional Inputs

The regional inputs describe the total initial economic impacts of a project. All of this data is to be collected in the field or from project documents. The only exceptions are the regional multipliers which pertain to the entire study area and are available from EIFS.

Project Name: The project name should succinctly describe the nature of the analysis, for example, Pine Creek Lake. The project name will appear in the title of the SAAM output.

County Where Activity is Located: Some projects are located in more than one county. Only one county should be selected for this entry and it should reflect the place where the bulk of the economic activity will occur. If the project is geographically separate, it may be necessary to carry out different model runs for each center of activity.

Regional Multipliers: The regional employment (income) multiplier relates a change in basic employment (income) to the total change in employment (income) in the study area. EIFS data automatically transfers this data to SAAM (refer to `Step 3, Enter Data` above).

Number of Affected Employees By Type: The affected employees are those persons directly affected by a project or activity. SAAM allows for the consideration of two separate employee categories–military and civilian. Most civil works projects will not involve military personnel, therefore this category can be ignored. Military personnel are included to make SAAM compatible with other EIFS models. Military personnel are often separated from civilians in economic studies due to significant differences in consumer spending patterns.

The civilian category will typically include nonmilitary employment at a site following project construction (i.e., operations phase). Construction labor will typically be handled as a separate expenditure category and is included under entry 6. Army installation military and civilian personnel data may be obtained from the post personnel office. Project-related employment and labor expenditures should be based on project-supporting documents.

Average Wages of Affected Employees: The average wage is the total annual payroll for each of the two categories of personnel divided by the average annual number of personnel in that classification. Payroll is defined as gross income (which is pay before deductions for income tax withholding and social security tax but does not include retirement and other benefits that are not received directly by the payee). You can find this information through the project supporting documentation or the post personnel office.

Dollar Amount Change in Regional Expenditures: This is the total annual change in project-related expenditures in the three categories of (1) goods and services, (2) construction labor, and (3) construction materials. During the construction phase of a project only categories 2 and 3 will be used. Goods and services expenditures are those associated with the operational phase of a project. It is important to note that these are expected annual expenditures, not total project costs. If the construction phase of a project

extends over several years with widely varying annual expenditures, then it is recommended that several runs of SAAM be made varying these amounts.

System Parameters

Fraction of Military Personnel Living On Post: This is the fraction of military personnel that reside in on-post housing. Again, if no military personnel are involved in a project, this entry can be ignored. Otherwise, this information is required. This information can be obtained from the post personnel office.

Average Propensity to Consume: The average propensity to consume (APC) is the fraction of gross wage and salary income that is spent in the study area. There are three different values for APC depending on employee type and location of the place of residence. For civilians the value of APC is 0.804. The APC for military personnel living on post is 0.276, while for off-post resident military personnel APC equals 0.489. The difference is due mainly to increased housing expenditures by off-post personnel.

Price Deflators: The CPI price deflator is the ratio of the costs of a given set of goods referenced against a base year. The CPI price deflator is used to convert income and expenditures to a common base, thus isolating the effects of inflation. The price deflators in SAAM will be updated by USACERL periodically. The CPI indices can be replaced by others as appropriate. For example, if an activity primarily involves construction, the most current construction cost index could be used.

Trade and Service Sales Per Worker: This is the average gross sales per worker in the trade and service sectors in the study area. Sales per worker is calculated by dividing total sales by total number of workers in the trade and service sectors. EIFS calculates this.

Trade and Service Income Per Worker: This is the average income per worker in the trade and service sector in the study area. Income per worker is calculated by dividing total income in the trade and service sectors by total number of workers in those sectors. EIFS calculates this.

Construction Income Per Worker: This is the average income per worker in the construction sector in the study area. Income per worker is calculated by dividing total income in the construction sector by the total number of workers in the sector. EIFS calculates this.

County Inputs

Multipliers: The county employment (income) multiplier relates a change in basic employment (income) to the total change in employment (income) in the county. EIFS data automatically transfers this to SAAM (refer to `Step 3, Enter Data` discussion above).

Trade and Service Employment: This is the employment within the trade and service sectors of the economy of the county. EIFS supplies this.

SAAM Outputs

The outputs of SAAM include separate reports for each individual county in the study area (if requested) and a summary report for the entire region. Each area report is identified by the county name or the word `Aggregated` if outputs include the whole study area. Income and employment multipliers used in calculating total impacts are also printed to assist the user in verifying the results.

Change in Local Sales Volume

This variable measures the change in local business activity resulting from a project. Specifically, *direct sales volume* is (1) the change in the dollar value of sales in the retail and wholesale trade sector and (2) receipts in the service sector resulting from local purchases by civilian and military personnel as well as construction and procurements expenditures. *Induced sales volume* is the additional business activity generated as a result of the direct change in sales. *Total sales volume* equals direct plus induced sales volume plus feedback effects; feedback effects are the additional sales activity generated when an economic stimulus in one county leads to increased trade with its neighbors, creating a synergism that leads to further economic activity in the originating county.

Change in Local Employment

Initial change in employment refers to the labor force hired to work on the project. The *direct change* in local employment is the change due to the project or activity. In SAAM, these are assumed to be the employees of the local retail, wholesale, and service establishments that are initially affected by a project. *Induced change* is the subsequent increase or decrease in employment produced by the multiplier effect. *Total change* in employment includes initial, direct, and induced effects plus feedback effects; where feedback effects are determined in the same manner as sales volume.

Change in Income by Place of Work

The *initial change* in local income is the wage and salary payments made to workers hired to build a project. *Direct income change* again refers to the wages earned by employees in the local trade and service industry whose jobs are dependent on local project-related expenditures. *Induced income* effects are those brought about through the multiplier process. *Total income* change includes initial, direct, and induced impacts plus feedback effects. Income feedback effects are the earnings of workers whose jobs are brought into existence from an increase in inter-county trade from a new project or activity.

Change in Income by Place of Residence

Income by place of residence is determined directly from total income by place of work by the subtraction of initial income effects and the addition of earnings of the resident work force (number of resident workers in each county is a parameter predetermined by the analyst).

10 MINIMUM REQUIREMENTS MODEL (MRM)

The Minimum Requirements Multiplier (MRM) profile computes regional trade (income) multipliers for impact analysis. The Minimum Requirements (M-R) approach assumes a basic relationship between the population of a region and the propensity to consume locally produced goods. This relationship has been recently re-estimated by Jacobsen (1982) using 1980 Census data, following on earlier work by Moore et al. (1975) and Ullman et al. (1969).

This profile allows a user to compute MRMs for a community of any size. Therefore, MRMs may be reasonable alternatives to EIFS Location Quotient-derived multipliers for analysis of sub-county economic impacts.

This profile is available as menu item 2 from the Miscellaneous Profiles, choice x from the EIFS main menu. A sample MRM computer run is demonstrated below:

```
                Miscellaneous Profiles  (x)

Type:  For Additional Profiles:
  1     MARF2 - Geographic Locations and Distances
  2     Minimum Requirements Multipliers (MRM) - 1990 Population Data
  3     Select year for which multipliers are to be calculated
  4     See the Multipliers
  5     State-Level Data for Sales Tax and Education Costs - 1982
  6     County-Level Data for Real Estate Assessed Valuation - 1982
  7     Mapping Polygon ID information
  8     Diverse Measures - Number of Area SICs compared to US
  9     Zip Code information
 10     Gross State Product 1977-1989 (State level - from BEA)

Experimental Profiles:
 99     Access to external programs (useful only to EIFS programmers)

Type:  To:                                  Type:  For:
  -     return to EIFS main menu              ?    a list of valid responses
  f     change output Format options          ??   more detailed help
  r     Review your county list             quit   exit to EIFS

by us       is available for:  5 6 10
by county   is available for:  4 5 6 10


EIFS v5.0 (x) - What profile?  (<cr> to see list): 2

        Minimum Requirements Multiplier Profile

County                          '90 Population    Multiplier
 Champaign County                      173,025        2.0495

Equations: M  = 1 / (1 - Kb)
           Kb = (-30.40331 + 15.58022 * Log10 (Pop)) / 100
   Source: Moore and Jacobsen, 1984, Economic Geography

*** Type  c  to continue,  ?  for more information, RETURN (or quit) to exit:
c

Area population: 173

Minimum Requirements Multiplier:   1.046747
```

11 SUMMARY

EIFS 5.0 provides a quick, cost-effective means of determining the impact of a military action on a given area or region. With its high degree of adaptability, EIFS can be applied to any county or combination of counties in the United States. Additional data fields, updated census figures, and expanded output options make the information version 5.0 generates easier to use in microcomputer software programs.

Use of EIFS models can aid the Army in analysis of installation planning, closure, and realignment issues.

METRIC CONVERSION FACTORS

1 mi	=	1.61 km
1 lb	=	0.453 kg
1 bushel	=	0.03524 m^3
1 ton	=	907.1848 kg

APPENDIX A: Starting and Running EIFS

This appendix provides step-by-step instructions for starting and running EIFS. EIFS is straightforward and user-friendly. It is menu-driven; simply enter the menu choices to run EIFS. Most menu choices are self-explanatory, thus one can learn to use EIFS with minimal instruction.

First Steps

Run EIFS and refer to the example sessions below. First:

1. Learn basic commands from a communications software package. Important commands to know:

a. Capturing data into a file—The user will most likely need to know how to capture on-screen displays into a text file. He/she can then look at, edit, and print this display using a word processing package. The text file can also be edited from the communications package, which has fewer manipulating commands. The user can also download EIFS displays into a file on the UNIX computer. These instructions are located online, as well as in Chapter 7 of this manual.

b. Viewing screen displays which have scrolled out of sight–Occasionally, information scrolls by too quickly to adequately observe. Most communications packages hold this information in a buffer, to which the user can easily gain access.

2. Learn basic UNIX commands—Learn how to login and logout. In addition, a user may wish to know how to send e-mail, and how to create, edit, and delete UNIX files. Ask ETIS support for UNIX information.

3. Familiarize yourself with the menus—Browse through the EIFS data tables and models. An illustration of the menus is shown in Figure A1.

Getting Into ETIS and EIFS

Sample runs follow, with descriptions, explanations, and comments. Use these to answer questions while running EIFS. Users can run EIFS directly from osiris or within ETIS. Figure A2 illustrates the first interaction with ETIS and EIFS.

Selecting a Study Area

A study area in EIFS consists of one or more counties. The user may specify counties individually by name, by Federal Information Processing Standard (FIPS) code, by specially defined regions (named lists of counties), or by having EIFS include counties within a specified distance of geographic coordinates (latitude and longitude). If the region names, FIPS code, or county names are unknown, type ? and EIFS will supply a list. This is illustrated in Figure A3.

