RIMS II

An essential tool for regional developers and planners

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Welcome

The Bureau of Economic Analysis (BEA) first provided regional input-output multipliers in the early 1970s as a tool to help economists analyze the potential impacts of economic activities on regional economies—for example, the construction of a new sports stadium or a new manufacturing plant. Since then, usage of these multipliers has grown steadily as economic impact studies took on a greater importance and as an increasingly diverse group of users began to take advantage of the tool. Today users of these multipliers, which are produced by the Regional Input-Output Modeling System (RIMS II), include researchers, state and local government officials, civic leaders, planners, students, and others.

We are pleased to present this updated RIMS II user's guide, which we sought to make less technical and easier to understand than previous guides. This guide covers the basic concepts and information needed to appropriately use the model for many applications. It is not intended to cover all aspects of economic impact analysis. But you will find it useful in making informed decisions and avoiding common pitfalls as you conduct economic impact studies.

Is This Guide for You?

This guide is for anyone who conducts or reviews economic impact studies. Even though it focuses on RIMS II, many of the basic concepts carry over to other input-output models.

How to Use This Guide

You can use this guide in several ways.

- Read the guide from start to finish.
- Read chapter 2, "RIMS II Framework," to understand how the model works.
- Read chapter 3, "Basic Application," and the sections in chapters 4, 5, and 6 on special topics that may be relevant to your particular application.

The model's assumptions in chapter 2 should not be overlooked. These assumptions are important in determining whether the model is suitable for a particular impact study.

Conventions Used in This Guide

The guide is organized by topic to make it easy to find the information that is relevant to a particular application. Margin notes are included to highlight important concepts and subtleties that might otherwise be missed. These notes can be helpful in determining whether the information presented in a section relates to your application.

Additional conventions are used in this guide.

- Step-by-step instructions so you can focus on making appropriate choices based on your knowledge of a regional economy.
- Realistic examples so you can better understand important concepts.
- Enough information so you can work through all the calculations.

We hope that you find this guide informative and useful when using our product.

J. Steven Landefeld
Director, Bureau of Economic Analysis

Acknowledgments

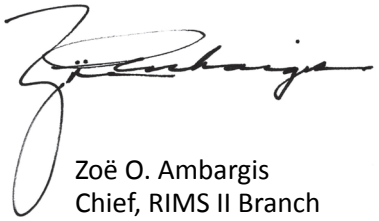
This user's guide was developed over a number of years and driven by our interest in creating a guide to best serve the needs of our customers. To complete this task, we received a considerable amount of support from many of our colleagues.

Special thanks goes to the Regional Input-Output Modeling System (RIMS II) staff, whose support extended well beyond that which could be expected from any staff. Hope Franklin identified the most common questions asked by customers, helped select the topics covered in the User's Guide, and coordinated efforts to ensure that all material fell into place in an orderly fashion. Thomas McComb generated and verified the results for the more technical material, such as the diagrams showing rounds of spending. Stanislaw Rzeznik provided invaluable research assistance on a wide range of topics—from the costs of operating prisons to the costs of new construction projects.

We would also like to give special thanks to the BEA staff members who helped develop the presentation of the material. Danielle Wittenberg prepared the user's guide for publication and solved many of the difficulties we faced when thinking about its design. Colby Johnson designed the diagrams, the cover, and the new RIMS II logo. Jonathan Avery, Lam Cao, and Ralph Rodriguez reviewed and prepared tables for publication.

Many of our other colleagues at BEA and those we know from outside conferences—such as those held by the Association for University Business and Economic Research, the Council for Community and Economic Research, and the Southern Regional Science Association—deserve recognition as well. We have found both sets of colleagues to always be friendly, helpful, and open to sharing their own experiences. We are grateful for their support.

Last, we would like to express our gratitude to our customers who have always given us something new to think about and have always been patient as we continually search for the best ways to convey technical information.



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Chapter 1

Overview

The Regional Input-Output Modeling System (RIMS II), a regional economic model, is a tool used by investors, planners, and elected officials to objectively assess the potential economic impacts of various projects. This model produces multipliers that are used in economic impact studies to estimate the total impact of a project on a region.

The idea behind the results of RIMS II is that an initial change in economic activity results in other rounds of spending—for example, building a new road will lead to increased production of asphalt and concrete. The increased production of asphalt and concrete will lead to more mining. Workers benefiting from these increases will spend more, perhaps by eating out at nicer restaurants or splurging more on entertainment.

Range of Applications

RIMS II multipliers are used to study economic impacts of a wide range of projects. There are a number of common examples.

- Federal, state, and local government agencies use the multipliers to study the local impacts of government regulation on specific industries and to assess the local impacts of transportation projects.
- Economic development organizations, such as chambers of commerce and economic development corporations, use the multipliers to study the local impacts of economic events in their area, such as long-term increases in tourism.
- Businesses use the multipliers to study the local impacts of a wide range of investment projects, such as the construction of a new hotel or the expansion of an existing factory.

The impacts can be expressed in terms of output (sales), value added (gross domestic product), earnings, or employment (full- and part-time jobs) on all industries and on individual industries in the local economy.

Other Considerations

Even though regional I-O models provide an objective way to estimate the economic impacts of projects, there are other factors that decisionmakers may want to consider.

Intangible benefits may also be an important factor in decision-making.

One additional set of factors that may be considered are intangible benefits. These benefits may include increases in public health or quality of life.

To give an example of how intangible benefits may play a role in the decisionmaking process, consider the case where local officials must decide whether to open a new fire station. An economic impact study may show that the impact of the operation of the station will result in only 10 new jobs. Yet if the local government's main objective is to increase public safety, this estimate of new jobs will not provide all of the information needed to make the decision.

Input-Output (I-O) and Macroeconomic Multipliers

Regional I-O multipliers, such as those provided by RIMS II, share similarities with macroeconomic (Keynesian) multipliers. Both types of multipliers provide a way to estimate the total impact that an initial change in economic activity has on an economy. They are both based on the idea that an initial change in economic activity results in diminishing rounds of new spending. Spending diminishes because of "leakages" from the economy in the form of savings, taxes, and imports.

Regional I-O multipliers are not a substitute for macroeconomic multipliers.

Despite their similarities, regional I-O multipliers are not a substitute for macroeconomic multipliers. Macroeconomic multipliers are based on assumptions related to how individuals adjust their labor supply, saving, and consumption decisions when their income changes. These multipliers are also based on estimates of the relationships between broad measures of economic activity, such as income and consumption.

The size of macroeconomic multipliers is closely linked to the marginal propensity to consume, which quantifies the relationship between changes in personal income and consumption. In extended models, the size of the multipliers is influenced by the degree to which individuals shift their consumption, labor supply, and savings across time in response to anticipated changes in taxes, interest rates, or asset prices that may make them feel wealthier or poorer. As competition for scarce resources increases, prices increase and the size of the multiplier decreases.

Regional I-O multipliers are based on a detailed set of industry accounts that measure the goods and services produced by each industry and the use of these goods and services by industries and final users. This detail allows for estimates of the impact of an initial change in economic activity on industries in a region. I-O models do not account for price changes that may result from increased competition for scarce resources.

Regional I-O and macroeconomic multipliers can be similar to one another under certain assumptions.[1] The multipliers are more likely to be similar in size when resources are more readily available in an economy.

1. For a further discussion on how the two different types of models can be related, see Thijs Ten Raa, *The Economics of Input-Output Analysis* (New York: Cambridge University Press, 2005).

Another set of factors that may be considered are any additional costs that may be needed to support a project, such as the costs of increasing public infrastructure.

Related Studies

For important decisions, fiscal impact and economic base studies can be used to complement an economic impact study.

Fiscal impact studies. These studies estimate the costs of local government services needed to support development projects. These costs include any new spending on public infrastructure or any cash incentives to attract new businesses. More sophisticated fiscal impact studies also consider the expected costs of providing more public services, such as education and public safety, resulting from economic growth.

A fiscal impact study considers the cost of a development project.

The fiscal benefits of a project—which include increased revenue from taxes, fees, and user charges—are typically subtracted from the costs of public services to summarize the results of the study.[1]

RIMS II does not provide all of the information needed for a fiscal impact study. Software offered by other government agencies, such as the Federal Reserve Fiscal Impact Tool, and private companies can be used to conduct these types of studies.[2]

Economic base studies. These studies identify the industries that export goods and services and estimate the impact of these exports on the region.[3] The presumption behind these models is that an increase in exports leads to economic growth in the region.

These studies have largely been replaced by economic impact studies, which rely on more sophisticated methods and techniques. Even though I-O models may simplify an analyst's work, the effort involved in conducting an economic base study tends to foster a deeper understanding of a regional economy.

It still makes sense to develop this deep understanding before conducting an economic impact study. The results of any study are only as accurate as the assumptions and information used to create them. By using detailed information on a region's economy, more informed decisions can be made when conducting an economic impact study.

The results of any study are only as accurate as the information used to create them.

1. If additional tax information is provided, an I-O model can be used to estimate the expected increases in tax revenue from a project. However, an I-O model cannot be used to conduct a complete fiscal impact analysis.
2. For a description of the applications that are available to conduct a fiscal impact study, see Jonathan Q. Morgan, "Analyzing the Benefits and Costs of Economic Development Projects," Community and Economic Development Bulletin No. 7 (Chapel Hill, NC: UNC School of Government, April 2007).
3. Additional information on economic base studies can be found in many standard text books on regional analysis, such as Robert J. Stimson, Roger R. Stough, and Brian H. Roberts, *Regional Economic Development: Analysis and Strategies, 2nd ed.* (New York: Springer, 2006).

Notes

Chapter 2

RIMS II Framework

RIMS II is based on a set of national input-output (I-O) accounts that show the goods and services produced by each industry and the use of these goods and services by industries and final users. Like most other regional I-O models, RIMS II adjusts these national relationships to account for regional supply conditions.

The I-O accounts not only provide the basis for the model's multipliers, but they also impose assumptions that need to be recognized when conducting an economic impact study.

Basic I-O Framework

I-O accounts organize producers into *n* industries, where businesses in an industry are assumed to use the same production process. Each industry *i* produces gross output, X_i, which is measured in dollars. This output is sold to industries *j* as intermediate inputs, z_{ij}, or to final users, Y_i,

$$X_i = z_{i1} + z_{i2} + z_{i3} + \ldots + z_{in} + Y_i.$$

The above equation shows how I-O models assume that production takes place under strict linear conditions. A set of relationships called "technical coefficients," a_{ij}, are defined as

$$a_{ij} = z_{ij} / X_j.$$

Each coefficient shows how much of industry *i*'s output is needed to produce a dollar of output in industry *j*. These coefficients show how I-O models assume that industries always use the same proportions of inputs to produce output.

RIMS II Assumptions

The I-O framework underlying RIMS II imposes at least six assumptions that need to be considered when conducting an economic impact study.

- Backward linkages
- Fixed purchase patterns
- Industry homogeneity
- No supply constraints
- No regional feedback
- No time dimension

There are also assumptions in the model related to regional supply conditions that need to be considered when conducting an economic impact study.

Backward linkages. I-O models can measure the impact of an industry's production on other industries in two ways. In a backward-linkage model, an increase in demand for output results in an increase in the demand for inputs. In a forward-linkage model, an increase in the supply of inputs results in an increase in the supply of output.

RIMS II considers only the impacts related to the production of output.

RIMS II is a backward-linkage model. To give an example of the impact measured by RIMS II, consider the expansion of a warehouse. The impacts of the expansion estimated with the model's multipliers will account for the increase in demand for inputs by the warehouse but will not account for the increase in production by the industries that may use the warehouse.[1]

Fixed purchase patterns. I-O models assume that industries do not change the relative mix of inputs used to produce output. They also assume that industries must double their inputs to double their output. If industries can increase their output without hiring as many workers as the model assumes, then using the model's multipliers will produce inflated impact estimates.

These assumptions are a particular concern for industries that employ many part-time or seasonal workers. These industries can often extend the hours of existing workers rather than hire as many workers as the model assumes, particularly if an increase in the demand for an industry's output is viewed as temporary.

RIMS II cannot account for major structural changes in an economy.

Another concern relates to estimating impacts of events that are large enough to alter the structure of a regional economy, such as a catastrophic event or the departure of a major industry. Because the purchase patterns in the model are measured before such events, impacts estimated with the model's multipliers will not adequately capture the new relationships among industries in the region.

Industry homogeneity. I-O models assume that all businesses in an industry use the same production process. If the production process of the business initially affected by a change in economic activity is not consistent with the production process of the industry in the national I-O accounts, using RIMS II multipliers will yield inaccurate impact estimates.

I-O models with more industry detail mitigate potential aggregation bias.

This assumption raises concerns of aggregation bias in I-O models with less industry detail. As industries are grouped together, the same production process is assumed for a wider range of industries. This practice can also assign production to local industries where none actually exist. These concerns suggest that detailed multipliers should be used unless there is a good reason to do otherwise.

No supply constraints. I-O models are often referred to as "fixed price" models because they assume no price adjustment in response to supply constraints.[2] In other words, businesses can use as many inputs as needed without facing higher prices.

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1. For more on backward- and forward-linkage models, see Ronald E. Miller and Peter D. Blair. 2009. *Input-Output Analysis: Foundations and Extensions*. 2nd ed. (New York: Cambridge University Press.)

2. Two types of models have been developed to relax the assumption of fixed prices in I-O models—computable general equilibrium models and hybrid conjoined models. Additional information on these last two types of models can be found in many standard textbooks on regional analysis, such as Ron Shaffer, Steve Deller, and Dave Marcouiller, *Community Economics: Linking Theory and Practice* (Ames, IA: Blackwell Publishing, 2004).

To give an example of how this assumption can affect an economic impact study's results, consider a new plant that manufactures automobile parts. I-O models assume that the new workers needed to work at the plant are available for hire at the existing wage rate. If this is not the case, using the model's multipliers will produce inflated impact estimates.

RIMS II assumes local businesses face constant prices for inputs.

Local supply conditions. RIMS II is based on national I-O relationships that are adjusted to account for local supply conditions. These adjustments account for the fact that local industries often do not supply all of the intermediate inputs needed to produce the region's output. Industries must purchase some intermediate inputs from suppliers outside the region. These purchases are often called leakages because they represent money that no longer circulates in the local economy.

RIMS II accounts for these leakages by considering each industry's concentration in the region relative to its concentration in the nation. This method does not explicitly account for what is often called cross-hauling. Cross-hauling is when a good or service is both an import and an export of a region.

To give an example of how cross-hauling can affect an economic impact study's results, consider a construction project that uses windows that are manufactured outside the region. If windows are manufactured in the region, the model assumes that these windows are purchased rather than those manufactured outside the region. In this case, using RIMS II multipliers is likely to produce inflated impact estimates.

Cross-hauling may be a concern for some economic impact studies.

No regional feedback. RIMS II is a single region I-O model. It ignores any feedback that may exist among regions.

To give an example of how regional feedback can affect an impact study's results, consider a construction project that requires wrought iron fencing that is manufactured in a second region. If the fence manufacturer purchases accounting services from the first region, these services will not be accounted for in the impact estimated for the construction project using multipliers for the first region.

It is unclear how the results of an economic impact study are affected by regional feedback without knowing the details of how a region is economically related to other regions. Choosing a study region that is large enough to encompass a group of interrelated industries can ease concerns of possible feedback effects.

No time dimension. The length of time that it takes for the total impact of an initial change in economic activity to be completely realized is unclear because time

is not explicitly included in I-O models. The actual adjustment period varies and is dependent on the initial change in economic activity and the industry structure that is unique to each region.