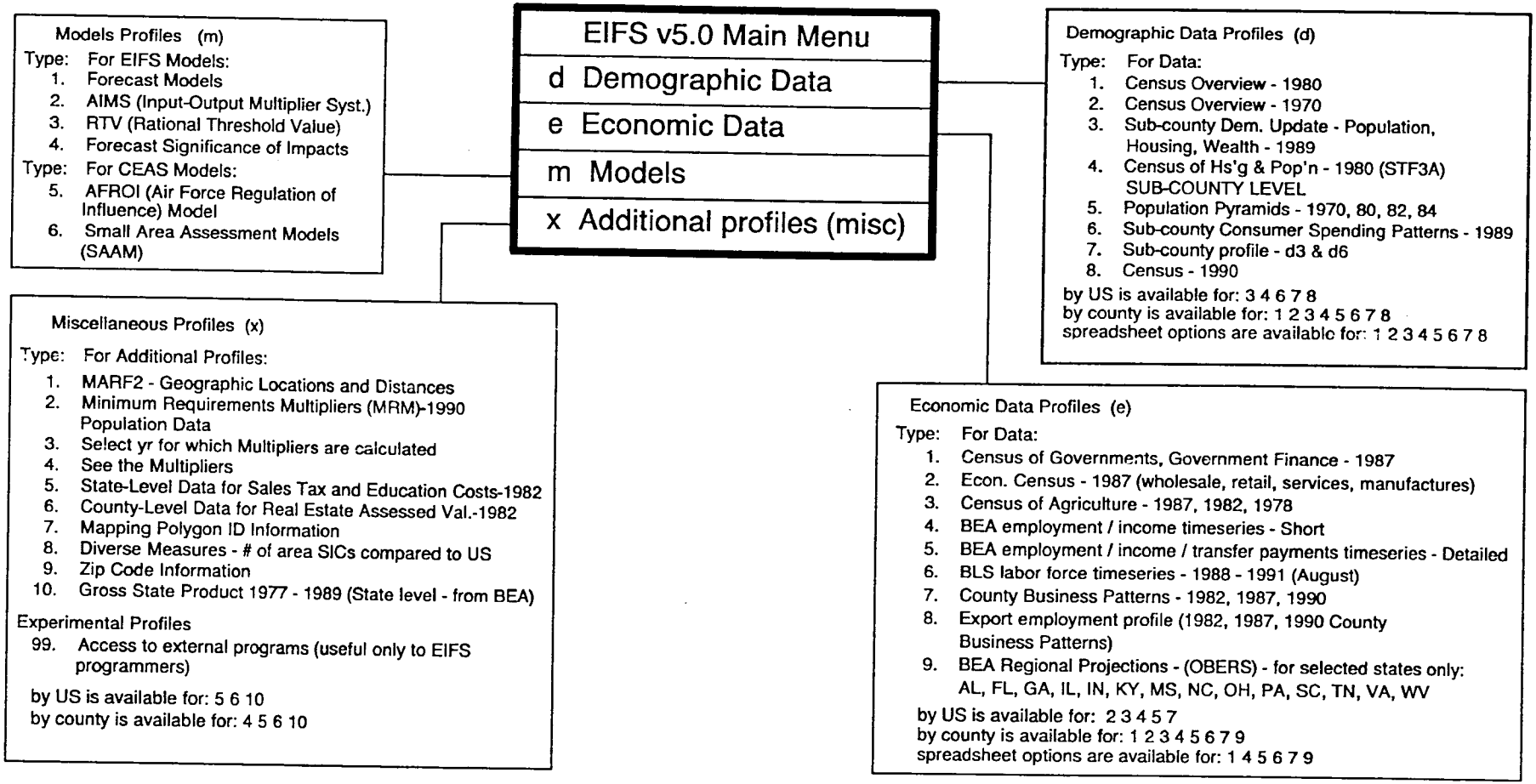


Figure A1. EIFS Main Menu Choices.

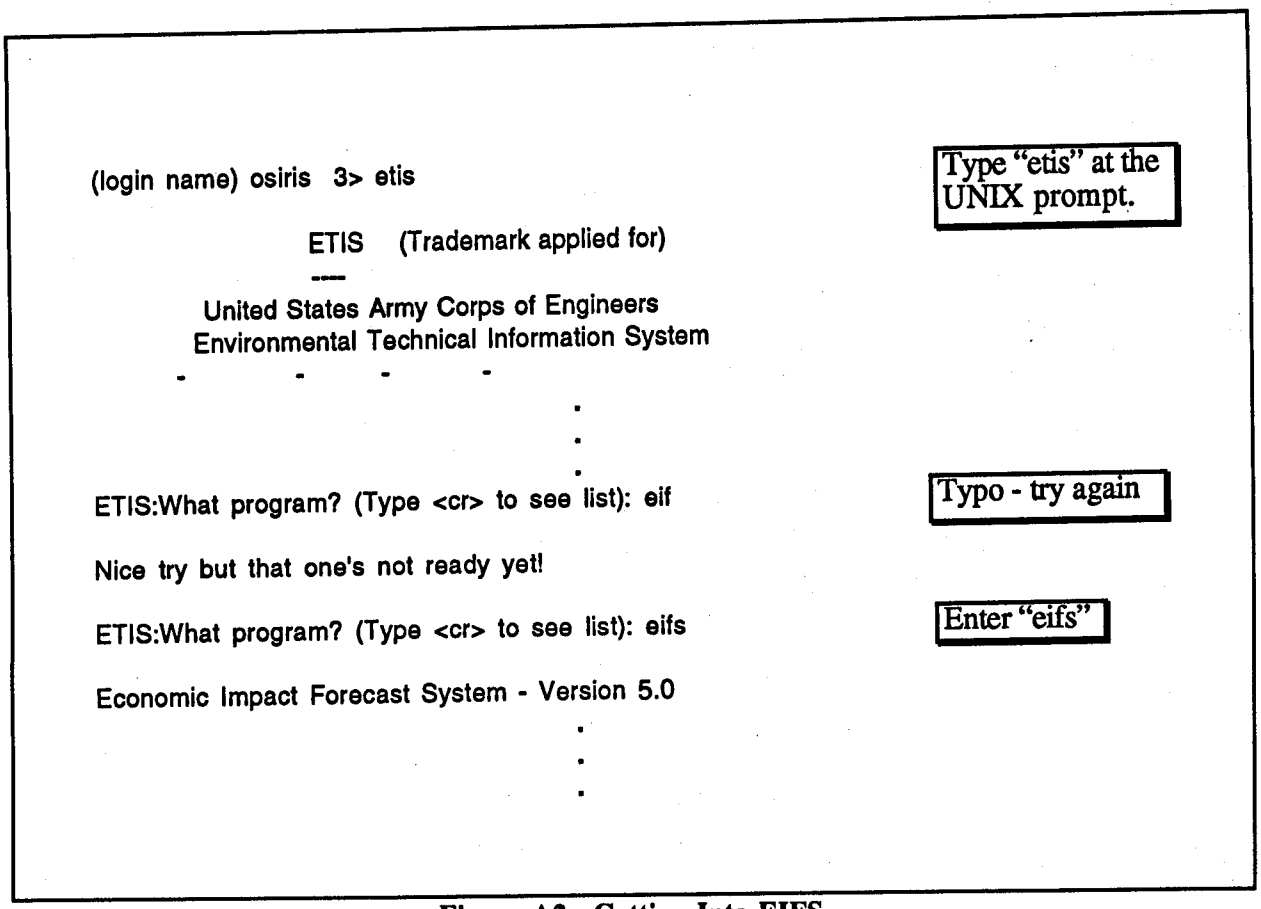


Figure A2. Getting Into EIFS.

Viewing Data Profiles

To view the available data, choose d or e from the main menu. A sample run showing data profiles is given in Figure A4.

Running EIFS Forecast Models

To run EIFS Forecast models, choose m from the main menu. A sample model run is given in Figure A5.

Help From EIFS

EIFS offers help at several points in the menu. All help prompts are displayed below in Figure A6.

How To Use AIMS

You need only to enter in the I-O codes to run AIMS. Instructions for running AIMS are provided online. This is illustrated in Figure A7.

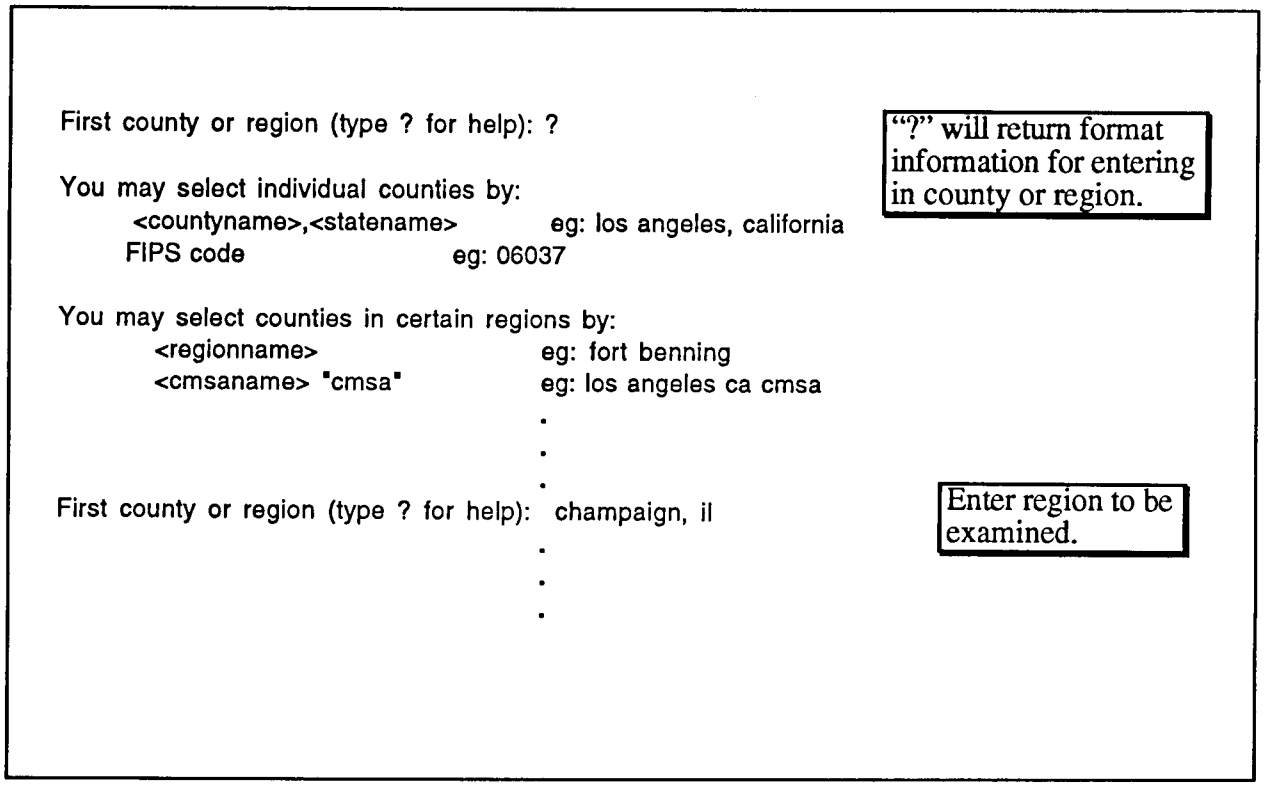


Figure A3. Selecting a Study Area.

Using RTV and FSI

No new information has to be entered to run the RTV model—just choose this model from the models (m) menu. A sample run is illustrated in Figure A8.

Forecast Significance of Impacts (FSI)

As with the RTV model, the user does not need to enter any new information to run the FSI model. Choose this model from the models (m) menu. EIFS FSI display is shown in Figure A9.

Air Force Region of Influence (AFROI) Model

The AFROI model is located in the models section of EIFS. The EIFS display of the AFROI run is given in Figure A10.

```
                EIFS v5.0 Main Menu

Type:  For Section Menu:
  d     Demographic Data
  e     Economic Data
  m     Models
  x     Additional profiles

Type:  For:
  1     EIFS messages
  2     List of contact people
  3     Description of the differences between v4.1 and v5.0
  4     List of changes to FIPS lists
  5     Help with downloading to PC's
  6     Database Information - including upgrade schedules

Type:  To:                                    Type:  For:
  -     return to EIFS main menu                ?     a list of valid
responses
  f     change output Format options            ??    more detailed help
  r     Review your county list                 quit  exit to EIFS



EIFS v5.0 - What Section?  (<cr> to see list): d

                Demographic Data Profiles  (d)

Type:  For Data:
  1     Census overview - 1980
  2     Census overview - 1970
                        .
                        .
                        .


EIFS v5.0 (d) - What profile?  (<cr> to see list): 1

1980 CENSUS OVERVIEW

AREA:  17019    champaign, il

HOUSING and POPULATION TOTALS
--------------------------------
        168,392   Population
         37,105   Families
         58,405   Households
         62,494   Housing Units *
* (year-round units)
                        .
                        .
                        .
```

To see data "by county" or "by us": If data for the US is available, or if the profile allows showing the data by county, this feature is activated by appending "by county" or " by us" to the profile number (eg "d4 by us" or "d1 by county").

Enter "t" (tables) unless you want the data given in spreadsheet format (enter "s"), for easy download to a spreadsheet package.

Figure A4. Viewing EIFS Data Profiles.

The POLY ID is a Polygon Identifying number for a mapping software package, MapAnalyst.

Enter "c" to look only at county level data, "t" to select MCD's or tracts within counties.

```
EIFS v5.0 (d) - What profile?  (<cr> to see list): 3

EI1989 SUB-COUNTY DEMOGRAPHICS
Are you entering PolyID's (y/<cr>)?

SELECT LEVEL: county data only or choose MCD's/tracts ?  (c/t/?): t

AREA selection: 17019  champaign, il ... (36 Census Tracts)

.. ADDING .. Enter tract number(s) (type  RETURN when done, ?  for help)
  : ?
Enter:
      A tract number, a hyphen separated range of numbers, or a comma
      separated list of numbers or ranges (ie: 24.3,3-5,25,111.5-112.4)
      +   to ADD                          -   to DELETE
      a   for all tracts except county    x   see tracts list, this county
      n   next county                     y   see selected list, this county
      q   to return to EIFS               z   see selected list, all

.. ADDING .. Enter tract number(s) (type  RETURN when done, ?  for help)
  : x

  17019 - champaign, il

  PolyID    seq  LEVEL     #      FIPS    Name
  ------------------------------------------------
  217019      1  COUNTY          17019    champaign, il
  313551      2  Tract     1     17019

   :          :    :       :       :

313567     18  Tract    52     17019
   --More-- (n/<cr>)? n
   .. ADDING .. Enter tract number(s) (type  RETURN when done, ?  for help)
     : 8-12.2
.. 6 tracts added
         :
         :
There are 6 areas on your list from 1 counties.
Do you want to save this list for future use? (y/<cr>):

Default: data shown is aggregated
You may toggle this option at the "Which table?" prompt.

NPDC 1989 UPDATE - POPULATION, HOUSING, WEALTH (6 areas - aggregated)
 - Which table?  (type  ?  for help   t  to toggle output): 6

** TABLE 6 **   POPULATION AND PER CAPITA INCOME (GROUP QUARTERS)
             +-------------------------------------------------+
             +---------- Population ----------+   Per-Capita Income
PolyID  FIPS          1980      1989e      1994p              1979
-----------------------------------------------------------------
Aggregated             236        236        236             4,131
```

The user can save the list of census tracts into a file for future use.

Figure A4. (Cont'd).

```
EIFS v5.0 (e) - What profile?  (<cr> to see list): e

                Economic Data Profiles  (e)

Type:  For Data:
  1     Census of Governments, Government Finance - 1987
  2     Economic Censuses - 1987 (Wholesale, Retail, Services, Manufactures)
  3     Census of Agriculture - 1982
  4     BEA employment/income timeseries - Short
  5     BEA employment/income/transfer payments timeseries - Detailed
  6     BLS labor force timeseries  - 1988-1991 (Aug)
  7     County Business Patterns - 1982, 1987, 1990
  8     Export employment profile (1982, 1987, 1990 County Business Patterns)
  9     BEA Regional Projections - (OBERS) - for selected states only:
                AL, FL, GA, IL, IN, KY, MS, NC, OH, PA, SC, TN, VA, WV


EIFS v5.0 (e) - What profile?  (<cr> to see list): 2
1987 ECONOMIC CENSUSES - Which census(es)?  (type  ?  for help): ?

Enter:   To see Census(es) of:
1 or m     Manufactures
2 or w     Wholesale, Retail and Services

9 or a     All of the Economic Censuses

  q      To return to EIFS

1987 ECONOMIC CENSUSES - Which census(es)?  (type  ?  for help): 1

1987 CENSUS OF MANUFACTURES - Which table? ( type  ?  for help ): [RETURN]
DETAILED LISTING

What level of detail? (type ? for help): 2
Start with which SIC? (type RETURN to start at the beginning): [RETURN]
End with which SIC? (type RETURN to end at the end): [RETURN]

1987 CENSUS OF MANUFACTURES


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
AREA:  17019    champaign, il
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
     Admin. ESTAB'MENTS   ++ ALL EMPLOYEES ++    ++++ PRODUCTION WORKERS ++++
 SIC    #1   Number #2     Number     Payroll     Number     Hours      Wages

19--              141        9.4       189.7        6.4      12.1      117.5
19-a                6        0.5        15.1        0.0       0.0        0.0
2000               11       2.5R         0.0D       0.0D      0.0D       0.0D
                                :
                                :

3400 10-19%         6        0.3         7.1        0.2       0.4        5.0
3500 20-29%        18       0.4R         0.0D       0.0D      0.0D       0.0D
3600 30-39%        10        0.5        11.5        0.4       0.7        5.7

Numbers of workers are in thousands; hours are in millions; payroll and wages
  are in millions of dollars.

D  Statistics are withheld to avoid disclosing data for individual companies.
R  For each industry group and industry with 150 employees or more, number of
   establishments is shown and an employment size range is indicated by the
   midpoint of a range of values.  Data in this field is the midpoint of one
   of the following ranges:
      150-249; 250-499; 500-999; 1000-2499; 2500 and over.
```

Figure A4. (Cont'd).

```
                Models Profiles  (m)

Type:  For EIFS Models:
  1     Forecast Models
  2     AIMS (Automated Input-Output Multiplier System)
  3     RTV (Rational Threshold Value)
  4     Forecast Significance of Impacts

Type:  For CEAS Models:
  5     AFROI (Air Force Region of Influence) Model

                  :
                  :

EIFS v5.0 (m) - What profile?  (<cr> to see list): 1


Forecast Models - which functional area?  (<cr> to see list):

 Type:  For:
   1      Standard EIFS Forecast Model
   2      Construction
   3      Construction of On-Base Housing
   4      Training
   5      AR 5-20 Economic Effects Analysis

  20     Information about the models and price deflation
  30     Overview of system supplied variables used in the models
  40     See and/or change values of selected variables
  50     See list of counties with hidden BEA data affecting the models
  90     See your county list

q or -   to return to EIFS
cntrl-d  to leave EIFS


Forecast Models - which functional area?  (<cr> to see list): 1

STANDARD EIFS FORECAST MODEL

Project name:  Standard Forecast Model Example

Enter    d    to enter your own price deflators
      RETURN  to use the default price deflators (latest year):

Default price deflators:
   baseline year (ex. business volume) (CPI - 1987)      = 100.0
   output and incomes  (ex b.v.)       (CPI - 1993)      = 126.3
   baseline year (business volume)     (PPI - 1987)      = 100.0
   local services and supplies         (PPI - 1993)      = 115.7
   output and incomes (business volume)(PPI - 1993)      = 115.7

                          .
                          .
                          .
```

Type any project name.

In some cases, EIFS default deflators may be less appropriate than other price deflators. See Chapter 2.

Figure A5. Running EIFS Forecast Models.