The initial change in activity should be persistent enough to work through the economy.

The initial change in economic activity should be permanent or at least persistent enough to fully work through the economy. If the change is not persistent, which is often the case with short-term projects and events, local businesses are likely to hire fewer workers and purchase fewer intermediate inputs from the region than the I-O model assumes.

National I-O Accounts

Three national I-O accounts are used to calculate RIMS II multipliers—the make table, the use table, and the import table. The transactions in these tables are measured over a given year and are stated in producer values.

Producer values exclude trade and transportation margins. These margins, which include sales and excise taxes collected by merchants, are shown as separate purchases by the users of goods and services. Purchaser values equal producer values plus trade and transportation margins.[3]

The make table. The entries in each row of this table show the production of the goods and services by each industry (table 2.1). Diagonal entries show the value of production of the good or service for which the industry has been designated a "primary" producer. Off-diagonal entries show the value of production of "secondary" goods or services—for example, financing services provided by automobile manufacturers. Entries in a row sum to total industry output. Entries in a column sum to total commodity output.

Table 2.1
National Make Table

Table 2.1. National Make Table

[Millions of dollars in producers' prices]

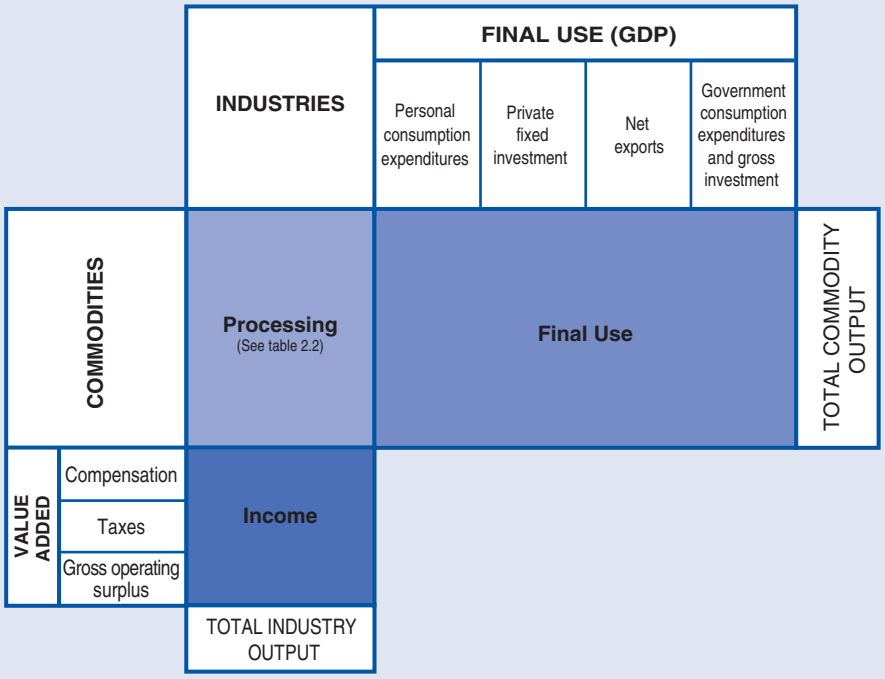
Industries	Commodities								Total industry output
	Agriculture, mining, and utilities	Construction	Manufacturing	Trade	Transportation and warehousing	Services	Government	Other	
Agriculture, mining, and utilities	1,056,504	4,274	16,925	177	377	2,733	1,429	0	1,082,419
Construction	0	1,091,005	0	0	0	0	0	0	1,091,005
Manufacturing	1,045	3,261	4,418,258	52,933	0	43,028	0	3,834	4,522,360
Trade	652	820	18,669	1,983,732	2,946	205,530	0	0	2,212,349
Transportation and warehousing	258	6,868	0	873	700,337	4,114	0	0	712,451
Services	73	27,560	0	39,203	27	11,956,903	0	758	12,024,524
Government	110,297	21,499	7,750	3,683	24,581	426,885	2,559,377	4,978	3,159,049
Total commodity output	**1,168,830**	**1,155,287**	**4,461,601**	**2,080,602**	**728,268**	**12,639,194**	**2,560,806**	**9,570**	**24,804,156**

3. For a more detailed explanation of the concepts underlying the make and use tables, see Karen J. Horowitz and Mark A. Planting, *Concepts and Methods of the U.S. Input-Output Accounts* (Washington, DC: Bureau of Economic Analysis, September 2006). For a description on how to access these accounts, see Mary L. Streitwieser, *A Primer on BEA's Industry Accounts* (Washington, DC: Bureau of Economic Analysis, May 2011).

The use table. This table shows the goods and services used by each industry and final user (figure 2.1). This table has three sections—a processing section, an income section, and a final-use section.

Figure 2.1
National Use Table

Figure 2.1. National Use Table



The processing section forms the basis of RIMS II multipliers (table 2.2). Entries in a column show the value of goods and services used by an industry. In other words, each column shows the "recipe" of intermediate inputs used by each industry to produce its output.

Table 2.2
National Use Table, Processing Sector

Table 2.2. National Use Table, Processing Sector

[Millions of dollars in producers' prices]

Commodities	Industries						
	Agriculture, mining, and utilities	Construction	Manufacturing	Trade	Transportation and warehousing	Services	Government
Agriculture, mining, and utilities	163,394	14,606	611,046	15,849	4,280	93,990	51,349
Construction	16,746	1,127	16,693	4,885	5,580	78,380	71,978
Manufacturing	105,011	280,551	1,475,459	107,061	104,652	466,883	307,105
Trade	21,358	67,089	204,762	44,922	13,078	95,646	45,987
Transportation and warehousing	34,768	15,026	101,729	60,737	70,481	99,026	46,127
Services	97,671	174,852	499,647	356,953	100,155	3,658,861	677,470
Government	266	51	2,351	13,111	9,056	45,385	12,040
Other	1,119	243	25,839	8,401	15,671	44,129	24,487

The income section (figure 2.1) shows three categories of income generated from production—payments to labor (compensation of employees), payments to government (taxes on production and imports), and returns on investment (gross operating surplus). The sum of these categories is value added.

The final use section (figure 2.1) shows four categories of purchases made by final users—purchases by households (personal consumption expenditures); investment in new buildings, equipment, and software by businesses and new housing by households (private fixed investment); net purchases by foreign businesses, households, and governments (net exports), and purchases by governments (government consumption expenditures and gross investment).

Changes in purchases made by final users are used with final-demand multipliers.

Changes in any of these four categories are called final-demand changes. These changes are multiplied by the RIMS II final-demand multipliers to estimate the total impact of the change on the region.

The use table (figure 2.1) shows that Gross Domestic Product (GDP) can be measured in three ways—the expenditure, income, or production approach. The expenditure approach measures GDP as the sum of all final uses—personal consumption expenditures; private fixed investment; net exports, and government consumption expenditures and gross investment. The income approach measures GDP as the sum of total income earned in current production—compensation of employees; taxes on production and imports, and gross operating surplus. The production approach measures GDP as the sum of total output less intermediate inputs across all industries. In other words, it is measured as the sum of value added for all industries.

The import table. Entries in each column of this table show the value of an imported good or service used by each industry or final user. Table 2.3 shows the imported goods and services used by industries in production.

Table 2.3

National Import Table, Processing Sector

Table 2.3. National Import Table, Processing Sector

[Millions of dollars in producers' prices]

Commodities	Industries						
	Agriculture, mining, and utilities	Construction	Manufacturing	Trade	Transportation and warehousing	Services	Government
Agriculture, mining, and utilities	12,347	173	93,839	719	754	3,755	1,339
Construction	0	0	0	0	0	0	0
Manufacturing	11,695	25,584	267,611	20,872	7,554	68,805	33,335
Trade	0	0	0	0	0	0	0
Transportation and warehousing	139	118	584	1,870	2,907	4,361	1,157
Services	223	492	724	4,499	2,257	26,394	2,076
Government	0	0	0	0	0	0	0
Other	1,559	279	19,061	7,894	16,132	42,261	17,101
Total	**25,963**	**26,646**	**381,819**	**35,854**	**29,604**	**145,576**	**55,008**

Output Multipliers

Output multipliers form the basis for all other multipliers.

RIMS II output multipliers are ratios of the total change in local output (sales) to the change in local output purchased by final users. These multipliers form the basis for all other RIMS II multipliers.

The output multipliers are created in four steps. First, the national make, use, and import tables are used to create a domestic direct requirements table. Second, this table is adjusted to create a regional direct requirements table. Third, a

household column and row is added. Last, the regional direct requirements table is used to create a regional total requirements table.

Domestic direct requirements. This table provides information on the first round of intermediate inputs required to produce another dollar of output (table 2.4). This first round includes only domestically produced inputs. In other words, this table accounts for leakages from the national economy.

Table 2.4. Domestic Direct Requirements Table [1]

Industries	Industries					
	Agriculture, mining, and utilities	Construction	Manufacturing	Trade	Transportation and warehousing	Services
Agriculture, mining, and utilities	0.1265	0.0129	0.1045	0.0064	0.0051	0.0070
Construction	0.0146	0.0009	0.0035	0.0021	0.0074	0.0061
Manufacturing	0.0863	0.2336	0.2667	0.0398	0.1359	0.0341
Trade	0.0208	0.0623	0.0463	0.0222	0.0207	0.0127
Transportation and warehousing	0.0309	0.0133	0.0216	0.0256	0.0913	0.0077
Services	0.0859	0.1524	0.1054	0.1511	0.1305	0.2861
Total	**0.3650**	**0.4754**	**0.5480**	**0.2472**	**0.3909**	**0.3537**

1. Government is not included in this table, because RIMS II does not recognize government as a producer. Other is not included, because it consists of commodities and not industries.

Table 2.4
Domestic Direct Requirements Table

This table is created in four steps. First, the transactions in the import table are subtracted from the transactions in the use table. This subtraction produces a domestic use table that includes only the domestically produced goods and services. Second, domestic use coefficients are created by dividing the transactions in each column of the domestic use table by the column total in the use table. Third, make coefficients are created by dividing the transactions in each column of the make table by the column total. Last, the make coefficients are multiplied by the domestic use coefficients to produce a domestic direct requirement table that is on an industry-by-industry basis.

Regional direct requirements. This table provides information on the first round of inputs required to produce another dollar of output (table 2.5). This first round includes only goods and services produced in the region. In other words, this table accounts for leakages from the region.

Table 2.5. Regional Direct Requirements Table

Industries	Industries						Households
	Agriculture, mining, and utilities	Construction	Manufacturing	Trade	Transportation and warehousing	Services	
Agriculture, mining, and utilities	0.0633	0.0065	0.0523	0.0032	0.0026	0.0035	0.0145
Construction	0.0146	0.0009	0.0035	0.0021	0.0074	0.0061	0
Manufacturing	0.0432	0.1168	0.1334	0.0199	0.0680	0.0171	0.0602
Trade	0.0208	0.0623	0.0463	0.0222	0.0207	0.0127	0.1398
Transportation and warehousing	0.0309	0.0133	0.0216	0.0256	0.0913	0.0077	0.0184
Services	0.0859	0.1524	0.1054	0.1511	0.1305	0.2861	0.6151
Households	0.1122	0.2607	0.1213	0.2190	0.2502	0.1727	0.0009
Total	**0.3709**	**0.6129**	**0.4838**	**0.4431**	**0.5707**	**0.5059**	**0.8489**

Table 2.5
Regional Direct Requirements Table

For example, the table shows that to produce $1 output, the agriculture, mining, and utilities industry requires 6 cents of inputs from the local firms in the same industry, 1 cent, 4 cents, 2 cents, 3 cents, 9 cents of inputs, respectively, from local firms in construction (this includes maintenance repair firms only because construction input is not an intermediate input), manufacturing, wholesale and retail trade, transportation and warehousing, and services industries, and 11 cents of labor inputs from local households.

Location quotients are used to account for regional supply conditions.

RIMS II accounts for these leakages by adjusting the relationships in the national direct requirements table with location quotients (LQs).[4] For most industries, these LQs consist of the ratio of an industry's share of local wages and salaries to that industry's share of national wages and salaries.[5] If the LQ for the industry is less than one, the national coefficients in the row are multiplied by the LQ. If the LQ for the industry is one or greater, the national coefficients in the row are not adjusted.[6]

Households. A household row is added to account for local household earnings, and a household column is added to account for local household purchases.

The household column is calculated in five steps.[7] First, household purchases of imports are subtracted from the personal consumption expenditures (PCE) column of the national use table. Second, the resulting values are divided by total PCE to create expenditure coefficients. Third, these coefficients are multiplied by make coefficients to produce a column of expenditures on an industry basis. Fourth, the resulting coefficients are adjusted by LQs in the same manner that the intermediate inputs were adjusted. Last, the adjusted coefficients are reduced to account for leakages stemming from savings and from Federal, state, and local taxes.

The household row consists of the earnings received by local workers in an industry divided by the industry's total output. These earnings consist of both compensation of employees and proprietors' income. Proprietors' income consists of the net earnings of sole proprietors and partnerships, which is included in gross operating surplus.

These calculations are used to create Type II multipliers, which account for both the interindustry and household-spending of a final-demand change. Type I

4. The tradition of using location quotients to determine regional multiplier effects extends back to Walter Isard and Stanislaw Czamanski, "Techniques for Estimating Local and Regional Multiplier Effects of Changes of Major Government Programs," in *Peace Research Society Papers, vol. III* (Germantown, NY: Periodicals Service Company, 1965).

5. The exceptions to the use of wages and salaries in the calculation of location quotients (LQs) include agricultural industries, where cash receipts are used instead. In addition, adjustments are made to the wages and salaries used to calculate the LQs for services to account for the earnings of privately owned businesses that are more typical in the service industries.

6. In RIMS II, the regional direct requirements table is created before any of the detailed industries are combined to form the aggregate industries to reduce the possibility of industry aggregation bias in this later set of multipliers.

7. A national personal saving rate and effective state tax rates are used in the calculation.

multipliers, which account for only the interindustry effect of a final-demand change, are created with a household column full of zeros.

Household Multipliers

Using a household multiplier to estimate the total impacts of a final-demand change can be a conservative alternative to using an industry's final-demand multiplier when most of the intermediate inputs purchased by the industry are produced and supplied by industries outside the region. This alternative method involves multiplying the household multiplier by the change in household earnings in the final-demand industry and adding the result to the change in the final-demand industry.[1]

Multiplying the change in household earnings by the household multiplier results in an estimate of the effect of household spending. Only final-demand multipliers are available for households because households do not produce output. Direct-effect multipliers exist only when labor inputs are used to produce output. In many cases, the final-demand output multiplier for households is less than one. This happens when most of the purchased goods and services are produced outside the region.

Only final-demand multipliers are available for households.

The change in household earnings that is used with the household multiplier should be consistent with the RIMS II definition of earnings. It should also only account for the earnings of workers who live in the region. This change does not need to be adjusted to account for taxes and savings. Taxes and savings are already implicitly accounted for in the value of the multipliers.

The impacts of the change in household earnings on each industry can be calculated with the multipliers in the household column in the industry breakdown tables. For value added, earnings, and employment, the last entry in the household column is used for estimating the impacts on domestic services provided by workers—such as butlers, maids, and gardeners—who are directly employed by households.

1. The household multipliers can also be used to estimate the impact of household spending not originating from local production, such as retiree spending.