"local" expenditures = money spent only in the study area. If total expenditures are entered, EIFS computes the "local" expenditures as a percent of the total.

```
(Enter decreases as negative numbers)
If entering total expenditures, enter  1
           local expenditures, enter  2  : 2
Change in expenditures for local services and supplies:  9780000
Change in civilian employment:  25
Average income of affected civilian personnel:  26500
Percent expected to relocate (enter <cr> to accept default):  (0.0)
Change in military employment:  63
Average income of affected military personnel:  27750
Percent of military living on-post:  65
```

Provide inputs here. For more information on accurate input entry, see chapters 2 and 3.

```
*** STANDARD EIFS MODEL FORECAST FOR Standard Forecast Model Example ***

Export income multiplier:                              2.2130
Change in local
  Sales volume ..............  Direct:       $10,829,000
                              Induced:       $13,136,000
                                Total:       $23,965,000    (    0.560%)
  Employment ................  Direct:                90
                                Total:               287    (    0.264%)
  Income ....................  Direct:        $1,433,000
                    Total (place of work):     $5,583,000
                 Total (place of residence):   $5,467,000    (    0.177%)
  Local population ..................:              157    (    0.092%)
  Local off-base population .........:               55
  Number of school children .........:               26
  Demand for housing .........  Rental:               14
                          Owner occupied:               8
  Government expenditures............:          $303,000
  Government revenues ...............:          $442,000
  Net Government revenues ...........:          $139,000
Civilian employees expected to relocate:               0
Military employees expected to relocate:              63


 Type:  To:
  f      print your input values and output to a file
  i      see your input values
  o      see your output again
  m      return to Forecast Models menu
  q      return to EIFS
```

Figure A5. (Cont'd).

```
                EIFS v5.0 Main Menu

Type:  For Section Menu:
  d     Demographic Data
  e     Economic Data
  m     Models
  x     Additional profiles

Type:  For:
  1     EIFS messages
  2     List of contact people
  3     Description of the differences between v4.1 and v5.0
  4     List of changes to FIPS lists
  5     Help with downloading to PC's
  6     Database Information - including upgrade schedules

          :

EIFS v5.0 (e) - What profile?  (<cr> to see list): ?
You are currently at the ECONOMIC DATA menu level
Valid responses are:
  a number 1 through 10  to see a profile on this menu
  -  to return to the EIFS main menu
  ??, quit, f, r, d, e, m, x, d1-d8, e1-e9, m1-m5, x1-x11
  a single  ?  followed by a valid response (eg: ?1, ?r, ?d4)

          :
EIFS v5.0 (e) - What profile?  (<cr> to see list): ??
You are currently at the ECONOMIC DATA menu level
Valid responses are:
  a number 1 through 10  to see a profile on this menu
  -  to return to the EIFS main menu
  r    to review your county list.
quit   to leave EIFS.
  a single letter (d, e, m, x) to go to the demographic data, economic data,
     models, or experimental menu.
  a letter/number combination (d1 - d8, e1 - e10, m1 - m5, x1 - x11) to see a
     profile from one of the above menus.
  a single  ?  followed by a valid response (eg: ?q  or ?d1) will show more
     information about the individual profile or command.
             :

EIFS v5.0 - What Section?  (<cr> to see list): m1

Forecast Models - which functional area?  (<cr> to see list):

 Type:  For:
   1      Standard EIFS Forecast Model
   2      Construction
   3      Construction of On-Base Housing
   4      Training
   5      AR 5-20 Economic Effects Analysis

  20     Information about the models and price deflation
  30     Overview of system supplied variables used in the models
  40     See and/or change values of selected variables
  50     See list of counties with hidden BEA data affecting the models
  90     See your county list
```

Choices 1-6 provide up-to-date help.

Entering "?" at any menu will return a list of valid responses.

Entering "??" at any menu will return more detailed help.

More help from EIFS is located in the Forecast Models menu, 20-90.

Figure A6. Help From EIFS.

```
EIFS v5.0 - What Section?  (<cr> to see list): m

                Models Profiles  (m)

Type:  For EIFS Models:
  1     Forecast Models
  2     AIMS (Automated Input-Output Multiplier System)
          :
EIFS v5.0 (m) - What profile?  (<cr> to see list): 2

AIMS - Automated Input-Output Multiplier System

   AIMS calculates multipliers for IO Codes specified by the user using the
   1977 National IO table.  CBP, BEA and Census of Agriculture data used by
   the EIFS multipliers is used in the calculations.

   The analyst must convert current dollar expenditure changes into 1977
   dollar equivalents for use with AIMS.

... reading CBP, BEA and Census of Agriculture data for 1987 ...
AIMS:  no 87 data in US for sic 1111.

Enter:              To:
# (up to 6 digits)  enter a code
  #(low)-#(high)    enter codes within a range
       r            review list of codes selected so far
       s            see the list of IO codes
       d            delete a code from your list

     <cr>           stop entering codes
       q            quit - returning to EIFS

Enter IO code or IO code range ( ? for help ): s
Start with which IO code? (enter  <cr>  to start at beginning):
 10100  Dairy Farm Products  (SIC 0240)
 10200  Poultry & Eggs  (SIC 0250)
          :
          :
******* AIMS Multiplier Computations (1977 IO table)  -  11 IO Codes ******

Direct Effect (DE)                                              0.516671
  Goods and Services Purchased Locally                0.337796
  Labor Hired Locally                                 0.178875

Indirect Effect (IE)                                            0.326691
  Agr Share of Local Non-Govt Earnings (P1)           0.001509
  Mfg Share of Local Non-Govt Earnings (P2)           0.293890
  Local Share of US Non-Govt Earnings (S2)            0.002088
  ln(IE) = 0.65 - 0.79*P1 - 0.13*P2 + 0.17*ln(S2) + 1.03*ln(DE)
  ln(IE)                                             -1.118740

                    :
                    :
```

AIMS is located in the Models section of EIFS.

Enter the I-O codes associated with the SIC categories you need. To see a list of I-O codes, enter "s".

Figure A7. Using AIMS.

```
                Models Profiles  (m)

Type:  For EIFS Models:
  1     Forecast Models
  2     AIMS (Automated Input-Output Multiplier System)
  3     RTV (Rational Threshold Value)
  4     Forecast Significance of Impacts

                  :

EIFS v5.0 (m) - What profile?  (<cr> to see list): 3

RATIONAL THRESHOLD VALUES


AREA:  17019    champaign, il

All dollar amounts are in thousands of dollars.
Dollar adjustment based on Consumer Price Index (1987=100).


BUSINESS VOLUME  (using Non-Farm Income)

          Non-Farm      adjusted
YEAR        income        income        change     deviation    %deviation
1969       469,760     1,389,823
1970       484,464     1,353,251       -36,571       -61,178        -4.402 %
                          :

average yearly change:                              24,607
maximum historic positive deviation:               151,036
maximum historic negative deviation:              -132,208
maximum historic % positive deviation:               9.288 %
maximum historic % negative deviation:              -8.256 %


PERSONAL INCOME

          Personal      adjusted
YEAR        income        income        change     deviation    %deviation
1969       569,013     1,683,470
1970       588,315     1,643,338       -40,132       -79,264        -4.708 %
                             :

average yearly change:                              39,132
maximum historic positive deviation:               131,322
maximum historic negative deviation:              -173,367
maximum historic % positive deviation:               6.119 %
maximum historic % negative deviation:              -8.305 %
positive rtv:                                        6.119 %
negative rtv:                                       -5.564 %

               :
```

RTV is located in the Models section of EIFS.

No new information is required to obtain the rational threshold values. The values are given in table form for the region selected in the beginning of your EIFS run.

RTV output

Figure A8. Sample RTV Run.

EMPLOYMENT

YEAR	Employment	change	deviation	%deviation
1969	82,145			
1970	78,839	-3,306	-4,634	-5.641 %
1971	81,293	2,454	1,126	1.429 %
1972	82,614	1,321	-7	-0.008 %
		:		
		:		
1988	111,507	2,698	1,370	1.259 %
1989	110,399	-1,108	-2,436	-2.184 %
1990	112,606	2,207	879	0.796 %
1991	111,356	-1,250	-2,578	-2.289 %

average yearly change:	1,328
maximum historic positive deviation:	3,577
maximum historic negative deviation:	-4,634
maximum historic % positive deviation:	3.563 %
maximum historic % negative deviation:	-5.641 %
positive rtv:	3.563 %
negative rtv:	-3.779 %

POPULATION

YEAR	Population	change	deviation	%deviation
1969	160,700			
1970	163,300	2,600	1,995	1.242 %
1971	164,300	1,000	395	0.242 %
		:		
		:		
1990	173,300	800	195	0.113 %
1991	174,000	700	95	0.055 %

average yearly change:	605
maximum historic positive deviation:	2,995
maximum historic negative deviation:	-4,105
maximum historic % positive deviation:	1.830 %
maximum historic % negative deviation:	-2.393 %
positive rtv:	1.830 %
negative rtv:	-1.197 %

Source: Bureau of Economic Analysis

Figure A8. (Cont'd).

FSI is located in the Models section of EIFS.

```
          Models Profiles  (m)

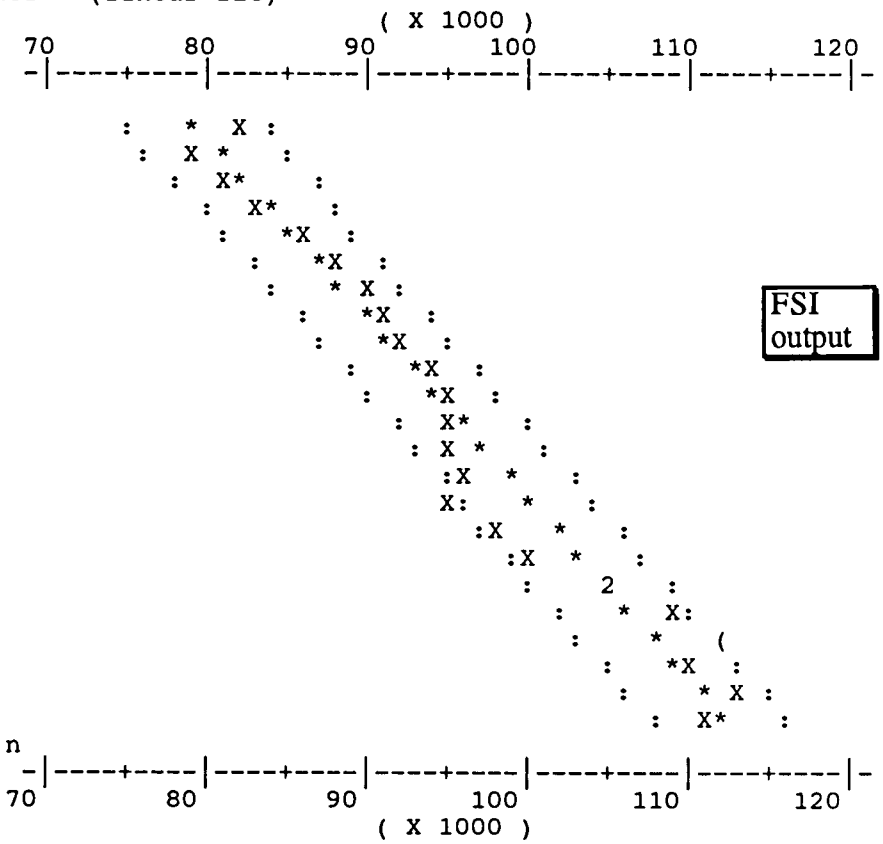
Type:  For EIFS Models:
  1     Forecast Models
  2     AIMS (Automated Input-Output Multiplier System)
  3     RTV (Rational Threshold Value)
  4     Forecast Significance of Impacts
                  :
                  :
FORECAST SIGNIFICANCE OF IMPACTS
For which year do you want projections? ( ? for help ) : ?
    Choose a year between 1992 and 2016
For which year do you want projections? ( ? for help ) : 2000
What confidence level for t-test ( ? for help) : ?
    Enter   60  75  90  95  or 99
            RETURN for default (90)
What confidence level for t-test ( ? for help) : 95


***** AREA:  17019    champaign, il *****

TOTAL EMPLOYMENT
Values and Predicted Values - (linear fit)
```

Type the year for which you need a predicted range, and confidence level for the t-test.

yr	act	pre	err
1969	82145	79264	4333
1970	78839	80754	4294
1971	81293	82243	4259
1972	82614	83732	4227
1973	86424	85222	4198
1974	87654	86711	4174
1975	89616	88200	4153
1976	91076	89689	4135
1977	92451	91179	4122
1978	93579	92668	4112
1979	95207	94157	4106
1980	94809	95647	4104
1981	95366	97136	4106
1982	95655	98625	4112
1983	95116	100115	4122
1984	97673	101604	4135
1985	100387	103093	4153
1986	105292	104582	4174
1987	108809	106072	4198
1988	111507	107561	4227
1989	110399	109050	4259
1990	112606	110540	4294
1991	111356	112029	4333
2000	0	125432	4819



FSI output

Figure A9. FSI Display.

```
Prediction years    :   1969 - 1991
Year of estimate    :   2000
Confidence Level    :   95
Predicted Value     :   125,432
% Forecast Error    :   3.8 %
Confidence Interval:    120,613 to 130,252

Degrees of Freedom :    21
X intercept (b0)    :   -2,853,146.61
Std Err of b0       :   145,306.42
Slope (b1)          :   1,489.29
Std Err of b1       :   73.39
R squared           :   0.9515

 Source:  Bureau of Economic Analysis

Enter:
  c     to redo table
  f     to see footnotes and graph key
  q     to return to EIFS menu
  r     to return to FSI menu
  ?     for help
RETURN  to continue : c
Enter first year  (RETURN to use 1969) : 1979
Enter last year  (RETURN to use 1991) : 1990

                    :
                    :
***** AREA:  17019    champaign, il *****

TOTAL PERSONAL INCOME
Values and Predicted Values (Deflated) - (linear fit)

                    :
                    :

***** AREA:  17019    champaign, il *****

POPULATION
Values and Predicted Values - (linear fit)

                     :
                     :

***** AREA:  17019    champaign, il *****

NON-FARM
Proxy for Business Volume ...
Values and Predicted Values (Deflated) - (linear fit)

                     :
                     :
```

Entering "c" to redo the table, and changing the prediction years changes the years for the rest of the impact analysis.

Figure A9. (Cont'd).

```
                Models Profiles  (m)

Type:  For EIFS Models:
  1     Forecast Models
  2     AIMS (Automated Input-Output Multiplier System)
  3     RTV (Rational Threshold Value)
  4     Forecast Significance of Impacts

Type:  For CEAS Models:
  5     AFROI (Air Force Region of Influence) Model

                      :
                      :

EIFS v5.0 (m) - What profile?  (<cr> to see list): 5
....You must run  x4 by county first......

                EIFS v5.0 Main Menu

Type:  For Section Menu:
  d     Demographic Data
  e     Economic Data
  m     Models
  x     Additional profiles

                      :
                      :

EIFS v5.0 - What Section?  (<cr> to see list): x

                Miscellaneous Profiles  (x)

Type:  For Additional Profiles:
  1     MARF2 - Geographic Locations and Distances
  2     Minimum Requirements Multipliers (MRM) - 1990 Population Data
  3     Select year for which multipliers are to be calculated
  4     See the Multipliers

                      :
                      :

EIFS v5.0 (x) - What profile?  (<cr> to see list): 4

  1 counties included have complete data:
    17019   champaign, il

1987 Multipliers - 17019    champaign, il
Employment Multiplier:   2.4452
Income Multiplier:       2.2130

                      :
                      :
```

AFROI is located in the Models section of EIFS. Refer to the AFROI user manual (Bloomquist, Merritt, and Pierce 1987) for more AFROI information.

To run AFROI, you must first go back to the Main Menu, enter "x", then enter "4". This is illustrated below.

Figure A10. AFROI Display.

```
                Models Profiles  (m)

Type:  For EIFS Models:
  1     Forecast Models
  2     AIMS (Automated Input-Output Multiplier System)
  3     RTV (Rational Threshold Value)
  4     Forecast Significance of Impacts

Type:  For CEAS Models:
  5     AFROI (Air Force Region of Influence) Model

                      :
                      :


EIFS v5.0 (m) - What profile?  (<cr> to see list): 5

                  Air Force Region of Influence Model - AFROI
                                (Version 1.7)

Reading inputs...

AFROI -- Which option? (Press RETURN for menu):

 TYPE:              TO:
   1 or print       Print a copy of the inputs questionnaire

Data-Related Commands
   2 or list        List existing data files
   3 or load        Load inputs from a data file
   4 or see         See the inputs you have loaded
   5 or eifsdata    How to load many AFROI inputs using EIFS
   6 or enter       Enter inputs
   7 or append      Append county inputs
   8 or delete      Delete county inputs
   9 or edit        Examine/Change inputs
  10 or save        Save inputs in a file
  11 or rm          Remove a data file

Model-Related Commands
  12 or run         Run the impacts estimation model
  13 or calibrate   Calibrate gravity model exponent

 ?opt               Get help on a menu option
 (q)uit             Exit program

You have loaded a set of inputs

                      :
                      :
```

Back to the Models menu to run AFROI.

Refer to the AFROI user manual (Bloomquist, Merritt, and Pierce, 1987) for more AFROI information.

Figure A10. (Cont'd).

APPENDIX B: EIFS Equations

Listed below are all variables and equations used in EIFS forecast models. These variables are also listed online, under the forecast model menu.

System-Supplied Variables

EIFS supplies the following parameters from its database. To see current and default values for these parameters, use FA 30. To change values for these parameters, use FA 40.

apcc Average propensity for civilian personnel or construction workers to consume local goods and services out of gross income. Presently, these types of employees are assumed to consume the same proportion of their income for locally produced goods and services as do the residents of the communities that compose the study area. Apc is defined as Total Expenditures/Income Before Taxes, where Total Expenditures excludes payments for life insurance, retirement plans, social security, etc. In 1985, for the general population, apcc was equal to $20,201/$25,127 = 0.804.

Source: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1988.* Also: Table No. 688, "Average Annual Income and Expenditures of Urban Consumer Units: 1985."

apcon Average propensity to consume locally by military personnel residing on post.

apcton A value of 0.276 is used for permanent military and 0.294 is used for trainees (apcton).

apcoff Average propensity to consume locally by military personnel residing off post.

apctoff A value of 0.489 is used for permanent military (apcoff) and 0.540 is used for trainees (apctoff). The difference between values for off-post and on-post personnel is due largely to expenditures for housing and furniture which are included only for on-post personnel.

Source: (apcon, apcton, apcoff, apctoff) – Calculated from survey data taken from W. Gunther (1982), *A Socioeconomic Survey of Air Force Employees.* Report Prepared for Headquarters Air Force, Engineering and Services Center, Tyndall AFB, FL.

basepop An estimate of the number of persons living in on-post military housing. IF AVAILABLE, LOCAL ESTIMATES FOR THIS PARAMETER SHOULD BE USED. The default figure used is the "Others in Group Quarters" population. This category includes: military personnel living in temporary quarters or military barracks, boarders in rooming houses, communes, missions, Salvation Army shelters, halfway houses, general hospitals, religious group quarters, and crews in other workers' dormitories (e.g., construction workers' camps, logging camps, etc.). Not included are military personnel who reside in housing units on post that are not classified as group quarters.

Source: U.S. Bureau of the Census, *1980 Census of Population and Housing.*

chc The average number of children (18 and under) per household in the general population. A national average value of 0.85 children is used in EIFS.

Source: U.S. Bureau of the Census, *1980 Census of Population and Housing.*

chcw The average number of children (18 and under) per household among nonlocal construction workers whose families accompany them to the area during the project. A national average value of 1.24 children is used in EIFS.

Source: Dunning, C.M., *Report of Survey of Corps of Engineers Construction Workforce*, Research Report 81-R05. Fort Belvoir, VA: Institute for Water Resources (June 1981).

chm The average number of children (18 and under) per active duty military household. An average value of 0.77 children is used in EIFS.

Source: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1987.* Table No. 551, "Active Duty Military Personnel and their Dependents: 1970 to 1985."

cypw Construction sector earnings per worker. This is the local ratio of construction sector earnings to construction sector employment for 1982.

Source: U.S. Bureau of Economics Analysis, Regional Economic Information System.

hhsizc Number of persons per household in the general population for the study area.

Source: U.S. Bureau of the Census, *1980 Census of Population and Housing.*

hhsizcw Number of persons per household of accompanied nonlocal construction workers = 3.11.

Source: Dunning, C.M., *Report of Survey of Corps of Engineers Construction Workforce*, Research Report 81-R05, Fort Belvoir, VA: Institute for Water Resources (June 1981).

hhsizm Number of persons per military household = 2.49 (national average).

Source: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States, 1987.* Table No. 551, "Active Duty Military Personnel and their Dependents: 1970 to 1985."

me The export-employment multiplier based on the location quotient methodology.

ms The export-sales multiplier based on the location quotient methodology. At present, the export-income multiplier (my) is used as a "proxy" until research can be carried out.

my The export-income multiplier based on the location quotient methodology.

Sources: (me, ms, my): (1) 1982 Enhanced County Business Patterns, National Planning Data Corporation and (2) U.S. Bureau of Economic Analysis, Regional Economic Information System.

milemp The number of full-time and part-time military employees in the study area.

Source: U.S. Bureau of Economic Analysis, Regional Economic Information System.

ownsource The total of local government less local revenues from Federal and state governments.

Source: U.S. Bureau of the Census, *1982 Census of Government Finance.*

pc Proportion of children attending local public schools. It is the ratio of children enrolled in public school to the number of persons from 3 through 18 years of age.