Regional total requirements. This table provides information on the first and subsequent rounds of intermediate inputs required to produce another dollar of output (table 2.6). These rounds include goods and services produced in the region that are used by industries and purchased by households in the region.

Table 2.6. Regional Total Requirements Table

Industries	Industries						Households
	Agriculture, mining, and utilities	Construction	Manufacturing	Trade	Transportation and warehousing	Services	
Agriculture, mining, and utilities	1.0776	0.0274	0.0728	0.0152	0.0201	0.0155	0.0321
Construction	0.0188	1.0066	0.0085	0.0065	0.0131	0.0113	0.0089
Manufacturing	0.0843	0.1876	1.1915	0.0659	0.1354	0.0630	0.1235
Trade	0.0661	0.1469	0.1031	1.0858	0.1015	0.0745	0.2068
Transportation and warehousing	0.0484	0.0390	0.0430	0.0447	1.1215	0.0256	0.0460
Services	0.3633	0.6684	0.4447	0.5587	0.6250	1.7214	1.1816
Households	0.2256	0.4460	0.2653	0.3572	0.4333	0.3327	1.2829
Total	**1.6585**	**2.0759**	**1.8636**	**1.7768**	**2.0166**	**1.9113**	**1.5989**

Table 2.6
Regional Total Requirements Table

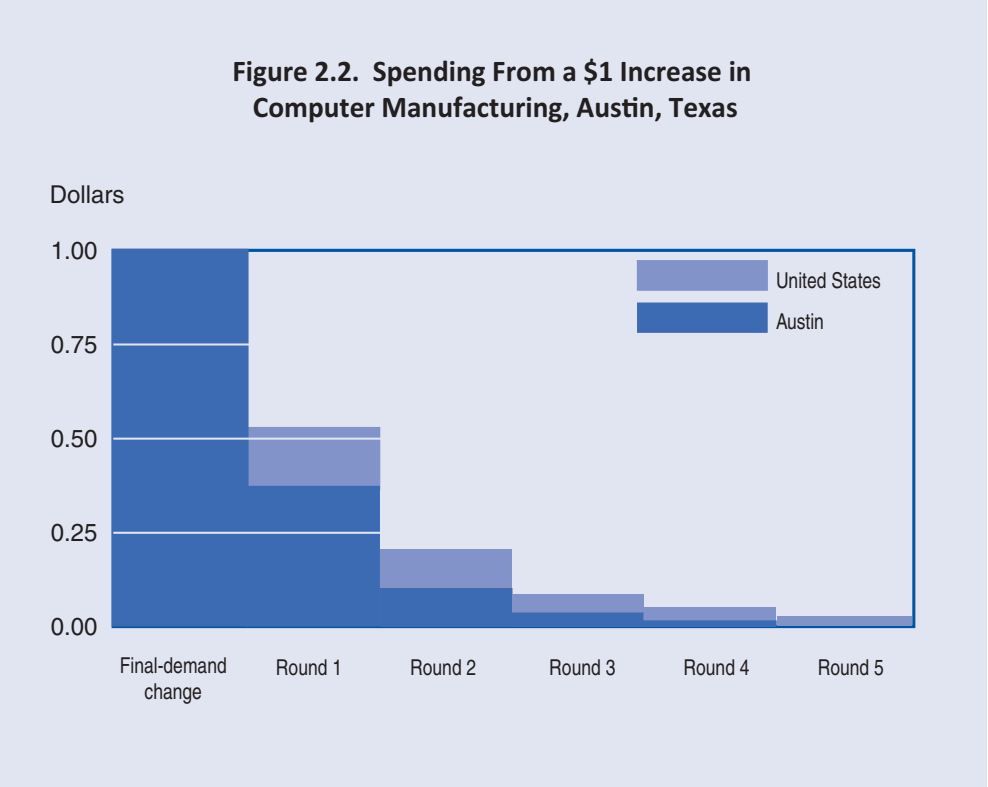
This table is also often called the output multiplier table. The sum of entries in a column equals an industry's final-demand output multiplier.[8] These final-demand multipliers measure the total change in output across all local industries per dollar of change in final demand.

The output multiplier table is created by taking the Leontief inverse of the regional direct requirements table.[9] The intuition behind this calculation is that a change in demand for an industry's output will result in a change in demand for the output of industries that supply intermediate inputs. This will result in a subsequent change in demand for the output of industries that supply intermediate inputs, which creates further change in a diminishing manner.

Figure 2.2 depicts the rounds of spending for a final-demand change. The first column shows a $1.00 increase in the production of computers manufactured in Austin, Texas. This increase requires the computer manufacturer to purchase

Figure 2.2

Spending Resulting From $1 Increase in Computer Manufacturing, Austin



8. Individual entries in a column of the total requirement table show the total impact of a change in activity on a particular industry. These detailed estimates form the basis of the industry breakdown tables that are presented in section 3.

9. This inversion is named after Wassily Leontief, who won a Nobel Memorial Prize for his finding that a final-demand change could be used to predict how an economy would react as measured by a change in total output. This result can be seen by substituting the second set of equations in this section into the first equation in this section and expressing the result in linear algebra form:

$$X = AX + Y$$

which can be rearranged as

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

where $(I - A)^{-1}$ is the Leontief inverse. The predictive form of this last equation is

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

which shows how a final-demand change can be multiplied by the coefficients in the total requirements table to predict total changes in output.

$0.52 of intermediate inputs, such as semiconductors, electronic circuit boards, and electronic storage devices. Only $0.35 of these inputs are purchased from local producers. This requires that these local producers purchase $0.21 of intermediate inputs, such as metals and plastics. Only $0.10 of these inputs are purchased from local producers, and so forth. The sum of these iterative rounds of local spending equals the value of the industry's output multiplier for Austin, Texas, which is 1.4963.

Other Multipliers

RIMS II multipliers that estimate the total impacts on earnings, employment, and value added are also available. These impacts can be calculated by using a change in sales with a final-demand multiplier or by using a change in earnings or jobs with a direct-effect multiplier.

Final-demand multipliers. In addition to the final-demand output multipliers, three other types of final-demand multipliers are available—earnings, employment, and value added.

The earnings multipliers measure the total change in local household earnings per dollar of final-demand change. Earnings consist of wages and salaries and of proprietors' income, which is the net earnings of sole-proprietors and partnerships. Employer contributions for health insurance are also included. These multipliers are calculated by multiplying each entry in the final-demand output multiplier table by the household-row entry in the regional direct requirements table that corresponds to the row industry for the output multiplier.

The employment multipliers measure the total change in the number of local jobs per dollar of final-demand change. Employment consists of full- and part-time jobs. These multipliers are created by multiplying each entry in the final-demand earnings multiplier table by the state-level employment-to-earnings ratio that corresponds to the row industry for the earnings multiplier.

The value-added multipliers measure the total change in local value added per dollar of final-demand change. Value added is comparable to regional measures of GDP. These multipliers are calculated by multiplying each entry in the final-demand output multiplier table by the value-added-to-output ratio in the national use table that corresponds to the row industry for the output multiplier.

Direct-effect multipliers. Two types of direct-effect multipliers are also available—earnings and employment.

The earnings multipliers measure the total change in local household earnings per dollar of change in household earnings in the final-demand industry. These multipliers are calculated by dividing each household-row entry in the regional total requirements table by the corresponding household entry in the regional direct requirements table.

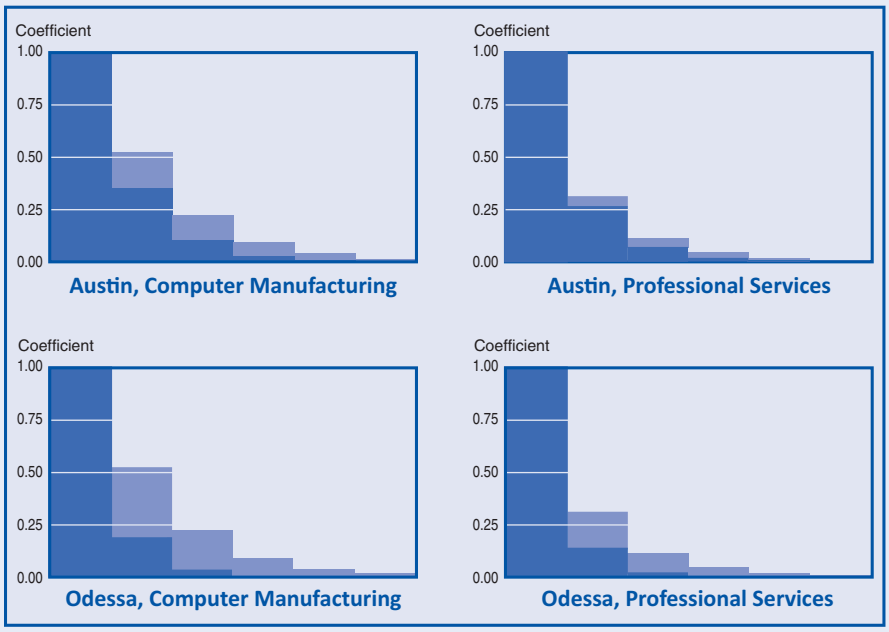
The employment multipliers measure the total change in local jobs per change in jobs in the final-demand industry. These multipliers are calculated by dividing

the final-demand employment multiplier for each industry by the product of the corresponding household-row entry in the regional direct requirements table and the employment-to-earnings ratio for the corresponding industry.

Multiplier sizes are affected by the degree to which industries use local intermediate inputs.

Multiplier Sizes

Multiplier sizes are affected by the degree to which industries use local intermediate inputs. The graphs below illustrate this concept.



The top left panel shows the rounds of spending resulting from a $1.00 increase in computer manufacturing in Austin, Texas. In the second column, the top of the light bar shows the total value of intermediate inputs purchased by the computer manufacturer, while the top of the dark bar shows the total value of these inputs purchased from local producers. The sum of the top of all the dark bars equals the value of the industry's multiplier.

The top left panel can be compared with the rounds of spending resulting from a $1.00 increase in professional and technical services in Austin. A comparison of the light bars shows that the service industry purchases fewer intermediate inputs than the manufacturing industry. This comparison helps explain why the multiplier for the service industry is smaller than the multiplier for the manufacturing industry in Austin.

The bottom two panels show the rounds of spending resulting from a $1.00 increase in computer manufacturing in Odessa, Texas, and from a $1.00 increase in professional and technical services in Odessa, Texas. For these industries, the dark bars show that less intermediate inputs are purchased from local producers in Odessa than in Austin. This comparison also helps explain why the multipliers for these industries are smaller for Odessa than for Austin.

Chapter 3

Basic Application

RIMS II multipliers are ratios of total changes to initial changes in regional economic activity—for example, a total change in jobs to an initial change in sales. When one of these ratios is multiplied by an initial change, the result is an estimate of a total change in a regional economy.

Even though the basic idea behind these multipliers is simple, using them in a suitable manner is often less straightforward. Choosing which multiplier to use, how to define the study region, and how to measure the initial change in economic activity is not always readily apparent. Making appropriate choices requires understanding the basic principles and techniques related to the use of RIMS II multipliers.

User Inputs

The accuracy of an economic impact study's results relies on the choice of the final-demand change, final-demand industry, and final-demand region.

Final-demand change. RIMS II multipliers are only meaningful for analyzing the impact of a final-demand change in a region. Final demand consists of a number of different types of transactions.

- Purchases by consumers outside the region
- Investment in new buildings, equipment, and software
- Purchases by government
- Purchases by households

The related purchased goods or services are called final because they are not used as intermediate inputs by industries in the region.

A final-demand change should account for net purchases of goods and services.

A final-demand change should account for the net purchases of goods and services produced by the initially affected industry. To clarify this concept, consider a new shopping mall. If a portion of the sales at the new mall would have occurred at existing shops, the final-demand change should consist of sales at the new mall less lost sales at existing shops.

Only changes in household purchases made by workers outside the region should be used with Type II multipliers.

In studies using Type I multipliers, all changes in household purchases are final-demand changes. In studies using Type II multipliers, all changes in household purchases must exclude the spending of workers who already both live and work in the region.[1] Household purchases made by individuals who live but do not

1. The presumption is that workers spend most of their earnings closer to home than to their workplace, so spending and living are used interchangeably in this context.

work in the region, such as retirees, are final-demand changes when using both Type I and Type II multipliers.

One of the biggest mistakes made when using Type II multipliers is to use a final-demand change that includes output that is purchased by workers who live in the region. This practice leads to inflated impact estimates because the spending of workers who live in the region is already accounted for in the Type II multipliers.

Investment purchases related to business expansions need to be estimated separately.

Business expansions often require investment in new buildings, equipment, or software.[2] RIMS II treats these purchases as final-demand changes rather than purchases of intermediate inputs because investment purchases are used in production for more than a year. The impact of investment purchases need to be separately estimated and added to the impact of increased business sales.

To give an example of how investment purchases are accounted for in an economic impact study, consider an apparel manufacturer that sees a large increase in sales after opening an online store. Impacts estimated with multipliers for the apparel industry will not include the impact of the computers that were purchased to upgrade the apparel manufacturer's operations. The impact of computer purchases need to be estimated separately and added to the impact of increased apparel sales to estimate the total impact of the business expansion.

Investment purchases exclude maintenance and repair expenses because these expenses are treated as intermediate inputs in RIMS II.

Final-demand industry. This is the industry that is initially affected by the final-demand change.

There are two levels of industry detail in RIMS II–406 detailed industries and 62 aggregate industries.[3] The level of industry detail used in an economic impact study is often determined by practical considerations: it is chosen to match the level of detail of the final-demand change. Multipliers at both levels of detail, which are available in the benchmark series, can be used in the same study.

More current multipliers for aggregate industries may improve a study's results.

Multipliers for the detailed industries are more likely to capture the true structure of the industry and are less subject to aggregation bias. However, these multipliers are often based on less current information. If the structure of the regional economy has changed, more current multipliers for the aggregate industries may improve a study's results.

Final-demand region. This region consists of the geographic area in which the total impact of a final-demand change is measured. Even though the choice of this region often receives little attention, it is one of the most important choices that can be made because it greatly influences a study's results.

2. Investment includes "own-account" software that is developed by business for its own internal use. The value of this particular type of investment is measured by the compensation of employees related to its development and the consumption of fixed capital, a depreciation-like measure that is related to its use in production.

3. The industry detail used in RIMS II is similar to the industry detail used in BEA's benchmark and annual input-output accounts.

The choice of the region depends on the purpose of the study and the questions being asked. The region should be large enough to capture the interdependencies between a group of related industries but small enough that the results are still economically significant—for example, a new manufacturing plant may have a large effect on economic activity in a county but a negligible effect on economic activity in the state.

If using Type II multipliers, the region should encompass where workers will spend most of their earnings. One of the biggest mistakes made when using Type II multipliers is to use a region that is much larger than the region where workers will actually spend their earnings. This practice often leads to inflated impact estimates.

Type II multipliers should be used for a region that just encompasses where workers will spend most of their earnings.

An analyst may be asked for impact estimates for a particular political jurisdiction. Using a political jurisdiction often does not allow RIMS II to properly account for important interrelationships between economic activities—for example, using a multiplier for the county that encompasses Boston does not allow the model to properly account for workers who work in Boston but spend most of their earnings at home in New Hampshire.

Core-based statistical areas, such as the U.S. Office of Management and Budget's metropolitan statistical areas (MSAs), often serve as good choices for a region because they consist of areas with close economic ties.[4] Smaller regions that encompass clusters of industries supporting each other, such as those related to information technology, may also serve as good choices. The smallest geographic area that can be studied in RIMS II is a county.