Source: U.S. Bureau of the Census, *1980 Census of Population and Housing.*

pcw Proportion of children of accompanied nonlocal construction workers attending local public schools. EIFS assumes that all school-aged children of these workers will attend local public schools.

Source: Dunning, C.M., *Report of Survey of Corps of Engineers Construction Workforce*, Research Report 81-R05. Fort Belvoir, VA: Institute for Water Resources (June 1981).

pmigm Proportion of military personnel who relocate. The default value for this variable is unity (pmigm = 1). If some affected military personnel do not relocate (for example, if some military personnel retire), then pmigm should be changed to reflect the number who actually relocate.

Source: post personnel office.

prentc Proportion of civilians who rent housing.

Source: U.S. Bureau of the Census, *1980 Census of Population and Housing.*

prentcw Proportion of nonlocal construction workers who rent housing = 1.00.

Source: Dunning, C.M., *Report of Survey of Corps of Engineers Construction Workforce*, Research Report 81-R05. Fort Belvoir, VA: Institute for Water Resources (June 1981).

prentm Proportion of off-post military personnel (nationally) who rent housing = 0.64.

Source: 1985 DOD *Survey of Officer and Enlisted Personnel User's Manual and Codebook*, Defense Manpower Data Center, pp 4-39.

rac Proportion of nonlocal construction workers who are accompanied by their spouses and other dependents = 0.60.

Source: Dunning, C.M., *Report of Survey of Corps of Engineers Construction Workforce*, Research Report 81-R05. Fort Belvoir, VA: Institute for Water Resources (June 1981).

radj A residence adjustment to convert income by place of work to income by place of residence. This statistic is defined as (total income by place of work—commuters' income) / total income by place of work.

Source: U.S. Bureau of Economic Analysis, 1980 Census-based Journey-To-Work File.

tbv Total local business volume for 1982. It is calculated by adding total local retail and wholesale trade sales, total local services receipts, and value added for local manufacturers.

Source: U.S. Bureau of the Census, *1982 Censuses of Retail Trade, Wholesale Trade, Selected Services, and Manufacturing.*

totemp The total number of full-time and part-time employees.

Source: U.S. Bureau of Economic Analysis, Regional Economic Information System.

totexp Total direct expenditures in 1982 for all local governments within the geographic boundaries of the study area.

Source: U.S. Bureau of the Census, *1982 Census of Government Finance.*

totpop Total population in 1982.

Source: U.S. Bureau of Economic Analysis, Regional Economic Information System.

tsspw Trade and service sector sales-per-worker-ratio. This is the local ratio of the value of sales to the number of employees (full-time and part-time) for retail and wholesale trade and selected service sectors in 1982.

Source: U.S. Bureau of the Census, *1982 Censuses of Retail Trade, Wholesale Trade, and Selected Services.*

tsypw Trade and service sector earnings per worker ratio. This is the local ratio of earnings to the number of employees (full-time and part-time) for retail and wholesale trade and selected service sectors in 1982.

Source: U.S. Bureau of the Census, *1982 Censuses of Retail Trade, Wholesale Trade, and Selected Services.*

xfers Total revenue from Federal and state governments.

Source: U.S. Bureau of the Census, *1982 Census of Government Finance.*

yres Earnings by place of residence. This is equal to total earnings by place of work plus income of U.S. residents working outside U.S. borders, less income of foreign residents working in the U.S.

Source: U.S. Bureau of Economic Analysis, Regional Economic Information System.

User-Supplied Variables

The following variables are entered into EIFS by the user.

Clab Percentage of construction expenditures used to hire labor (Clab) and to purchase materials and supplies (Cmat). EIFS provides default values Clab = 34.3 percent and Cmat = 57.8 percent. The difference (100.0 - 34.2 - 57.8) = 8.0 reflects additional overhead costs, profits, etc.

Source: U.S. Bureau of Economic Analysis, *The Detailed Input-Output Structure of the U.S. Economy, 1977*, vols I and II (1984).

Clab for a specific construction industry (I-O codes 11.0101 - 12.0216) is calculated by dividing employee compensation (I-O code 88.0000) by total industry output (from Table 1, The Use of Commodities by Industries [refer to the above source]). Cmat is calculated by dividing total intermediate inputs by total industry output. Other possible sources of information are local construction firms and the latest Census of Construction (U.S. Bureau of the Census), which has state-specific receipts and expenditures by type of construction activity, including expenditures for labor and materials.

EXc Dollar value of the contracted service for the AR 5-20 Economic Effects Analysis forecast model. This figure is assumed to represent a contract with a local business establishment.

Sources: (1) U.S. Commercial Activities Office; (2) U.S. Resource Management Office.

EXp Dollar value of expenditures for all services and supplies that are related to the action. This figure is entered by the user when the local purchases are not known. The system then computes an estimated value for the local purchases. Items supplied by General Services Administration (GSA) or Defense Logistics Agency (DLA) are not normally included in EXp. A negative value is entered for a decrease in activity and a positive value is used if there is an expansion. Note that for the Construction forecast model this represents construction expenditures, otherwise these are expenditures for services and supplies.

Sources: (1) U.S. Army Post Comptroller; (2) U.S. Army Resource Management Office.

Pc Number of civilian personnel affected by the action. These are separated or newly added civilian employees. Personnel shifted from one position to another within the same geographic area should not be included. Enter a positive number for an increase or a negative number for a decrease.

Source: post personnel office.

Pm Number of military personnel affected by the military action. These are the transferred (out of the region) or newly added military personnel. Personnel shifted from one position to another on post or within the same geographic area should not be included. Enter a positive number for an expansion or a negative number for a decrease. For the Training forecast model, these are nonbasic trainee-type military personnel.

Source: post personnel office.

Pmigc Proportion of civilians who relocate. The default value for this variable is zero (Pmigc = 0). The actual value will vary depending on work force composition and local availability of labor in the required skill categories. If the employees affected generally are clerical, professional, or highly skilled technical personnel, then it is likely that some of these workers will move to or from other geographic areas. If the action involves a large number of personnel, the proportion of those relocating is also likely to increase. One rule-of-thumb would be to assume that all upper-level personnel will migrate while all clerical and semiskilled personnel will remain in the study area.

Source: post personnel office.

Pmigcw Proportion of construction labor who immigrate to the region to work on the construction project. The default value for this variable is 0.30. This value will vary geographically and according to the skill-mix of the construction workforce used on the project. For example, construction projects in the eastern part of the U.S. use local workers more intensely than projects in the west. In addition, projects which require highly skilled workers will employ a smaller proportion of local workers than projects which need less skilled workers.

Source: Dunning, C.M., *Report of Survey of Corps of Engineers Construction Workforce*, Research Report 81-R05. Fort Belvoir, VA: Institute for Water Resources (June 1981).

Ron Percentage of affected military personnel residing on post.

Source: post housing office.

Roff Percentage of affected military personnel residing off post. (Ron + Roff = 100 percent).

Source: post housing office.

Yc Average annual gross (before tax) income of civilian personnel affected by the action. Average income figures are entered as positive numbers. Income, in EIFS, is a broader concept than just the wages and salaries of employees. Consideration should also be given, if possible, to income earned from second jobs, working dependents, unearned income (i.e., interest, dividends, and rents), etc.

Source: post personnel office.

Ym Average annual gross (before tax) income of all military personnel affected by the military action. The comments about Yc (above) also apply to Ym.

Source: post personnel office.

Calculated Variables

EIFS calculates the following variables:

dBVd Direct change in business activity attributable to the military action. This represents the change in sales volume at local retail and wholesale service establishments where civilian

and military personnel spend their wages and salaries and where local procurements are made. Housing expenditures are also included in this variable.

dBVt Total change in local business volume due to the military action. Business volume is defined as local business activity or sales and is the sum of total retail and wholesale trade sales, total selected service receipts, and value added by manufacturing.

dBVi Induced change in local business volume due to the military action. Defined as the difference between dBVt and dBVd (described above).

dCM Number of civilians who relocate.

dEMd Direct change in local employment due to the military action. These are establishments that are initially affected by the military action.

dEMt Total change in local employment due to the military action. This not only includes the direct and secondary changes in local employment, but also includes those military and civilian personnel who are initially affected by the military action.

dEXl Dollar value of post expenditures for local services and supplies that are related to the military action. This figure is entered by the user directly, if it is known, or an estimate is made by multiplying the total expenditures for services and supplies (i.e., EXp) by a factor representing the local availability of services and supplies. At present, this factor is measured by (1 - 1/ms). The local area for post expenditures should be the same as the study region defined by the user upon entering EIFS. Items supplied by GSA or DLA should not be included, unless they can be traced to local manufactures. A negative value is entered for a decrease in military activity and a positive value is used if there is an expansion. Note that for the Construction forecast model this represents local construction expenditures, otherwise these are local expenditures for services and supplies.

dEXll Change in construction project expenditures used to hire local labor.

dEXlm Change in construction project expenditures used to purchase local services and supplies.

dGE Total change in local government expenditures due to the military action. The EIFS models divide local government expenditures into services for residential and nonresidential (e.g., commercial and industrial) activities. The change in total local governmental expenditures is assumed proportional to the change in off-post population and new civilian employment. EIFS assumes that each new civilian job and each new off-post resident demands equal amounts of services.

dGR Total change in local government revenues due to the military action. The EIFS models separately estimate the change in "own-source" revenues (taxes, charges, utilities, liquor revenues, etc.) and transfer payments from Federal and state governments. The change in "own-source" revenues is assumed to be directly proportional to the change in income by place of residence. The change in intergovernmental transfers is calculated using the existing ratio of transfer payments per capita for the population residing off post, multiplied by the change in off-post population.

dGRn Net change in local government revenues due to the military action.

dMM Number of military personnel who relocate.

dOWN Change in demand for owner-occupied housing (number of units).

dPOP Change in local population (on post and off post) due to the military action.

dPOPoff Change in local off-post population due to the military action.

dRENT Change in demand for local rental housing (number of units).

dS Change in the number of children attending local public schools due to the military action. These children are the dependents of the affected military personnel and civilians who migrate.

dYd Direct change in local wages and salaries due to the military action. This is assumed to be earnings of the employees in local retail, wholesale, and service establishments that are initially affected by the military action.

dYtr Total change in local personal income of residents due to the military action. This not only includes the direct and secondary changes in local personal income, adjusted for commuting patterns, but also includes the income of the civilian and military personnel initially affected by the military action.

dYtw Total change in local wages and salaries earned in the area due to the military action. This is the sum of the direct and secondary changes in wages and salaries plus the income of the civilian and military personnel affected by the military action.

Equations Used In Standard EIFS Forecast Model

dEXl = EXp * (1 - 1/my)

dBVd = dEXl + apcc * Pc * Yc + (apcon * Ron + apcoff * Roff) * Pm * Ym

dBVt = dBVd * my

dBVi = dBVt - dBVd

dEMd = dBVd/tsspw

dEMt = (dBVd/tsspw) * my + Pc + Pm

dYd = (dBVd/tsspw) * tsypw

dYtw = (dBVd/tsspw) * tsypw * my + Pc * Yc + Pm * Ym

dYtr = Pm * Ym * Ron + radj * (BVd/tsspw) * tsypw * my + Pc * Yc + Pm * Ym * Roff

dMM = pmigm * Pm

dCM = Pmigc * Pc

dS = pc * (chc * dCM + chm * dMM)

dPOP = dMM * hhsizm + dCM * hhsizc

dPOPoff = dPOP - dMM * Ron * hhsizm

dRENT = dMM * Roff * prentm + dCM * prentc

dOWN = dCM + dMM * Roff - dRENT

dGR = ownsource * (dYtr/yres) + xfers * (dPOPoff/totpop - basepop)

dGE = totexp * ((dPOPoff + dEMt - Pm) / (totpop - basepop + totemp - milemp))

dGRn = dGR - dGE

Equations Used In Construction Model

dEXl = EXp * (1 - 1 / my)

dEXll = Clab * dEXl

dEXlm = Cmat * dEXl

dBVd = dEXlm + apcc * dEXll

dBVt = dBVd * my

dBVi = dBVt - dBVd

dEMd = dBVd / tsspw

dEMt = (dBVd / tsspw) * my + (dEXll / cypw)

dYd = (dBVd / tsspw) * tsypw

dYtw = (dBVd / tsspw) * tsypw * my + dEXll

dYtr = (dBVd / tsspw) * tsypw * my * radj + dEXll

dCM = Pmigcw * dEXll / cypw

dS = pcw * chcw * Rac * dCM

dPOP = (1 - Rac) * dCM + Rac * dCM * hhsizcw

dPOPoff = dPOP

dRENT = dCM * prentcw

dOWN = dCM - dRENT

dGR = ownsource * (dYtr / yres) + xfers * (dPOPoff / totpop - basepop)

dGE = totexp * ((dPOPoff + dEMt) / (totpop - basepop + totemp - milemp))

dGRn = dGR - dGE

Equations Used In Construction of On-Base Housing Model

dEXl = EXp * (1 - 1/ms)
new: dEXl = EXp * (1 - 1/my)

dEXll = Clab * dEXl

dEXlm = Cmat * dEXl

dBVd = dEX1m + apcc * dEXll + (apcon - apcoff) * Pm * Ym

dBVt = dBVd * ms
new: dBVt = dBVd * my

dBVi = dBVt - dBVd

dEMd = dBVd/tsspw

dEMt = (dBVd /tsspw) * me + (dEXll / cypw)
new: dEMt = (dBVd/sspw) * me + (dEXll/cypw)

dYd = (dBVd/tsspw) * tsypw

dYtw = (dBVd/tsspw) * tsypw * my + dEXll

dYtr = (dBVd/tsspw) * tsypw * my * radj + dEXll

dPOPoff = - Pm * hhsizm

dRENT = - Pm * prentm

dOWN = - Pm - dRENT

dGR = ownsource * (dYtr/yres) + xfers * (dPOPoff/totpop - basepop)

dGE = totexp * ((dPOPoff + dEMt) / (totpop - basepop + totemp - milemp))

dGRn = dGR - dGE

Equations Used in Training Model

dEXl = EXp * (1 - 1/ms)

dBVd = dEXl + (apcon * Ron + apcoff * Roff) * Pm * Ym

dBVt = dBVd * my

dBVi = dBVt - dBVd

dEMd = dBVd / tsspw

dEMt = (dBVd/tsspw) * me + Pm

dYd = (dBVd/tsspw) * tsypw

dYtw = (dBVd/tsspw) * tsypw * my + Pm * Ym

dYtr = Pm * Ym * Ron + radj * ((BVd/tsspw) * tsypw * my + Pm * Ym * Roff)

dMM = pmigm * Pm

dS = 0 (trainees are assumed not to bring their families)

dPOP = dMM * hhsizm

dPOPoff = dPOP - dMM * Ron * hhsizm

dRENT = dMM * Roff * prentm

dOWN = dMM * Roff - dRENT

dGR = ownsource * (dYtr/yres) + xfers * (dPOPoff/totpop - basepop)

dGE = totexp * ((dPOPoff + dEMt - Pm) / (totpop - basepop + totemp - milemp))

dGRn = dGR - dGE

Equations Used in AR 5-20 Economic Effects Analysis Model

dEXl = EXp * (1 - 1/ms)
new: dEXl = EXp * (1 - 1/my)

dBVd = dEXl + dEXc + apcc * Pc * Yc + (apcon * Ron + apcoff * Roff) * Pm * Ym

dBVt = dBVd * ms
new: dBVt = dBVd * my

dBVi = dBVt - dBVd

dEMd = dBVd/tsspw

dEMt = (dBVd/tsspw) * me + Pc + Pm
new: dEMt = (dBVd/tsspw) * my + Pc + Pm

dYd = (dBVd/tsspw) * tsypw

dYtw = (dBVd/tsspw) * tsypw * my + Pc * Yc + Pm * Ym

dYtr = Pm * Ym * Ron + radj * (BVd/tsspw) * tsypw * my + Pc * Yc + Pm * Ym
* Roff)

dMM = pmigm * Pm

dCM = Pmigc * Pc

dPOP = dMM * hhsizm + dCM * hhsizc

dPOPoff = dPOP - dMM * Ron * hhsizm

dRENT = dMM * Roff * prentm + dCM * prentc

dOWN = dCM + dMM * Roff - dRENT

dS = pc * (chc * dCM + chm * dMM)

dGR = ownsource * (dYtr/yres) + xfers * (dPOPoff/totpop - basepop)

dGE = totexp * ((dPOPoff + dEMt - Pm) / (totpop - basepop + totemp - milemp))

dGRn = dGR - dGE

APPENDIX C: Related Tutorials and Other Reference Materials

Related Tutorials

The following tutorials may enhance your EIFS knowledge. To obtain them, contact ETIS, at (217) 333-1369.

1. An Introduction to EIFS (May 1987). 10 pages. An introductory guide to EIFS. Describes what EIFS is, what it can be used for, and the level of knowledge required to use the system effectively. Intended primarily for first-time EIFS users.

2. *EIFS Tutorial: Selecting a Study Area* (June 1987). 11 pages + appendixes (92 pages). A discussion of conceptual and practical issues for selecting study areas for socioeconomic impact analysis. EIFS procedures and commands for selecting regions are described. An extensive appendix section lists the predefined regions available in EIFS (e.g., MSAs, BEA Economic Areas, and military installation regions).

3. *EIFS Tutorial: Deflating Monetary Values* (June 1987). 5 pages. The importance of taking the effects of inflation on monetary inputs used in econometric models into account is discussed. Examples are provided showing how to restate a price index in another base year and how to deflate monetary values.

4. *EIFS Tutorial: The Data Profiles* (June 1987). 51 pages + appendixes (38 pages). This document is an introductory guide to the EIFS data profiles. Through the use of examples the user is shown how to retrieve and display data, save output in files for later use, and download data to a microcomputer.

5. *EIFS Tutorial: The Automated Input-Output Multiplier System* (July 1987). 15 pages + appendixes (13 pages). The Automated Input-Output Multiplier System (AIMS) is a system for generating regional industry-specific input-output multipliers. This paper shows users how to generate and apply AIMS industry multipliers. A case example is provided using AIMS multipliers to estimate the regional economic impacts of a military base closure.

6. *Methods for Evaluating the Significance of Impacts: The RTV and FSI Profiles* (July 1987). 22 pages. EIFS provides two separate procedures for assessing the significance of economic impacts: the Rational Threshold Value (RTV) and the Forecast Significance of Impacts (FSI) profiles. These techniques are described and their use with the EIFS forecast models is illustrated with case examples.

7. *Multiplier Estimation in EIFS* (August 1987). 7 pages. This paper documents the modified location quotient technique for calculating the income and employment multipliers used in the EIFS forecast models.

Papers and Publications

The following papers may increase a user's understanding of the theory behind EIFS.

1. *A Comparison of Alternative Methods for Generating Economic Base Multipliers.* Bloomquist, K.M. Paper presented at the Mid-Continent Regional Science Association Annual Meeting, St. Louis, MO, June 1988.

2. "An Interactive System for Generating Regional Input-Output Multipliers." Bloomquist, K.M., D.P. Robinson, and R.D. Webster. *Modeling and Simulation*, vol 18 (1987), pp 135-140.

3. *An Interactive System for the Retrieval and Display of Census Farm and Land Use Data.* Bloomquist, K.M. Paper presented at the U.S. Army Corps of Engineers' Environmental Planning Conference, Clarion Hotel, New Orleans, LA, March 1987.

4. *A Method for Evaluating the Significance of Sub-Regional Economic Impacts From Military Spending.* Bloomquist, K.M. Paper presented at the Thirty-Third North American Meetings of the Regional Science Association, Columbus, OH, November 1986.

5. "A Decision Support System For Identifying Areas Receiving Economic Impacts From Military Installations." Bloomquist, K.M. *Modeling and Simulation*, vol 17 (1986), pp 147-152.

6. *Employment Impacts Resulting From Contract Awards in Labor Surplus Areas.* Robinson, D.P. Paper presented at the Meetings of the Mid-Continent Regional Science Association in Duluth, MN, 1985.

Applications

Examining the Spatial and Temporal Variation in Regional Consumption Activity. Robinson, D.P., and K.M. Bloomquist. Paper presented at the Southern Regional Science Association Meetings, Morgantown, WV, April 1988.

"Use of Quantitative Models to Identify Socioeconomic Effects of Transportation Investments." Jarzab, J.T. *Operations Review*, Vol 1 (1986), pp 19-30.

"Information for Long-Term Planning of Regional Development." Batey, P.W.J. *Information Systems for Integrated Regional Planning*, P. Nijkamp and P. Rietveld, eds. (1984), pp 63-79.

Other EIFS Documents

1. *Economic Impact Forecast System (EIFS) Fact Sheet.* April 1987. Brief description of EIFS—data, models, status, and points of contact.