Model Output

RIMS II provides both final-demand and direct-effect multipliers. Orders for individual regions include multipliers for all RIMS II industries. Orders for individual industries include multipliers for all states and the District of Columbia.

Orders for regions do not include multipliers for each county and state within the region. Multipliers cannot be summed or broken down into constituent regions because this practice does not suitably account for the economic structure of the regions and their relationships with one another. If it is necessary to calculate results for different regions, separate orders must be placed for each region.

Multipliers cannot be summed or broken down into constituent regions.

Final-demand multipliers. When multiplied by a final-demand change, these multipliers provide an estimate of the total impact across all industries in the region (table 3.1). The impact can be expressed in terms of gross output, value added (GDP), earnings, and employment (full- and part-time jobs). These multipliers are often called "per-output" multipliers—for example, final-demand employment multipliers are often called "jobs-per-output" multipliers.

Table 3.1. Final-Demand Multipliers

Multiplier	Definition	Application
Output	Total industry output per $1 change in final demand	Change in final demand x multiplier = total output impact
Value added	Total value added per $1 change in final demand	Change in final demand x multiplier = total value-added impact
Earnings	Total earnings per $1 change in final demand	Change in final demand x multiplier = total earnings impact
Employment	Total jobs per $1 million change in final demand	Change in final demand x multiplier = total jobs impact

Table 3.1
Final-Demand Multipliers

4. For a description of the core based statistical areas defined by the U.S. Office of Management and Budget, see www.census.gov/population/metro.

Value added is comparable to regional measures of GDP.

Output, value added, and earnings are related in the following way: Output is the sum of value added and intermediate inputs. The exclusion of intermediate inputs makes value added comparable to regional measures of GDP. Earnings are a part of value added. The rest of value added consists of taxes on production and imports and of gross operating surplus, which is a profits-like measure.

Employment Multipliers

Because RIMS II employment multipliers are not based on measures of full-time equivalent (FTE) employment, they tend to be higher for the industries that employ more part-time workers. Information on part-time employment is not available for individual regions, but this information is available at the national level in BEA's national income and product accounts.

Part-time employment can heavily influence the value of Type II multipliers for industries that pay high wages.

The following table shows the ratio of FTE to total employment for the industries with the biggest difference between the two measures. Most of these industries, such as food services and retail trade, produce goods and services that are purchased by households. Because all Type II multipliers include the effects of household spending, the difference in full- to part-time employment can heavily influence the value of these multipliers, particularly for industries that pay high wages.

Ratio of FTE to Total Employment

Industry	Ratio
Food services and drinking places	0.78
Amusements, gambling, and recreation industries	0.82
Performing arts, spectator sports, museums, and related activities	0.82
Motion picture and sound recording industries	0.83
Other services, except government	0.84
Retail trade	0.85
Farms	0.86
Social assistance	0.86
Forestry, fishing, and related activities	0.87
Educational services	0.89
Accommodation	0.89
Nursing and residential care facilities	0.89
Ambulatory health care services	0.89
Publishing industries (includes software)	0.90

NOTE. Calculations based on information from BEA's National Income and Product Account tables 6.4D and 6.5D for 2010.

Output is a duplicative total in that the value of goods and services is counted multiple times when these goods and services are further processed in production. Output multipliers can be used to gauge an industry's dependency on the production of other industries in the region. The higher the value of the multiplier, the more the industry depends on other industries in the region.

RIMS II earnings includes the net earnings of sole proprietors and partnerships.

RIMS II earnings consist of wages and salaries and of proprietors' income, which is the net earnings of sole proprietors and partnerships. Employer contributions for health insurance are also included. Personal contributions to social insurance, such as Social Security and Medicare, and employee pension plans are excluded because RIMS II needs to account for only the portion of personal income that is available to spend.

Employment is the number of full- and part-time jobs.

Direct-effect multipliers. When multiplied by a change in earnings in the final-demand industry, a direct-effect earnings multiplier provides an estimate of the total change in earnings across all industries in the region (table 3.2). These multipliers are often called earnings-to-earnings multipliers.

When multiplied by a change in jobs in the final-demand industry, a direct-effect employment multiplier provides an estimate of the total changes in jobs across all industries in the region. These multipliers are often called jobs-to-jobs multipliers.

Table 3.2. Direct-Effect Multipliers

Multiplier	Definition	Application
Earnings	Total earnings per $1 change in earnings in the final-demand industry	Change in earnings in final-demand industry x multiplier = total earnings impact
Employment	Total jobs per one job change in the final-demand industry	Change in jobs in final-demand industry x multiplier = total jobs impact

Table 3.2
Direct-Effect Multipliers

The change in earnings or jobs used with these multipliers should include both full- and part-time workers.

Estimates of total changes based on direct-effect multipliers should result in the same value as estimates based on final-demand multipliers, but differences may occur in practice. These differences occur when the relationships between output, earnings, and employment in RIMS II differ from the relationships in the information gathered for a study.

Type I and Type II multipliers. RIMS II provides Type I and Type II multipliers. Type I multipliers account for the direct and indirect impacts of a final-demand change. The direct impact relates to the first round of inputs purchased by the final-demand industry. [5] The indirect impact relates to the subsequent rounds of inputs purchased by supporting industries. The sum of the direct and indirect impacts is often called the interindustry effect.

Type I multipliers include only inter-industry effects.

Type II multipliers not only account for the interindustry effect, but they also account for the induced impact of a final-demand change. The induced impact relates to the spending of workers whose earnings are affected by a final-demand change. This impact is often called the household-spending effect.

Type II multipliers include inter-industry and household-spending effects.

Breakdown tables. These tables allow for an industry breakdown of the impacts of a final-demand change. The aggregate industries in this table are often referred to as row industries. These tables are available for all four types of final-demand multipliers.

Additional Resources

Additional resources can help when conducting an economic impact study. These resources include BEA's national distribution cost tables, national use tables, and regional accounts.

5. I-O models often refer to the final-demand change as the direct effect and the changes in the output of all supporting industries as the indirect effect. However, in RIMS II, the direct effects consist of the purchases of intermediate inputs made by the initially affected industry during the first round of spending to maintain consistency with the terminology in BEA's national I-O accounts.

Distribution cost tables. These tables provide the information needed to calculate producer value and distribution cost shares. The type of final-demand change determines which table should be used—for example, the distribution cost table for personal consumption expenditures should be used to calculate retail margins for purchases made by households.

The national use table can be used to help gauge whether an industry's multiplier is likely to be small.

National use table. This table shows intermediate purchases and value added for industries at the national level. This information can help in understanding the results of the model—for example, if the share of total intermediate inputs to gross output for an industry is close to zero, then Type I multipliers for the industry are likely to be small.

Regional accounts. These accounts consist of regional statistics on personal income, employment, and GDP. Statistics on personal income and employment are available down to the county level. Statistics on GDP are available down to the MSA level. These statistics can be used to gauge whether a final-demand change is likely to be large enough to alter the structure of the regional economy. In these cases, RIMS II multipliers should not be used, because they will not adequately reflect the new structure of the economy.

Local officials and industry experts are a valuable resource.

Other resources. The information that can help when conducting an economic impact study is not limited to the information available from BEA. Many other government agencies and trade organizations provide statistics that can be used to improve the accuracy of an economic impact study's results. Local officials and industry experts may also provide useful information.

University Example

Basic Application

Basic Example

Consider a private university in Austin, Texas, that plans to offer a new graduate studies program. This university is interested in showing the importance of this program to the local community by estimating its economic impact on the region. The program is expected to increase tuition receipts by $10.0 million and attract students from outside the area.[6] No other local universities plan to offer a similar program.

To conduct the economic impact study, the following decisions are made:

- **Final-demand change.** This change is the expected increase in tuition receipts. Because the program is not expected to draw students away from other local universities, this increase does not need to be reduced to account for lost tuition at other local universities. Most of the new students are expected to come from outside the area, so this increase does not need to be reduced to exclude the purchase of educational services by local residents if Type II multipliers are used.
- **Final-demand industries.** The junior colleges, colleges, universities, and professional schools industry from the benchmark series is chosen because it most closely matches the industry detail available for the final-demand change.

6. Tuition receipts serve as one approach for estimating the output of the new program. An alternative and perhaps better method would be to use all of the university's purchases for running the program with the exception of investment purchases for buildings, equipment, and software.

- **Final-demand region.** The final-demand region is the Austin-Round Rock-San Marcos, Texas, MSA. This region is a good choice when using Type II multipliers because most of the university workers are expected to spend their earnings locally.

Final-demand multipliers. Table 3.3 shows the Type II final-demand multipliers for universities in Austin. Using these multipliers, gross output is expected to increase by $21.9 million ($10.0 million x 2.1871). This estimate includes the $10.0 million increase in tuition receipts. The value-added portion of this output is $13.0 million ($10.0 million x 1.2982). The earnings portion of this value added is $7.6 million ($10.0 million x 0.7603). Employment, which includes both full- and part-time workers, is expected to increase by 240 jobs ($10.0 million x 24.0).

Table 3.3. Type II Final-Demand Multipliers for Universities, Austin-Round Rock-San Marcos, Texas, Metropolitan Statistical Area

Table 3.3
Final-Demand Multipliers for Universities, Austin

Industry [1]	Output	Value added	Earnings	Employment (jobs/ $1 million)
Junior colleges, universities, and professional schools	2.1871	1.2982	0.7603	24.0101

1. Detailed industry from benchmark series

Direct-effect multipliers. If an estimate of the increase in earnings and employment for full-time and part-time university workers is available, direct-effect multipliers can be used to conduct the analysis. Suppose the university expects to hire 150 workers who will live locally. These workers are expected to earn $4.2 million.

Table 3.4 shows the Type II direct-effect multipliers for universities in Austin. Using these multipliers, total earnings in the region are expected to increase $7.2 million ($4.2 million x 1.7261). This estimate includes the $4.2 million in earnings paid to the new university workers. Total employment in the region is expected to increase by 245 jobs (150 jobs x 1.6338). This estimate includes the 150 new jobs at the university.

Table 3.4. Type II Direct-Effect Multipliers for Universities, Austin-Round Rock-San Marcos, Texas, Metropolitan Statistical Area

Table 3.4
Direct-Effect Multipliers for Universities, Austin

Industry [1]	Earnings	Employment
Junior colleges, colleges, universities, and professional schools	1.7261	1.6338

1. Detailed industry from benchmark series

These estimates differ slightly from those estimated with the final-demand multipliers. This result occurs because the relationships between output, earnings, and employment in the information provided for the example differ from the relationships in RIMS II.

Industry Breakdown. Table 3.5 shows the breakdown of the Type II multipliers for each aggregate industry in Austin. Using these multipliers and the $10.0 million final-demand change, gross output in the agriculture, forestry, fishing, and hunting row industry is expected to increase by $10 thousand ($10.0 million x 0.0010). The value added portion of this output is $4 thousand ($10.0 million x 0.0004). The earnings portion of this value added is $2 thousand ($10.0 million x 0.0002). Employment is expected to remain unchanged ($10.0 million x 0.0002).

Table 3.5

Industry Breakdown of Final-Demand Multipliers for Universities, Austin

Table 3.5. Breakdown of Type II Final-Demand Multipliers for Universities, Austin-Round Rock-San Marcos, Texas, Metropolitan Statistical Area

Row industry	Output	Value added	Earnings	Employment (jobs/ $1 million)
Agriculture, forestry, fishing, and hunting	0.0010	0.0004	0.0002	0
Mining	0.0101	0.0051	0.0021	0
Utilities	0.0769	0.0468	0.0148	0.1
Construction	0.0143	0.0071	0.0052	0.1
Manufacturing	0.0562	0.0206	0.0112	0.2
Wholesale trade	0.0558	0.0377	0.0174	0.3
Retail trade	0.0859	0.0563	0.0293	1.2
Transportation and warehousing	0.0251	0.0143	0.0100	0.2
Information	0.0878	0.0485	0.0197	0.3
Finance and insurance	0.1062	0.0612	0.0290	0.5
Real estate and rental and leasing	0.2802	0.2130	0.0264	1.2
Professional, scientific, and technical services	0.0974	0.0641	0.0452	0.7
Management of companies and enterprises	0.0042	0.0026	0.0017	0
Administrative and waste management services	0.0465	0.0297	0.0188	1
Educational services	1.0163	0.5648	0.4466	14.9
Health care and social assistance	0.0845	0.0523	0.0396	1
Arts, entertainment, and recreation	0.0092	0.0055	0.0032	0.2
Accommodation	0.0138	0.0089	0.0041	0.2
Food services and drinking places	0.0403	0.0210	0.0128	0.9
Other services	0.0753	0.0371	0.0220	0.8
Households	0.7603	0.0010	0.0010	0.1
Total	**2.1871**	**1.2982**	**0.7603**	**24**

Using these same multipliers, gross output in the educational services row industry is expected to increase by $10.2 million ($10.0 million x 1.0163). This estimate includes the $10.0 million increase in tuition receipts. The value-added portion of this output is $5.6 million ($10.0 million x 0.5648). The earnings portion of this value added is $4.5 million ($10.0 million x 0.4466). Employment is expected to increase by 149 jobs ($10.0 million x 14.9).

Chapter 4

Wholesale and Retail Sales, Investment Purchases, and Government Services

Three types of final-demand changes require further discussion because of the way RIMS II is constructed—wholesale and retail sales, investment purchases, and government services.

Wholesale and Retail Sales

Estimating the impact of a change in wholesale and retail sales requires special attention: simply multiplying the change in sales by a final-demand multiplier for wholesale trade on retail trade will produce incorrect results because of the way wholesale and retail trade are measured in RIMS II.

In RIMS II, output for retail trade is measured by sales receipts less the cost of goods sold. These costs include the value of goods purchased from manufacturers and the cost of transporting these goods to retailers. If wholesalers sold these goods to retailers, the costs of goods sold will also include a wholesale markup (margin). In other words, output for retail trade is measured by the margin earned by retailers for selling goods. This margin includes any sales or excise taxes collected by retailers and remitted to federal, state, or local government.

Margins are used to separately account for the activity of producers and of retailers.

The use of a margin to measure output for wholesale and retail trade allows RIMS II to focus on the industries that produce goods and the use of these goods by industries and final users. If this standard accounting convention were not used, most production would appear to come from the wholesale and retail trade industries. RIMS II would also be unable to separately account for the output of producers and of wholesalers and retailers, which are often located in different regions.

Method. The impact of a change in retail (or wholesale) sales can be calculated in five steps:

1. Collect information on the change in retail sales by type of purchased good. The value of these sales should include any sales or excise taxes.

2. For each type of purchased good, calculate the national retail margin share. These shares can be calculated with information from the national distribution cost table for personal consumption expenditures.

3. For each type of purchased good, multiply the national retail margin share by the local retail sales to calculate the local retail margin.

4. Sum all the local retail margins calculated in step 3 to get an estimate of the total retail margin.

5. Multiply the total retail margin by the final-demand multipliers for retail trade to estimate the impact of the change in retail sales.

Tourism Example

Retail Sales

Example. To give an example of how to estimate the impact of a change in retail sales, consider an economic development corporation that plans to launch a new advertising campaign to attract more tourists to Branson, Missouri. The campaign is expected to generate an increase in a wide variety of tourism-related activities, including shopping. The corporation wants an estimate of the total impact of the increase in retail sales. Clothing sales at the four local outlet malls are expected to increase by $2.5 million. Gasoline sales are expected to increase by $750 thousand. All of the purchased products are expected to be produced and transported by businesses outside the region.