2. *Comprehensive Economic Analysis System Procedural Requirements Text.* Robinson, D.P. December 1985. A discussion of issues concerning regional economic impact modeling and a description of the methodologies found in the regional economic models in the Comprehensive Economic Analysis System (CEAS). These are: EIFS, the Local Economic Consequences Study (LECS), the Bureau of Reclamation Economic Assessment Model (BREAM), and the Regional Input-Output Multiplier System (RIMS) (Now AIMS, the Automated Input-Output Multiplier System).

Technical Reports

To obtain a copy of any of these, contact USACERL, PO Box 9005, Champaign, IL (217) 352-6511 or (800) USA-CERL.

1. *Small Area Assessment Model (SAAM): User Manual.* Bloomquist, K.M. Final Report for U.S. Army Corps of Engineers, Institute for Water Resources, February 1988. SAAM (IWR/USACERL) is

an interactive computer-based system for rapidly assessing the local area income and employment impacts associated with water resource projects. The purpose of this document is to describe the assumptions and procedures underlying SAAM and to provide instructions and examples on how to use the model.

2. *Air Force Region of Influence Model (AFROI): User Manual.* Bloomquist, K.M., L. Merritt, and S.R. Pierce. January 1987. Technical Report N-87/08/ADA178251. U.S. Army Construction Engineering Research Laboratories (USACERL). AFROI is an interactive computer system for identifying geographic areas that would receive significant economic impacts following a realignment action. This manual provides information on how to enter AFROI, gather data, and run the model. Several example problems are also included.

3. *Mat—An Interactive Calculator for Matrix Operations: Description and Application Examples.* Bloomquist, K.M., August 1986. Special Report N-86/16/ADA171701. USACERL. Mat is an interactive program for solving systems of equations expressed as matrices. The program is available as an option in CEAS. This report shows how to use Mat to solve problems in matrix algebra, input-output analysis, and regression analysis.

4. *Enhancements to the Economic Impact Forecast System (EIFS).* Robinson, D.P., and R.D. Webster, April 1984. Technical Report N-175/ADA142652. USACERL.

5. *The Two-Tier Concept for Economic Impact Analysis: Introduction and User Instructions.* Webster, R.D., J.W. Hamilton, and D.P. Robinson, August 1982. Technical Report N-127/ADA118855. USACERL. This report describes the two-tier concept for economic analysis of impacts associated with new DOD programs. The first tier is EIFS, which is used for conducting a preliminary screening of the impacts. The second tier is LECS, which provides a detailed analysis of realignment impacts.

6. *Local Economic Consequences Study (LECS) Preliminary User Manual.* Hamilton, J.W., and R.D. Webster, July 1980. Interim Report N-94/ADA088261. USACERL. LECS is an Air Force model that allows users to conduct more in-depth socioeconomic impact analyses of local communities than is possible in EIFS. This report is a hands-on manual that provides user instructions and identifies sources of required data.

7. *Tract Level Socioeconomic Data System (TRACT) User Manual.* Webster, R.D., and A.B. Moy, August 1978. Interim Report N-48/ADA058825. USACERL. Describes the income and population data available in EIFS at the Census tract and minor civil division levels of geographic aggregation.

8. *Development of the Economic Impact Forecast System (EIFS)—The Multiplier Aspects.* Webster, R.D., L. Ortiz, R. Mitchell, and W. Hamilton, May 1978. Technical Report N-35/ADA057936. USACERL. A discussion of the location quotient technique used to calculate the regional income and employment multipliers used in EIFS.

9. *The Rational Threshold Value (RTV) Technique for the Evaluation of Regional Economic Impacts.* Webster, R.D., and E. Shannon, June 1978. Technical Report N-49/ADA055561. USACERL. Describes the development of the RTV Technique for evaluating the significance of socioeconomic impacts.

APPENDIX D: Workshops

ETIS workshops are often scheduled toward the end of every academic semester. Workshop notices appear online. For EIFS, Computerized Environmental Legislative Data System (CELDS), and Environmental Impact Computer System (EICS) training, etc., please contact the ETIS Support Office for registration information and further details:

Planning Information Program (PIP) Office, ETIS Support Center, University of Illinois, 907 West Nevada Street, Urbana, IL, 61801, (217) 333-1369.

GLOSSARY

4 Digit SIC Level: The fourth level of detail for the Standard Industrial Classification code.

AIMS: The Automated Input-Output Multiplier System (AIMS) generates input-output (I-O) multipliers for any county or group of counties in the U.S. AIMS estimates industry-specific multipliers for assessing the economic impacts of proposed activities such as military base realignments or private industry plant closures.

AFROI: The Air Force Region of Influence Model (AFROI) identifies geographic areas that would receive significant economic impacts following a realignment action.

Agglomeration: The combining of several unrelated items, services, activities, or people into one group. The term "agglomeration economies" can apply to a city. A city experiences agglomeration economies when its large size gives the population or companies an advantage by having many diverse services, products, or amenities nearby. For instance, a person living in a large city can visit more museums, have more stories in which to shop, and have a wider range of jobs to choose from than a person living in the smaller city. That person is benefitting from the agglomeration economies of the larger city.

Aggregation: The process of gathering together into a mass or sum so as to constitute a whole or total.

Autocorrelation: A measurement of the dependence among observations at different times.

Average Propensity to Consume: The proportion of household gross income expended for consumption of local goods and services, including housing.

Basic Employment: Employment in the basic sector industries. Basic sector industries bring in income from outside regions. They can be contrasted with nonbasic, or service-sector industries.

Confidence Interval: The interval (a random set of values with upper and lower limits) containing the true value sought with a certain probability.

Degrees of Freedom: The number of independent normal deviates in the description of sums of squares. Estimates of the population variance are calculated using degrees of freedom as a divisor.

Direct Effects: The change in local economic activity due to the first round of spending. For example, if the initial change in expenditures from an export-related activity equals $1 million and the average propensity to consume is 0.80, then the direct effect is equal to $1 million * 0.80, or $800,000.

Double Counting: Counting an observation twice.

Econometric Model: A set of equations designed to provide a quantitative explanation of the behavior of economic variables.

Economic Base Theory: Also referred to as the Export Base Theory. It is the idea that regional economic growth is dependent upon the sales of exports.

Economic Impact Forecast System (EIFS): A computer-based economic modeling and information system that supports regional economic impact analysis by military installations and planners.

EIFS Forecast Models: EIFS forecast models predict the impact of a proposed action on the region of influence.

Elasticity of Demand: The percent change in quantity demanded for a good divided by the percent change in the price of the good.

Exogenous: Originating from outside. An exogenous stimulus to a region's economy is one that comes from outside the region, that is, through the sales of exports. The opposite of exogenous is endogenous.

Export Income Multiplier: The Export Income Multiplier relates the dollar worth of income that results from a $1 change in the region's exports.

Forecast Model: A set of mathematical equations that describes the relationships among key economic and demographic variables in a region. A forecast model is used to estimate the total effects of an exogenous change on a local economy.

Gravity Potential: Describes the spatial interaction, or interdependency between all activities and their locations in large areas.

Induced Effects: The additional changes in local economic activity captured by the multiplier process.

Initial Effects: The change in economic activity associated with the action (e.g., base closure) itself.

Interactive System: A computer program that allows a user to enter commands and data from a keyboard terminal and to usually obtain immediate results. Interactive systems are often characterized as user-friendly and have built-in help facilities.

Location Quotient: This is a number indicating whether a region exports a commodity (e.g., wood products) to other regions or whether it must import that commodity to satisfy local demands. A location quotient greater than 1 suggests that the commodity is exported. A location quotient less than 1 implies the commodity must be imported since insufficient quantities are produced locally; a location quotient equal to 1 means the region neither imports nor exports the commodity. The EIFS forecast models employ the location quotient technique to calculate the multipliers used to estimate the economic effects associated with planning activities.

Multicollinearity: The multiple correlation between one variable and more than one other variable.

Multiplier: A measure of the recirculation of dollars in a local economy.

Price Indexes: A price index is a number that indicates a relative change in the price of a commodity over time or that shows the relative change in an average of the prices for several goods over time.

Profile: An option in EIFS that allows the user to retrieve data or execute an economic impact model for a prespecified study area.

Realignment Action: A change in the normal activities carried out at a military installation that has consequences for the economy of the community where the installation is located.

RTV and FSI: The Rational Threshold Value model (RTV) and the Forecast Significance of Impacts (FSI) help the EIFS user assess the significance of the proposed action's impact on a region.

Spatial Distribution: The distribution of observations across a geographical region.

ABBREVIATIONS AND ACRONYMS

AF	Department of the Air Force
AFB	Air Force Base
AFROI	Air Force Region of Influence
AIMS	Automated Input-Output Multiplier System (formerly RIMS)
AOI	Area of Interest
APC	average propensity to consume
AR	Army Regulation
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BRAC	Base Realignment and Closure
BREAM	Bureau of Reclamation Economic Assessment Model
BX	Base Exchange
CBP	County Business Patterns
CELDS	Computerized Environmental Legislative Data System
CMSA	consolidated metropolitan statistical area
CPI	Consumer Price Index
DA	Department of the Army
DLA	Defense Logistics Agency
DOD	Department of Defense
EICS	Environmental Impact Computer System
EIFS	Economic Impact Forecast System
EIS	Environmental Impact Statement
ETIS	Environmental Technical Information System
FA	Functional Area
FIPS	Federal Information Processing Standard
FIRE	Finance, Insurance, and Real Estate
FSI	Forecast Significance of Impacts
FY	fiscal year
GSA	General Services Administration
INF	Intermediate Nuclear Forces
I-O	input-output
IWR	Institute for Water Resources

LECS	Local Economic Consquences Study
MCP	Military construction program
MFH	military family housing
M-R	minimum requirements
MRM	Minimum Requirements Multiplier
MSA	Metropolitan Statistical Area
MWR	Morale, Welfare, and Recreation
NAF	Nonappropriated Fund
NEPA	National Environmental Policy Act
PMSA	primary metropolitan statistical area
RAS	Regional Accounting System
REIS	Regional Economic Information System
RIMS	Regional Input-Output Multiplier System (now AIMS)
ROI	region of influence
RTV	Rational Threshold Value
SAAM	Small Area Assessment Model
SIC	Standard Industrial Classification
SMSA	standard metropolitan statistical area
TDY	temporary duty
UIUC	University of Illinois at Urbana-Champaign
USACE	U.S. Army Corps of Engineers
USACERL	U.S. Army Contruction Engineering Research Laboratories

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129
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