To conduct the economic impact study, the following decisions are made:

- **Final-demand change.** This change consists of only the retail margin on the increased sales because none of the goods purchased by tourists is expected to be produced, wholesaled, or transported by businesses in the region.
- **Final-demand industry.** Retail trade is the only final-demand industry. Because the detail for retail trade is the same in both the detailed and aggregate industry series, multipliers from the more recent annual series are used in the analysis.
- **Final-demand region.** This region is the Branson, Missouri, Micropolitan Statistical Area. This region is a good choice for the analysis because most of the inputs purchased by retailers are expected to be supplied locally.[1] This region is also good choice when using Type II multipliers because most of the retail sales associates are expected to spend their earnings locally.

Table 4.1 shows national retail margin shares for apparel, leather, and allied products. For each type of product, the retail margin share (column 3) equals the retail margin (column 1) divided by the purchaser value (column 2). The values in the first two columns are from the national distribution cost table for personal consumption expenditures.

Table 4.1

Retail Margins for Apparel, Leather, and Allied Products

Table 4.1. U.S. Retail Margins for Apparel, Leather, and Allied Products

Commodity	Retail margin (millions of dollars)	Purchaser value (millions of dollars)	Retail share
Women's and girls' clothing	72,115	161,036	0.45
Men's and boys' clothing	32,175	97,053	0.33
Children's and infants" clothing	3,431	6,995	0.49
Other clothing materials	0	212	0.00
Footwear	14,641	49,918	0.29
Furniture, furnishings, and floor coverings	64	145	0.44
Household textiles	27	93	0.29
Other sporting and recreational goods	280	744	0.38
Pets, pet products, and related services	318	920	0.35
Photographic goods and services	118	344	0.34
Personal care	7	22	0.32
Personal items	4,460	16,557	0.27
Total	**127,636**	**334,039**	**0.38**

This table shows that the retail shares vary by clothing category. Because no information is available on tourist spending by category, a retail share for all clothing (0.38) is used in the analysis. This share equals the sum of the retail margins ($127.6 million) divided by the sum of the purchaser values ($334.0 million). This calculation implicitly weights the spending across all of the detailed categories in accordance with national spending patterns.

1. Since the cost of goods sold is excluded from the measure of output for retail trade, the purchase of these goods are not treated as intermediate inputs. The primary inputs to this industry are hired labor and business services.

Table 4.2 shows the retail shares for petroleum and coal products. Because tourists are only expected to purchase gasoline, only the share for motor vehicle fuels (0.17) is used in the analysis.

Table 4.2. U.S. Retail Margins for Petroleum Products

Commodity	Retail margin (millions of dollars)	Purchaser value (millions of dollars)	Retail share
Fuel oil and other fuels	4,406	24,843	0.18
Pharmaceutical products	703	2,249	0.31
Motor vehicle fuels, lubricants, and fluids	66,133	386,406	0.17
Total	**71,242**	**413,498**	**0.17**

Table 4.2
Retail Margins for Petroleum Products

Table 4.3 shows the local retail margins for the total expected increase in retail sales in Branson. For each purchased good, the local retail margin (column 3) equals local retail sales (column 1) times the national retail margin share (column 2). The total retail margin is $1.08 million.

Table 4.3. Retail Margins, Branson, Missouri, Micropolitan Statistical Area

Commodity	Retail sales (thousands of dollars)	U.S. share	Local retail margin (thousands of dollars)
Apparel, leather, and allied products	2,500	0.38	950
Motor vehicle fuels, lubricants, and fuels	750	0.17	128
Total	**3,250**	**n.a.**	**1,078**

n.a. Not applicable

Table 4.3
Retail Margins, Branson

Table 4.4 shows the Type II final-demand multipliers for retail trade in Branson. Using these multipliers, gross output is expected to increase by $1.60 million ($1.08 million x 1.4778). This estimate includes the $1.08 million increase in local retail margins. The value-added portion of this output is $1.05 million ($1.08 million x 0.9686). The earnings portion of this value added is $507,384 ($1.08 million x 0.4698). Employment, which includes both full- and part-time workers, is expected to increase by 21 jobs ($1.08 million x 19.4100).

Table 4.4. Type II Final-Demand Multipliers for Retail Sales, Branson, Missouri, Micropolitan Statistical Area

Industry [1]	Output	Value added	Earnings	Employment (jobs/ $1 million)
Retail trade	1.4778	0.9686	0.4698	19.4100

1. Aggregate industries from annual series

Table 4.4
Multipliers for Retail Sales, Branson

This example highlights the importance of separately accounting for the output of manufacturers and of retailers. The impact is considerably smaller when the products are sold, but not manufactured, in the region because only the retail margin affects regional economic activity.

The impact of retail trade is smaller when the products sold are not produced in the region.

Investment Purchases

Business expansions often require investment in new buildings, equipment, and software. RIMS II treats these purchases as final-demand changes rather than as purchases of intermediate inputs because investment purchases are used in production for more than a year. This standard accounting convention allows RIMS II to appropriately account for the costs of capital, labor, and intermediate inputs used in production. [2]

Impacts for two stages of production often need to be estimated for business expansions.

For business expansions requiring investment purchases, impacts need to be estimated for two separate stages of production. The first stage consists of the investment to upgrade the business's facilities, which may include expanding a factory or installing new equipment or software. The second stage consists of the increase in production at the upgraded facilities. The impacts for these two stages are added together to estimate the total impact of the expansion.

Calculating the impact of the construction of a new building is more nuanced than calculating the impact of installing new equipment or software, so a section in chapter 6 is dedicated to construction projects.

Method. The impact of an equipment or software purchase can be calculated in five steps:

1. Collect information on the investment purchase. The purchase price should include any sales taxes.

2. Determine which local industries will be involved in the supply of the investment good to the final-demand industry. If the investment good is purchased directly from a local manufacturer, skip to step 5.

3. Calculate the cost shares for the investment good. These shares can be calculated with information from the national distribution cost table for private fixed investment in equipment and software.

4. Calculate the final-demand change for each local industry involved in the supply of the investment good by multiplying each industry's cost share by the purchase price.

The final-demand changes may not sum to the purchase price for two reasons. First, some businesses involved in the supply of the product may be located outside of the region. Second, the national cost shares may not be representative of the region's cost shares. These shares can be modified if any additional information indicates that the assumptions used to calculate the cost shares could be improved upon.[3]

5. Multiply each final-demand change by the industry's final-demand multiplier and sum the results.

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2. The value of services provided by investment in new buildings, equipment and software are included in industry measures of gross output and gross operating surplus, a profit-like measure that includes a return on capital investment.

3. Final-demand changes often do not sum to the purchaser price when the product is purchased directly from a wholesaler instead of a retailer. In these cases, the producer value and distribution costs are often divided by the purchase price less the retail margin to calculate cost shares.

University Example

Investment Purchases

Example. To give an example of how to estimate the impact of a business expansion requiring investment purchases, consider again the university that plans to offer the new graduate studies program. For this program, the university plans to spend $2.0 million on new computers to convert a classroom into a new computer lab. These computers are expected to be produced, wholesaled, and transported by local businesses.

To conduct the economic impact study, the following decisions are made:

- **Final-demand changes.** There are three separate final-demand changes because the computers will be produced, wholesaled, and transported by local businesses. These changes consist of the production cost, wholesale margin, and truck transportation cost for the purchase.
- **Final-demand industries.** Computer manufacturing, wholesale trade, and truck transportation are the final-demand industries. The aggregate industry series is used in the analysis because it most closely matches the industry detail available for the final-demand changes.
- **Final-demand region.** This region is the Austin-Round Rock-San Marcos, Texas, MSA. This region is a good choice for the analysis because many of the inputs for the computer manufacturer are expected to be supplied locally. This region is also a good choice when using Type II multipliers because most of the manufacturing plant's workers are expected to spend their earnings locally.

Table 4.5 shows the local final-demand changes for the purchase of computers (column 3). These changes are equal to the national shares (column 2) times the $2 million paid for the computers—for example, the final-demand change for truck transportation is $20 thousand ($2 million x 0.01). The national shares are equal to the costs divided by the purchaser value.

Table 4.5

Final-Demand Changes, Austin

Table 4.5. Final-Demand Changes, Austin-Round Rock-San Marcos, Texas, Metropolitan Statistical Area

Category	U.S. purchase		Final-demand change (thousands of dollars)
	Cost (millions of dollars)	Share	
Producer value	52,601	0.77	1,540
Truck transportation	347	0.01	20
Other transportation	111	0.00	n.a.
Wholesale margin	11,773	0.17	340
Retail margin	3,391	0.05	n.a.
Purchaser value	**68,223**	**1.00**	**n.a.**

n.a. Not applicable

Table 4.6 shows the total impact on earnings of the purchase of computers (column 3). For each industry, the impact equals the final-demand change (column 1) times the final-demand earnings multiplier (column 2). Earnings across all industries are expected to increase by $829 thousand.

Table 4.6

Earnings Impact, Austin

Table 4.6. Earnings Impact, Austin-Round Rock-San Marcos, Texas, Metropolitan Statistical Area

Industry [1]	Final-demand changes (thousands of dollars)	Final-demand earnings multiplier	Earnings impact (thousands of dollars)
Computer manufacturing	1,540	0.4089	630
Wholesale trade	340	0.5494	187
Truck transportation	20	0.5829	12
Total	**1,897**	**n.a.**	**829**

1. Aggregate industries from benchmark series
n.a. Not applicable

The total impact on earnings of the new graduate studies program is calculated by adding the impact of the university's purchase of computers to the impact of the increase in university services. In chapter 3, earnings were expected to increase by $7.6 million from the increase in university services. Thus, the total earnings impact of the new graduate program is $8.4 million ($7.6 million + $0.8 million).

Government Services

Estimating impacts of changes in government services often requires information on government purchases.

Estimating the impact of a change in government services requires collecting information on the purchases required to provide these services because of the way RIMS II accounts for government. RIMS II recognizes all government institutions with the exception of government enterprises as purchasers, not as producers, of final goods and services.

RIMS II does provide multipliers for government enterprises, but these multipliers should only be used to study the activity of this limited set of government institutions.[4]

Government enterprises consist of government institutions that cover a substantial portion of their operating costs by selling goods and services to the public. Typical examples of government enterprises include the Government Printing Office, the National Flood Insurance Program, and public utility companies. State universities and public parks may collect admission charges and fees, but they are not treated as government enterprises because their charges and fees cover only a small portion of their operating costs.

General governments provide services without selling them.

The general government sector consist of government institutions that primarily rely on tax receipts or transfer payments to cover their operating costs. They provide services to the general public without selling goods and services to the public. Typical examples of general government include the U.S. military, state legislatures, and local school boards.

Method. The impact of a change in government services can be calculated in seven steps.

1. Decide whether Type I or Type II multipliers will be used in the analysis. If Type II multipliers will be used, the change in the earnings of local government workers is needed. This estimate should be based on the RIMS II definition of earnings, which is provided in chapter 3.

2. Collect information on the government's purchases. This information should be grouped by RIMS II industry.

3. For each type of purchased good, determine which local industries will be involved in its supply to the government.

4. For each type of purchased good, calculate producer and distribution cost shares. These shares can be calculated with information from the national use table.

4. In RIMS II, the activities of public transit authorities and federal utility companies are accounted for in the multipliers for private transit and utility companies. Separate multipliers are also provided for the U.S. Post Office.

5. For each type of purchased good, calculate the final demand for each local industry involved in the supply of the good by multiplying the industry's cost share by the purchase price.

6. Multiply each final-demand change by the industry's final-demand multiplier and sum the results.

7. If the impact is to be expressed as a measure of jobs or earnings, the change in jobs or earnings in the government should be added to the sum of the jobs or earnings impacts calculated in step 6 to estimate the total impact.[5]

If using Type II multipliers, the impact of spending by local government workers needs to be added as well. This impact is calculated by multiplying the change in local government earnings by the household multiplier.

Prison Example

Government Services

Example. To give an example of how to estimate the impact of a change in government services, consider a state prison complex in Cañon City, Colorado, that plans to rent space to house 200 inmates for a neighboring state. On an annual basis, the prison expects to pay $1.4 million in earnings to its new workers and to purchase an additional $990 thousand of goods and services to cover the basic living expenses of the new inmates. The state expects to be reimbursed $3.5 million for providing this service. A representative in the state legislature wants an estimate of the total impact on earnings in both Colorado and Cañon City.

To conduct the economic impact study, the following decisions are made:

- **Final-demand change.** This change is the increase in prison services. Because there are no RIMS II multipliers for general government, information on the purchases made by the prison to house the new inmates is needed.
- **Final-demand industry.** Multipliers for each local industry expected to supply goods and services to the prison are needed. An estimate of the change in earnings paid to prison workers is also needed because Type II multipliers will be used in the analysis. Detailed and aggregate industries from the benchmark series are chosen to match the detail available on the prison's purchases.
- **Final-demand regions.** These regions are the state of Colorado and the Cañon City, Colorado, Micropolitan Statistical Area. Cañon City is a good choice when using Type II multipliers because most of the prison workers are expected to spend their earnings locally. Using Type II multipliers for Colorado instead of for Cañon City may result in inflated impact estimates if the prison's workers spend most of their earnings in Cañon City.

5. The national I-O accounts recognized general government as a producer with the release of the 2002 benchmark accounts. The output of general government is measured as the costs incurred to provide public services. These costs include labor, material, and supplies. They also include the consumption of fixed capital (CFC), a depreciation-like measure. Most analysts will not be able to develop measures of output or value added for a government institution because of a lack of information on CFC.

Table 4.7 shows the purchases made by the prison to house the new inmates. These purchases do not sum to the amount the State will be reimbursed for at least three reasons. First, the agreement between the states does not represent a market sale of prison services. The amount paid to Colorado may have little relation to the actual costs incurred by the prison. Second, these purchases represent only the major intermediate inputs needed to house the new inmates. Third, these purchases do not include the earnings paid to the new workers or a reasonable rate of return for committing new resources to the prison.

Table 4.7
Intermediate Inputs

Table 4.7. Intermediate Inputs Purchased by the Prison

Industry	Purchases (thousands of dollars)
Utilities	155
Maintenance and repair construction	60
Medical supplies	500
Food products	275
Total	**990**

Table 4.8 shows that only two industries in Colorado, utilities and construction, will produce goods or services purchased by the prison. Because there are no trade or transportation margins for these industries, cost shares do not need to be calculated for them. Cost shares do need to be calculated for medical supplies and food products because these goods are purchased from wholesalers in the state.

Table 4.8
Local Supply Conditions, Colorado

Table 4.8. Local Supply Conditions for the Prison's Purchases, Colorado

Industry	Production	Truck transportation	Wholesale trade	Retail trade
Utilities	Yes	n.a.	n.a.	n.a.
Maintenance and repair construction	Yes	n.a.	n.a.	n.a.
Medical supplies	No	Yes	Yes	No
Food products	No	Yes	Yes	No

n.a. Not applicable

Table 4.9 shows the changes in output for each industry in Colorado involved in the production and distribution of goods and services to the prison. The change in output for each industry equals the cost share times the price paid for the intermediate input. These cost shares are based on information in the national use table.

Table 4.9
Changes in Local Output, Colorado

Table 4.9. Final-Demand Changes, Colorado

Category	Medical equipment and supplies			Food products		
	U.S. purchases		Final-demand changes (millions of dollars)	U.S. purchases		Final-demand changes (millions of dollars)
	Cost (millions of dollars)	Share		Cost (millions of dollars)	Share	
Producer value	263	0.84	n.a.	145	0.91	n.a.
Truck transportation	27	0.08	40	3	0.02	6
Other transportation	1	0.00	n.a.	0	0.00	n.a.
Wholesale margin	25	0.08	40	11	0.07	19
Retail margin	0	0.00	n.a.	0	0.00	n.a.
Purchaser value	**315**	**1.00**	n.a.	**159**	**1.00**	n.a.

n.a. Not applicable

Table 4.10 shows that the total impact on earnings in Colorado is $2.1 million. For each industry, this impact (column 3) is calculated by multiplying its output (column 1) by its final-demand multiplier (column 2). This impact is equal to the impact of purchases of intermediate inputs ($193 thousand) plus the initial change in prison worker earnings ($1.4 million) plus the impact of prison worker spending ($550 thousand).

Table 4.10. Type II Earnings Impact, Colorado

Table 4.10
Earnings Impact, Colorado

Industry [1]	Final-demand change (thousands of dollars)	Final-demand earnings multiplier	Earnings impact (thousands of dollars)
Utilities	155	0.4947	77
Construction	60	0.7711	46
Truck transportation	46	0.7086	33
Medical supplies	40	n.a.	n.a.
Food products	6	n.a.	n.a.
Wholesale trade	59	0.6278	37
Medical supplies	40	n.a.	n.a.
Food products	19	n.a.	n.a.
Subtotal (intermediate inputs)	**320**	**n.a.**	**193**
Plus: Initial change in prison workers' earnings	n.a.	n.a.	1,400
Plus: Impact of prison workers' spending	1,400	0.3928	550
Total	**1,720**	**n.a.**	**2,143**

1. Detailed and aggregate industries from benchmark series
n.a. Not applicable

The total impact on earnings in Colorado is largely determined by the new earnings paid to the new prison workers. This initial change in earnings for these workers accounts for over 65 percent of total impact on earnings (($1.4 million / $2.1 million) x 100). The impact of the new spending by these workers accounts for at least 26 percent of the total impact on earnings (($550 thousand / $2.1 million) x 100).[6] The supply of intermediate inputs to the prison has little impact because over half of the prison's new costs are labor expenses and only two of the intermediate inputs are produced in Colorado.

Table 4.11 shows the total impact on earnings in Cañon City. Because the supply of intermediate inputs is likely to have little impact on the region, only the impact of the increase in earnings of local prison workers is considered in the analysis. The total impact ($1.6 million) is calculated by multiplying the earnings paid to prison workers ($1.4 million) by the household multiplier (0.1483) and adding the result to the initial increase in earnings ($1.4 million).

Table 4.11. Type II Earnings Impact, Cañon City, Colorado, Micropolitan Statistical Area

Table 4.11
Earnings Impact, Cañon City

Industry [1]	Final-demand change (thousands of dollars)	Final-demand earnings multiplier	Earnings impact (thousands of dollars)
Prison workers' earnings	1,400	0.1483	208
Plus: Initial change in prison workers' earnings	n.a.	n.a.	1,400
Total	**1,400**	**n.a.**	**1,608**

1. Household multiplier from benchmark series
n.a. Not applicable

The results for the total impact on earnings for Colorado and Cañon City show the importance of choosing the appropriate final-demand region. The household-spending effect is more than twice as large for Colorado ($550 thousand) as for Cañon City ($208 thousand). The estimate for Colorado is likely too high because it is based on the unrealistic assumption that the prison workers will spend their earnings on goods and services produced and sold throughout the state.

Choosing a study region that is too large can lead to unrealistically large impact estimates.

6. This percentage represents a lowerbound estimate because it only includes the household spending effects of prison workers. The household spending effects of the workers in the industries supplying inputs to the prison are accounted for in the impacts calculated with the Type II multipliers for each final-demand industry.

Notes

Chapter 5

Special Topics

Four special techniques can be helpful when conducting an impact study. The first two use RIMS II multipliers to back out an estimate of a final-demand change or a change in jobs or earnings in the final-demand industry. The third provides a way to separately identify the interindustry and household-spending effects of a total impact. The fourth replaces the information for the final-demand industry in RIMS II with detailed information that is specific to a study to improve the accuracy of the study's results.

The multipliers are also sometimes used in contribution studies. These studies estimate an industry's total contribution to a regional economy.

Calculating a Final-Demand Change

A final-demand change can be calculated from an initial change in jobs.

There is often a need to use a final-demand multiplier when only the change in jobs or earnings in the final-demand industry is known. This change can be used with RIMS II multipliers to provide an estimate of the final-demand change.

This calculation can be useful in two other applications—separately identifying the interindustry and household-spending effects of a total change in output or value added and providing a final-demand change for the bill-of-goods method.

Method 1. If a change in jobs in the final-demand industry is available, the final-demand change can be calculated in two steps.

1. For the final-demand industry, divide the final-demand employment multiplier by the direct-effect employment multiplier. Either Type I or Type II multipliers can be used; they will produce the same result. This result is a ratio of the number of jobs per million dollars of output for the final-demand industry.

2. Divide the change in jobs in the final-demand industry by the ratio calculated in step 1. The result is the final-demand change expressed in millions of dollars.

Method 2. If a change in earnings in the final-demand industry is available, the final-demand change can be calculated in two steps.

1. For the final-demand industry, divide the final-demand earnings multiplier by the direct-effect earnings multiplier. Either Type I or Type II multipliers can be used; they will produce the same result. This result is a ratio of the earnings per dollar of output for the final-demand industry.

2. Divide the change in earnings in the final-demand industry by the ratio calculated in step 1. The result is the final-demand change expressed in dollars.

Motor Vehicle Parts Example

Calculating a Final-Demand Change

Example. To give an example that shows how a final-demand change can be calculated, consider a manufacturing plant in Kokomo, Indiana, that decides to hire 250 workers to add a third production shift. The plant produces automobile transmissions that are shipped to an assembly plant in Toluca, Mexico. The mayor, who helped convince the manufacturer to add the third shift, wants an estimate of the total impact of the increase in the plant's production on local GDP (value added) to show the importance of the increase in production to the community.

To conduct the economic impact study, the following decisions are made:

- **Final-demand change.** This change is the increase in transmissions produced for export. The number of workers hired by the manufacturing plant can be used with the final-demand and direct-effect employment multipliers to calculate the final-demand change.
- **Final-demand industry.** The automobile parts manufacturing industry from the benchmark series is chosen for the analysis because it most closely matches the industry detail available for the final-demand change.
- **Final-demand region.** The final-demand region is the Kokomo, Indiana, MSA. This region is a good choice when using Type II multipliers because most of the plant's workers are expected to spend their earnings locally.

Table 5.1 shows the multipliers for the automobile parts manufacturing industry in Kokomo, Indiana. Using the change in jobs in the final-demand industry and the Type I multipliers, the related final-demand change is $109.1 million (250 jobs / (3.3654 / 1.4680)). Using this estimate and the final-demand value-added multiplier, local GDP is expected to increase by $44.8 million ($109.1 million x 0.4102).

Table 5.1

Multipliers for Motor Vehicle Parts, Kokomo

Table 5.1. Multipliers for Motor Vehicle Parts Manufacturing, Kokomo, Indiana, Metropolitan Statistical Area[1]

Type	Final-demand			Direct–effect	
	Value added	Earnings	Employment (jobs/ $1 million)	Earnings	Employment
Type I	0.4102	0.1778	3.3654	1.3508	1.4680
Type II	0.4703	0.1992	4.1447	1.5135	1.8080

1. Detailed industries from the benchmark series

The most recent measure of Kokomo's GDP is $3.7 billion.[1] Based on this information, Kokomo's GDP is expected to increase 2.70 percent as a result of the increase in the plant's production ((($3.8 billion / $3.7 billion) – 1) x 100).

Calculating a Change in Jobs or Earnings

An change in jobs in the final-demand industry can be calculated by a final-demand change.

There is often a need to calculate the change in jobs or earning in the final-demand industry when only the final-demand change is available. The final-demand change can be used with RIMS II multipliers to calculate the change in jobs or earnings in the final-demand industry.

1. See Sharon D. Panek, Slavea A. Assanova, Jake R. Hinson, and Ralph M. Rodriguez, "Gross Domestic Product by Metropolitan Area: Advanced Statistics for 2010 and Revised Statistics for 2007-2009," Survey of Current Business 91 (October 2010).

This calculation can be useful in two applications—separately identifying the interindustry and household-spending effects of a total change in jobs or earnings and providing an initial change in jobs or earnings for the bill-of-goods method.

Method 1. The change in jobs in the final-demand industry can be calculated in two steps.

1. For the final-demand industry, divide the final-demand employment multiplier by the direct-effect employment multiplier. Either Type I or Type II multipliers can be used; they will produce the same result. This result is the ratio of the number of jobs per million dollars of output for the final-demand industry.

2. Multiply the final-demand change by the ratio calculated in step 1. The result is the change in jobs in the final-demand industry.

Method 2. The change in earnings in the final-demand industry can be calculated in two steps.

1. For the final-demand industry, divide the final-demand earnings multiplier by the direct-effect earnings multiplier. Either Type I or Type II multipliers can be used; they will produce the same result. This result is the ratio of the earnings per dollar of output for the final-demand industry.

2. Multiply the final-demand change by the ratio calculated in step 1. The result is the change in earnings in the final-demand industry.

Example. To give an example that shows how an initial change in jobs can be calculated, consider again the manufacturing plant in Kokomo, Indiana. Suppose it is only known that the plant's output is expected to increase by $115.0 million. The mayor would like an estimate of the related increase in jobs at the plant.

Motor Vehicle Parts Example

Calculating a Change in Jobs or Earnings

Using the final-demand change and the Type II multipliers in table 5.1, the plant is expected to hire 263 workers to increase production ($115 million x (3.3654 / 1.4680)). This estimate differs from the final-demand change in the prior example (250 jobs) because the estimate is based on the ratio of jobs to output for the final-demand industry in RIMS II rather than on the information collected for the example.

Separating Impacts

RIMS II does not provide separate estimates of the interindustry and household-spending effects of a final-demand change, but these estimates can be easily created by using the Type I and Type II multipliers.

Interindustry and household spending effects can be separately identified.

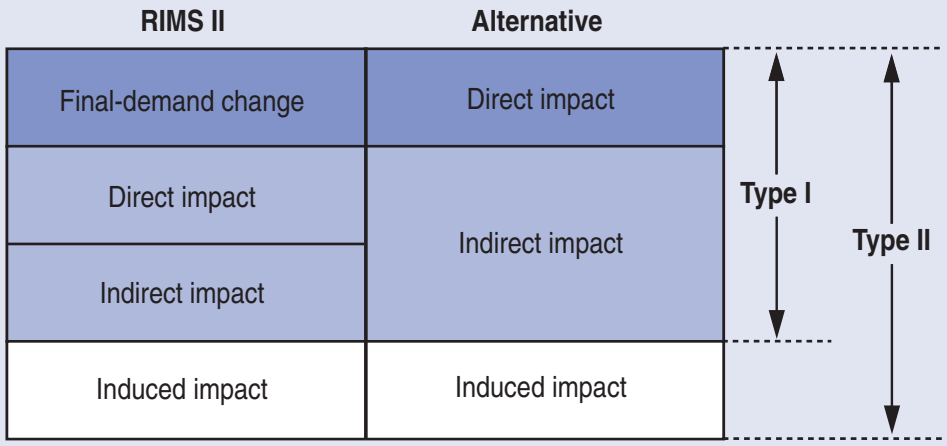
RIMS II uses the following definitions for three types of impacts: the direct impact is the value of inputs purchased in the first round of spending by the final-demand industry; the indirect impact is the value of inputs purchased in subsequent rounds of spending by the supporting industries, and the induced impact is the value of goods and services purchased by all workers whose earnings are affected by the final-demand change.

These definitions are not always consistent with the definitions in other I-O models (figure 5.1). Some models refer to the final-demand change as the "direct impact" and jointly refer to the direct and indirect impacts as the "indirect impact." Regardless, the impacts that can be separately identified in the different models are conceptually the same.

Figure 5.1

Comparison of Impact Definitions

Figure 5.1 Comparison of Impact Definitions



Method. In RIMS II, the separation of impacts can be calculated in three steps.

1. Estimate the Type I and Type II impacts of the final-demand change.

2. If these impacts are expressed in terms of output, subtract the final-demand change from the Type I output impact. The result is an estimate of the direct and indirect impacts expressed in terms of output. If the impacts are expressed in terms of jobs or earnings, subtract the change in jobs or earnings in the final-demand industry from the Type I job or earnings impact. The result is an estimate of the direct and indirect impacts expressed in terms of jobs or earnings.[2]

3. Subtract the Type I impact from the Type II impact. The result is an estimate of the induced impact expressed in the same terms as the total impact.

Motor Vehicle Parts Example

Separating Impacts

Example. To give an example that shows how the impacts of a final-demand change can be separated, consider again the manufacturing plant in Kokomo, Indiana, that plans to hire 250 workers. The mayor would like a separation of the total impact on jobs in the region.

The separation of impacts can be calculated by using the direct-effect employment multipliers in table 5.1. Using these multipliers, the Type I impact of the final-demand change is 367 jobs (250 jobs x 1.4680). The Type II impact of the final-demand change is 452 jobs (250 jobs x 1.8080). Both of these estimates include the 250 jobs at the manufacturing plant. The sum of the direct and indirect impacts is 117 new jobs (367 jobs – 250 jobs). The induced impact is 85 new jobs (452 jobs – 367 jobs).

2. To separate impacts, a final-demand change or a change in jobs or earnings in the final-demand industry may need to be calculated using one of the other techniques in this chapter

Bill-of-Goods

The accuracy of an impact study's results can be improved with the bill-of-goods method. The improved accuracy comes from replacing RIMS II information on the inputs purchased by the final-demand industry with information specific to a particular study. It is important to account for this first round of purchases as accurately as possible because these purchases typically account for a large share of the total impact on the region.

This method requires a great deal of information. This information includes the final-demand change and the first round of purchases made by the final-demand industry. This also includes knowing which local industries will be involved in the supply of goods and services to the final-demand industry.

Reasonable assumptions can be made to replace missing information.

All of this information may not be available. However, the bill-of-goods method can still significantly improve the results of an economic impact study with information on only the major purchases made by the final-demand industry.[3] Reasonable assumptions can also be made to fill in some of the missing information—for example, it can be assumed that most of the intermediate inputs will not be produced locally, an assumption that results in more conservative impact estimates.

Another advantage of the bill-of-goods method is that the sensitivity of results can be examined by seeing how the results would differ under different sets of assumptions.

Method. The impact of a final-demand change can be calculated with the bill-of-goods method in seven steps.

1. Decide whether Type I or Type II multipliers will be used in the analysis. If Type II multipliers will be used, the change in earnings of local workers in the final-demand industry is needed. This estimate should be based on the definition of RIMS II earnings, which is presented in chapter 3.

2. Collect information on the intermediate inputs purchased by the final-demand industry. This information should be grouped by RIMS II industry. The prices paid for these inputs should include any sales or excise taxes.

3. For each type of purchased good, determine which local industries will be involved in its supply to the final-demand industry.

4. For each type of purchased good, calculate producer and distribution cost shares. These shares can be calculated with information from the national use table.

5. For each type of purchased good, calculate the change in output for each local industry involved in its supply by multiplying the cost share by the purchase price.

3. For an assessment of how a bill-of-goods method can improve the accuracy of results based on RIMS II, see Richard M. Beemiller, "Hybrid Approach to Estimating Economic Impacts Using the Regional Input-Output Modeling System (RIMS II)," *Transportation Research Record 1274* (1990).

6. For each local industry involved in the supply of goods and services, multiply the change in the industry's output by the industry's final-demand multiplier and sum the results.

7. If the total impact is to be expressed as a measure of output, add the final-demand change to the sum of the impacts calculated in step 6. If the total impact is to be expressed as a measure of earnings or jobs, add the initial change in earnings or jobs in the final-demand industry to the sum of the earnings or jobs impacts calculated in step 6.

If using Type II multipliers, the impact of the spending of local workers in the final-demand industry needs to be added as well. This impact is calculated by multiplying the change in earnings of workers in the final-demand industry who live in the region by the final-demand multiplier for households.

Computer Manufacturing Example

Bill-of-Goods Method

Example. To give an example that shows how to use the bill-of-goods method, consider a manufacturer in Austin, Texas, that expects its sales of computers to customers outside the region to increase by $100.0 million. To meet this increase, the manufacturer expects the earnings of its workers to increase by $11.5 million, $9.7 million of which is expected to be earned by workers who live in the region. The manufacturer would like an estimate of the total impact on earnings to show the importance of the increase in sales to the local community.

Bill-of-Goods Tips

The bill-of-goods method can greatly improve the accuracy of an economic impact study's results. A number of things should be considered when deciding when to use this method.

- This method can greatly improve the accuracy of results when the purchase patterns in the final-demand industry are notably different from the purchase patterns for the final-demand industry in the national use table.
- This method can greatly improve the accuracy of results when major purchases are made from suppliers outside the region even though they can be supplied by industries in the region.
- When information on local supply conditions is missing, a conservative assumption that can be made is that an intermediate input is produced and supplied by industries outside the region.
- When calculating Type II impacts, the earnings estimate is particularly important because it often makes up the largest share of the inputs purchased by an industry.
- This method is much easier to use when the final-demand industry purchases only a few major intermediate inputs.

To conduct the economic impact study, the following decisions are made:

- **Final-demand change.** Because the new computers are an investment purchase, the final-demand change consists of the manufacturer's increase in sales.
- **Final-demand industry.** Computer manufacturing is the final-demand industry. However, because a bill-of-goods method is used, multipliers for each industry expected to supply intermediate inputs to the computer manufacturer are needed. An estimate of the change in earnings paid to workers at the plant who live in the region is also needed because Type II multipliers will be used in the analysis. The detailed benchmark series is chosen because it most closely matches the industry detail available on the computer manufacturer's purchases.
- **Final-demand region.** This region is the Austin-Round Rock-San Marcos, Texas, MSA. This region is also a good choice when using Type II multipliers because most workers at the plant are expected to spend their earnings locally.

Table 5.2 shows the computer manufacturer's purchases of intermediate inputs. These purchases do not sum to the production cost of the computers for at least two reasons. First, they represent only major purchases of intermediate inputs. Second, they do not include compensation of employees, taxes on production and imports, and a reasonable rate of return for committing assets to the production of the new computers.

Table 5.2. Intermediate Inputs Purchased by the Computer Manufacturer

Table 5.2
Intermediate Inputs

Industry	Purchases (thousands of dollars)
Computer storage device manufacturing	17,900
Computer terminals and other computer peripheral equipment manufacturing	5,900
Semiconductor and related device manufacturing	9,600
Printed circuit assembly (electronic assembly) manufacturing	11,400
Software publishers	8,700
Management of companies and enterprises	8,600
Other	5,000
Total	**67,100**

Table 5.3 shows that four of the intermediate inputs are not produced locally. Two of these inputs, computer storage devices and circuit boards, are not even purchased from local wholesalers or retailers.

Table 5.3. Local Supply Conditions for Intermediate Inputs, Austin-Round Rock-San Marcos, Texas, Metropolitan Statistical Area

Table 5.3
Local Supply Conditions, Austin

Industry	Production	Truck transportation	Wholesale trade	Retail trade
Computer storage device manufacturing	No	No	No	No
Semiconductor and related device manufacturing	No	Yes	Yes	No
Printed circuit assembly (electronic assembly) manufacturing	No	No	No	No
Computer terminals and other computer peripheral equipment manufacturing.	Yes	Yes	Yes	No
Software publishers	No	No	Yes	No
Management of companies and enterprises	Yes	n.a.	n.a.	n.a.

n.a. Not applicable

Table 5.4 shows the changes in output for each local industry involved in the supply of intermediate inputs to the computer manufacturer. The change in output for each industry equals the cost share times the price paid for the intermediate inputs. These cost shares are based on information in the national use table.

Table 5.4
Changes in Local Output, Austin

Table 5.4. Changes in Local Output, Austin-Round Rock-San Marcos, Texas, Metropolitan Statistical Area

Category	Semiconductor and related device manufacturing			Computer terminals and other computer peripheral equipment manufacturing			Software publishers		
	U.S. purchases		Local output (millions of dollars)	U.S. purchases		Local output (millions of dollars)	U.S. purchases		Local output
	Cost (millions of dollars)	Share		Cost (millions of dollars)	Share		Cost (millions of dollars)	Share	
Producer value	3,589	0.86	n.a.	2,189	0.75	4,425	3,214	0.96	n.a.
Truck transportation	22	0.01	96	15	0.01	59	1	0.00	n.a.
Other transportation	9	0.00	n.a.	5	0.00	n.a.	7	0.00	n.a.
Wholesale margin	544	0.13	1,248	717	0.25	1,475	115	0.03	261
Retail margin	0	0.00	n.a.	0	0.00	n.a.	0	0.00	n.a.
Purchaser value	**4,163**	**1.00**	n.a.	**2,926**	**1.00**	n.a.	**3,337**	**1.00**	n.a.

n.a. Not applicable

Table 5.5 shows the total impact on earnings of the $100.0 million increase in computer production. For each industry, the earnings impact (column 3) is calculated by multiplying its output (column 1) by its final-demand earnings multiplier (column 2). The total impact on earnings is $25.3 million. This impact is equal to the impact of purchases of intermediate inputs ($10.5 million) plus the initial change in the computer manufacturing workers' earnings ($11.5 million) plus the impact of computer manufacturer workers' spending ($3.3 million).

Table 5.5
Earnings Impact, Austin

Table 5.5. Type II Earnings Impact of Computer Manufacturing, Austin-Round Rock-San Marcos, Texas, Metropolitan Statistical Area

Industry [1]	Increase in local purchases (thousands of dollars)	Final-demand earnings multiplier	Earnings impact (thousands of dollars)
Computer terminals and other computer peripheral equipment manufacturing	4,425	0.5393	2,386
Management of companies and enterprises	8,600	0.7462	6,417
Wholesale trade	2,984	0.5460	1,629
Semiconductor and related device manufacturing	1,248	n.a.	n.a.
Computer terminals and other computer peripheral equipment manufacturing	1,475	n.a.	n.a.
Software publishers	261	n.a.	n.a.
Truck transportation	155	0.5847	91
Semiconductor and related device manufacturing	96	n.a.	n.a.
Computer terminals and other computer peripheral equipment manufacturing	59	n.a.	n.a.
Subtotal (intermediate inputs)	**16,164**	n.a.	**10,523**
Plus: Initial change in workers' earnings	n.a.	n.a.	11,500
Plus: Impact of workers' spending	9,700	0.3379	3,278
Total	**25,864**	n.a.	**25,301**

1. Detailed industries from benchmark series
n.a. Not applicable

The bill-of-goods method can greatly improve the accuracy of a study's results.

This example highlights how the accuracy of an economic impact study's results can be improved with the bill-of-goods method. If the final-demand change ($100.0 million) is multiplied by the final-demand earnings multiplier for the computer manufacturing industry (0.3551), earnings are estimated to increase by a much larger amount ($35.5 million).

Contribution Studies

Even though RIMS II multipliers are most often used to estimate the impacts of incremental changes in economic activity, such as an increase in exports or the construction of a new highway, the multipliers are sometimes used to estimate an industry's total contribution to a region.

These contribution studies are based on the idea that a local industry supports other industries through its purchases of intermediate inputs. The industry's workers also support other industries by purchasing goods and services.

Interpreting the results of a contribution study is a bit nuanced. Even though results show an industry's current support of a certain level of economic activity or a certain number of jobs in the region, it is unclear what this economy would look like if the local industry truly did not exist. Many workers in the industry would likely have been employed by other industries. Many intermediate inputs purchased by the industry would likely have been sold to other industries.

It is unclear what the economy would look like if an industry no longer existed.

For contribution studies involving more than one final-demand industry, adjustments may need to be made to output to avoid double-counting.

To give an example of the adjustments that may be need to be made, consider a contribution study for all fishing-related industries. Only the fish sold directly to final users should be used with the multipliers for the fishing industry. The fish sold to the food processing and restaurant industries are already accounted for in contributions calculated for the food processing and restaurant industries.

Adjustments may need to be made for contribution studies involving more than one final-demand industry.

Method. An industry's contribution to a region can be calculated in two steps.

1. Collect information on the total value of the industry's output.

2. Multiply the total value of the industry's output by any of the four final-demand multipliers for the industry. The results can be interpreted as the total amount of local economic activity that is currently supported by the industry.[4]

Example. To give an example of how to conduct an industry contribution study, consider the fish processing industry in Bellingham, Washington. The industry's sales are estimated to be $118.5 million. A local fish processing company wants to estimate the industry's contribution to the region to show the industry's importance to the community.

Fish Processing Example

Contribution Study

- **Final-demand change.** There is no final-demand change, per se. Since the company is interested in estimating the contribution made by the entire fish processing industry, the industry's total output is used with the final-demand multipliers for the industry.

4. Contribution studies may also use total earnings or jobs in an industry and direct-effect multipliers to calculate an industry's contribution to a local economy.

- **Final-demand industry.** The seafood product preparation and packaging industry from the benchmark series is chosen for the analysis because it most closely matches the industry under consideration.
- **Final-demand region.** The final-demand region is the Bellingham, Washington, Metropolitan Statistical Area. Since the company is interested in the contribution made by the spending of workers, Type II multipliers are used in the analysis.

Table 5.6 shows the Type II final-demand multipliers for the seafood product preparation and packaging industry in Bellingham, Washington. Using these multipliers, the industry supports $181.4 million in gross output ($118.5 million x 1.5311). This value includes the $118.5 in sales made by the processing and packaging industry. The value-added portion of this output, which is equivalent to gross domestic product, is $54.8 million ($118.5 x 0.4628). The earnings portion of this value added is $34.3 million ($118.5 x 0.2898). The employment supported by this industry, which includes both full- and part-time jobs, is 774 jobs ($118.5 million x 6.5286).

Table 5.6

Multipliers for Seafood Packaging, Bellingham

Table 5.6. Type II Final-Demand Multipliers for Bellingham, Washington, Metropolitan Statistical Area

Industry[1]	Output	Vale added	Earnings	Employment (jobs/$1 million)
Seafood production preparation and packaging	1.5311	0.4628	0.2898	6.5286

1. Detailed industry from the benchmark series

Chapter 6

Tourism and Construction

Industries

There are two common types of impact studies where additional guidance may be useful—tourism and construction studies.

Tourism

Even though RIMS II multipliers are well-suited for many tourism impact studies, a number of common mistakes are made.

Separate impacts need to be calculated for each tourism-related industry.

One common mistake is to multiply tourist spending by an average of the multipliers for all tourism-related industries. This practice unrealistically assumes that tourist spending is equally distributed across all of these industries—for example, it assumes that the amount spent on accommodations is equal to the amount spent on entertainment. To avoid this practice, an analyst should collect enough information on the purchases made by tourists to separately calculate the impact of increased spending for each tourism-related industry. [1]

A second common mistake is to multiply retail sales by a final-demand multiplier for retail trade. This practice does not appropriately account for the way retail trade is measured in RIMS II and results in inflated impact estimates. To avoid this practice, an analyst needs to calculate the retail margin on sales if using a final-demand multiplier for retail trade.[2]

Estimating the impacts of tourist spending for short-term events likely leads to inflated estimates.

A third common mistake is to estimate the impacts of tourist spending for short-term events, such as major sporting events and week-long music festivals. For these types of events, local restaurants, hotels, and gift shops are unlikely to hire as many workers or purchase as many intermediate inputs from the region as the model assumes. To avoid this practice, an analyst should refrain from using multipliers for studies of these types of events.

Method. For long-term events, the impact of tourism spending can be calculated in four steps.

1. Collect information on the types of purchases that are likely to be made by tourists. The value of these purchases should include any sales, excise, or lodging taxes collected by sellers.

2. For each service other than retail trade, multiply the purchases made by tourists by the industry's final-demand multiplier. The result is the impact of the increase in each service on the region.

1. This information is typically collected on surveys that identify the purchases of tourists. These surveys can be important because these purchases are likely to vary widely across regions.
2. The section on retail trade shows how to calculate a retail margin.

3. Calculate the impact of retail sales, which is discussed in chapter 4. The result is the impact of the increase in retail sales on the region.

4. Sum the impacts calculated in steps 2 and 3. The result is the total impact of the increase in tourism spending on the region.

Tourism Example

All Tourist Spending

Example. To give an example of how the impact of tourism spending can be calculated, consider again the case of the new advertising campaign to attract visitors to Branson, Missouri. The economic development corporation is interested in estimating the total impact of the expected increase in all tourist spending on earnings. The new advertising campaign is estimated to attract 25 thousand additional tourists who are expected to spend $21.5 million on an annual basis.

To conduct the economic impact study, the following decisions are made:

- **Final-demand changes.** There are many final-demand changes because the new tourists are expected to purchase goods and services from many different industries. Because these purchases are expected to only be made by visitors, Type II multipliers can be used without the need to subtract purchases made by local residents.
- **Final-demand industries.** These industries include accommodation, food, entertainment, retail, and travel services. Multipliers from the annual series are used because they are based on more recent information and more closely match the industry detail on spending.
- **Final-demand region.** The final-demand region is the Branson, Missouri, Micropolitan Statistical Area. This region is a good choice when using Type II multipliers because most of the workers in the tourism-related industries are expected to spend their earnings in the region.

Table 6.1 shows the expected increases in purchases for each tourism-related industry in Branson. Purchases are expected to increase the most for accommodations ($7.0 million) and food services ($5.8 million). Because the region is a mecca for live entertainment and has its own amusement park, purchases are also expected to increase a considerable amount for entertainment services ($4.8 million). Last, purchases are expected to increase at local retail outlet stores and gas stations ($3.3 million) and at travel agencies ($750 thousand).

Table 6.1

Tourist Purchases, Branson

Table 6.1. Tourist Purchases, Branson, Missouri, Micropolitan Statistical Area

Industry	Increase in local purchases (thousands of dollars)
Accommodations	7,000
Food services and drinking places	5,750
Entertainment	4,750
Performing arts, spectator sports, museums, zoos, and parks	3,500
Amusements, gambling and recreation	1,250
Retail trade	3,250
Apparel, leather, and allied products	2,500
Motor vehicle fuels, lubricants, fluids	750
Administrative and support services	375
Other transportation and support activities	375
Total	**21,500**

Table 6.2 shows the total earnings impact on the region. This impact ($8.8 million) equals the sum of the earnings impacts for each tourism-related industry. With the exception of retail sales, the impact equals the increase in tourist spending times the industry's final-demand earnings multiplier. The impact for

retail sales equals the retail margin for all retail sales times the final-demand earnings multiplier for retail trade.[3]

Table 6.2. Type II Earnings Impact of Tourist Purchases, Branson, Missouri, Micropolitan Statistical Area

Table 6.2
Earnings Impact, Branson

Industry[1]	Increase in local purchases (thousands of dollars)	Final-demand earnings multiplier	Earnings impact (thousands of dollars)
Accommodations	7,000	0.3972	2,780
Food services and drinking places	5,750	0.4109	2,363
Entertainment	4,750	n.a.	n.a.
Performing arts, spectator sports, museums, zoos, and parks	3,500	0.6427	2,249
Amusements, gambling and recreation	1,250	0.3922	490
Retail	1,078	0.4698	506
Apparel, leather, and allied products	950	n.a.	n.a.
Motor vehicle fuels, lubricants, fluids	128	n.a.	n.a.
Administrative and support services	375	0.4947	186
Other transportation and support activities	375	0.5169	194
Total	**19,328**	**n.a.**	**8,768**

1. Aggregate industries from annual series
n.a. Not applicable

The total impact on earnings is largely determined by increases in accommodations, food services, and entertainment. The impact of these purchases account for almost 90 percent of the total impact ($7.8 million / $8.8 million). Even though retail purchases account for 15 percent of the expected increase in total purchases ($3.3 million / $21.5 million), retail purchases account for only 6 percent of the total impact ($506 thousand / $8.8 million). These sales have little impact because local retailers only earn a margin on the goods they sell.

Construction

For many construction projects, the bill-of-goods method is the best approach for estimating impacts because RIMS II multipliers for the construction industry are based on national averages across a wide variety of construction projects. By using the bill-of-goods method, an analyst can replace these averages with information that is specific to an individual construction project.

Information in the national use table suggests that RIMS II multipliers for the construction industry are more suited for estimating the impacts of commercial and residential construction projects. The intermediate inputs for these projects account for 55 percent of the intermediate inputs for the entire construction industry (table 6.3).[4] Other nonresidential structures account for only 29 percent of the industry's purchases, and maintenance and repair account for the rest.[5]

Table 6.3. Selected Economic Measures by Construction Category

Table 6.3
Selected Economic Measures, Construction

Construction category	Share					
	Gross output	Intermediate inputs	Value added	Compensation of employees	Taxes on production and imports, less subsidies	Gross operating surplus
Nonresidential commercial, health care, and manufacturing structures	0.15	0.16	0.14	0.18	0.21	0.11
Other nonresidential structures	0.28	0.29	0.28	0.31	0.29	0.21
Residential structures	0.43	0.39	0.48	0.36	0.34	0.48
Maintenance and repair	0.13	0.16	0.11	0.15	0.16	0.20
Total	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

3. The retail margins used in this example are the same retail margins calculated for the retail trade example in chapter 4.

4. In the national benchmark I-O accounts, there are five industries for new construction and two industries for maintenance and repair. In RIMS II, these seven industries are combined into a single industry because of a lack of detailed information on regional construction earnings.

5. The category of other nonresidential structures is highly diverse. This category not only includes buildings—such as churches, hotels, and prisons—but it also includes roads, bridges, airports, rail yards, communication towers, oil rigs, and power lines.

The use of local labor should be identified.

One possible concern when using multipliers for the construction industry is that some construction projects use specialized workforces from outside the region—for example, ironworkers may be brought in to build a bridge. Since RIMS II assumes that local workers can work on all types of construction projects, the construction multipliers may produce inflated impact estimates for projects that use specialized, nonlocal labor.

The bill-of-goods method can provide more accurate estimates when specialized workforces from outside the region are used in a construction project. This method can also be used to appropriately account for other inputs that may be produced locally but purchased from outside the region.

Method. The seven steps of this method are presented again with specific guidance for construction projects.

1. Decide whether Type I or Type II multipliers will be used in the analysis. If Type II multipliers will be used, an estimate of the change in earnings of local construction workers is needed. This estimate should be based on the definition of RIMS II earnings, which is presented in chapter 3.

2. Collect information on the intermediate inputs purchased by the construction company. This information should be grouped by RIMS II industry.

Any equipment permanently installed in a new structure, such as an elevator or air conditioning system, should be treated as an intermediate input rather than as an investment purchase. This practice maintains consistency with how these purchases are treated in the model.

Labor and material costs should be separately identified.

The construction company may subcontract work to specialists, such as electricians, plumbers, masons, and roofers. In these cases, the cost of labor and materials need to be separately identified before using the multipliers.

The financing of construction projects often causes confusion when conducting an economic impact study. If construction equipment is financed with an operating lease and used on multiple projects, the amount paid on the lease should be prorated to appropriately measure the leasing services for the project. If construction companies take out a commercial loan to pay its workers and purchase intermediate inputs, taking about 2.0 percent of the total loan amount will provide a reasonable estimate of the related purchase of banking services.[6]

6. Two types of services are accounted for in the multipliers for the banking industry—explicit and implicit banking services. For a commercial loan, the explicit services include loan origination fees, which are often amortized and included in loan payments. The implicit services include any costs incurred by the bank to provide borrowing services that are included in the interest rate. Both types of service are typically valued at about 2.0 percent of the total amount of the loan.

3. For each purchased good, determine which local industries will be involved in its supply.

Care should be taken to determine the local supply conditions for architectural and banking services. These services can constitute a large share of a construction project's total cost and are easily provided by businesses outside the region. Improperly treating these as locally purchased services can notably affect the accuracy of an economic impact study's results.

4. For each purchased good, calculate producer and distribution cost shares. These shares can be calculated with information from the national use table.

5. For each purchased good, calculate the change in output for each local industry involved in its supply by multiplying the industry's producer or cost share by the purchase price.

6. For each local industry involved in the supply of goods and services to the construction company, multiply the change in the industry's output by the industry's final-demand multiplier.

7. If the total impact is to be expressed as a measure of output, add the final-demand change to the sum of the output impacts calculated in step 6. If the total impact is to be expressed as a measure of earnings or jobs, add the sum of the earnings or job impacts calculated in step 6 to the change in earnings or jobs in the final-demand industry.

If using Type II multipliers, the impact of the spending of local construction workers needs to be added as well. This impact is calculated by multiplying the change in earnings for local construction workers by the final-demand multiplier for households.

Road Construction Example

Bill-of-Goods Method

Example. To give an example of how the bill-of-goods method can be used for a construction project, consider a local construction company that wins a bid to construct a highway in Greensboro, North Carolina. The company will be paid $100.0 million upon completion of the project. The state would like to estimate the total impact on output of the project on the region.

To conduct the economic impact study, the following decisions are made:

- **Final-demand change.** This change consists of the amount that will be paid to the construction company to construct the highway.
- **Final-demand industry.** Construction is the final-demand industry. However, since a bill-of-goods method will be used in the analysis, the multipliers for each industry expected to supply intermediate inputs to the construction company are needed. The detailed benchmark series is used in the analysis because it most closely matches the industry detail available for the inputs purchased by the construction company.

- **Final-demand region.** This region is the Greensboro, North Carolina, MSA. Because it is not clear where many of the construction workers will spend their earnings, Type I multipliers are used in the analysis to provide more conservative impact estimates.

Table 6.4 shows the construction company's purchases of intermediate inputs. These purchases do not sum to the contract price for at least three reasons. First, the total ($31.3 million) does not include any of the overhead costs related to bidding on the contract. Second, the sum represents only major purchases of intermediate inputs. Third, the sum does not include compensation of employees, taxes on production and imports, and a reasonable rate of return for committing resources to the project.

Table 6.4
Intermediate Inputs

Table 6.4. Intermediate Inputs Purchased by a Construction Company

Industry	Purchases (thousands of dollars)
Stone mining and quarrying	7,000
Petroleum refineries	10,000
Asphalt paving mixture and block manufacturing	7,500
Ready-mix concrete manufacturing	750
Monetary authorities and depository credit intermediation	2,000
Commercial and industrial machinery and equipment repair and maintenance	4,000
Total	**31,250**

The financing of the construction project is reflected in the purchases of intermediate inputs in the following manner: The construction company owns all of the equipment that will be used on the project. Because there are no outstanding loans for this equipment, no leasing services will be purchased. The company will need to take out a $100.0 million commercial loan from a local bank to pay its workers and purchase intermediate inputs until the company gets paid by the state upon the completion of the project. The banking services for this loan are estimated to be $2.0 million.

Architectural services are not purchased by the construction company because the plans for the road were developed by engineers at the state's Department of Transportation in Raleigh, North Carolina.

Table 6.5 shows that most of the intermediate inputs will be produced locally and purchased directly from the manufacturer. In fact, an asphalt plant will even be transported to the site. Only the special fuel needed for the construction equipment will not be produced locally, but this fuel will be purchased from a local wholesaler. The construction company will also need to pay a large amount for the delivery of gravel from a local quarry.

Table 6.5
Local Supply Conditions, Greensboro

Table 6.5. Local Supply Conditions of Intermediate Inputs, Greensboro, North Carolina, Metropolitan Statistical Area

Industry	Production	Truck transportation	Wholesale trade	Retail trade
Stone mining and quarrying	Yes	Yes	No	No
Petroleum refineries	No	No	Yes	No
Asphalt paving mixture and block manufacturing	Yes	No	No	No
Ready-mix concrete manufacturing	Yes	No	No	No
Monetary authorities and depository credit intermediation	Yes	n.a.	n.a.	n.a.
Commercial and industrial machinery and equipment repair and maintenance	Yes	n.a.	n.a.	n.a.

n.a. Not applicable

Table 6.6 shows the changes in local output for each industry involved in the supply of intermediate inputs to the construction company. The output for each industry equals the cost share times the price paid for the intermediate input. These cost shares are based on information from the national use table.

Table 6.6. Changes in Local Output, Greensboro, North Carolina, Metropolitan Statistical Area

Table 6.6
Changes in Local Output, Greensboro

Category	Stone mining and quarrying			Petroleum refineries		
	U.S. purchases		Local output (millions of dollars)	U.S. purchases		Local output (thousands of dollars)
	Cost (millions of dollars)	Share		Cost (millions of dollars)	Share	
Producer value	1,570	0.57	3,990	5,192	0.91	n.a.
Truck transportation	1,006	0.37	2,590	93	0.02	n.a.
Other transportation	114	0.04	n.a.	108	0.02	n.a.
Wholesale margin	44	0.02	n.a.	333	0.06	600
Retail margin	0	0.00	n.a.	0	0.00	n.a.
Purchaser value	**2,734**	**1.00**	**n.a.**	**5,726**	**1.00**	**n.a.**

n.a. Not applicable

Table 6.7 shows the total impact on output in Greensboro, North Carolina. For each industry, the output impact (column 3) is calculated by multiplying its output (column 1) by its final-demand output multiplier (column 2). The total output impact is $131.4 million. This value is equal to the impact of the purchase of intermediate inputs ($31.4 million) plus the initial change in output for the construction company ($100.0 million).

Table 6.7. Type II Output Impact of Road Construction, Greensboro, North Carolina, Metropolitan Statistical Area

Table 6.7
Output Impact, Greensboro

Industry[1]	Increase in local purchases (thousands of dollars)	Final-demand output multiplier	Output impact (thousands of dollars)
Stone mining and quarrying	3,390	1.4524	5,795
Asphalt paving mixture and block manufacturing	7,500	1.4390	10,793
Ready-mix concrete manufacturing	750	1.4915	1,119
Monetary authorities and depository credit intermediation	2,000	1.2899	2,580
Commercial and industrial machinery and equipment repair and maintenance	4,000	1.5682	6,273
Truck transportation	2,590	1.5590	4,038
Stone mining and quarrying	2,590	n.a.	n.a.
Wholesale trade	600	1.3467	808
Petroleum refineries	600	n.a.	n.a.
Subtotal (intermediate inputs)	**21,430**	**n.a.**	**31,405**
Plus: Initial change in output	n.a.	n.a.	100,000
Total	**21,430**	**n.a.**	**131,405**

1. Detailed industries from benchmark series
n.a. Not applicable

The estimate of the total impact on output is small because the construction company's largest cost is the earnings paid to workers. Since Type I multipliers are used in the analysis, the impact of increased spending by construction workers are not included in this estimate.

This estimate is also limited to the impact of the construction of the highway. It does not reflect any changes that may result from new homes being built or new businesses locating near the new highway. RIMS II accounts for the impact of only the supply of inputs to the construction company and does not account for any increases in economic activity that may result from the use of the highway.

This example highlights how the accuracy of an economic impact study's results for a construction project can be improved by using a bill-of-goods method. If the final-demand change ($100.0 million) is multiplied by the final-demand output multiplier for the construction industry (1.5136), output is expected to increase by a much larger amount ($151.4 million).

Notes

Citing RIMS II Multipliers

When mentioning the use of RIMS II multipliers, please clarify that the Bureau of Economic Analysis does not endorse any resulting estimates and/or conclusions about the economic impact of a proposed change on an area.

When referring to the multipliers, simply note the source as BEA.

Examples

"Applying a final-demand multiplier of 1.0412 (BEA RIMS II multiplier) indicates that an increase in final demand of $1 million would lead to..."

"According to conclusions that were derived using BEA's RIMS II multipliers..."

"Our analysis, which was conducted using BEA's RIMS II multipliers, shows that..."

Glossary

Annual series
Multipliers based on more current but less detailed annual input-output tables.

Backward-linkage model
Model where an increase in the demand for output results in an increase in the demand for inputs.

Benchmark series
Multipliers based on more detailed but less current benchmark input-output tables.

Bill-of-goods method
Method that uses detailed information on a final-demand industry's purchases to improve the accuracy of an impact study's results.

Contribution study
Study that examines an industry's total economic contribution to a regional economy.

Direct-effect multipliers
For earnings, the ratio of the total change in household earnings per dollar change in household earnings in the final-demand industry. For employment, the ratio of the total change in jobs per change in job in the final-demand industry.

Direct impact
Change in economic activity resulting from the initial round of inputs purchased by the final-demand industry.

Direct requirements table
Table that shows the initial round of inputs required to produce a dollar of output.

Distribution cost table
Table that provides information on the value of wholesale, retail, and transportation costs.

Earnings
Compensation of employees plus the net earnings of sole proprietors and partnerships. In RIMS II, earnings exclude personal contributions to social insurance programs, such as Social Security and Medicare, and employee pension plans.

Economic impact study
Study that examines the total economic impact of a final-demand change on a regional economy.

Employment
Number of full- and part-time employees.

Final demand (final use)
Purchases by customers outside the region; investment in new buildings, equipment, and software; purchases by government; and purchases by households.

Final-demand change
Change in the purchases of goods or services by final users.

Final-demand industry
Industry that is initially affected by a final-demand change.

Final-demand multipliers
Ratios of a total change in economic activity to a dollar or million dollar change in final demand. These multipliers can be used to estimate total changes in output, value added, earnings, and employment.

Final-demand region
Geographic area used for estimating the impacts of a final-demand change.

Forward-linkage model
Model where an increase in the supply of inputs results in an increase in the supply of output.

Gross domestic product (GDP)
The market value of final goods and services produced in an economy.

Gross output
Total market value of industry output (sales). It equals intermediate inputs plus value added. Gross output is not the same as gross domestic product (GDP), which only includes value added.

Indirect impact
Change in economic activity resulting from the subsequent rounds of inputs purchased by industries affected by a final-demand change.

Induced impact
Change in economic activity resulting from the changes in spending by workers whose earnings are affected by a final-demand change.

Input-output tables
Accounts that show the goods and services produced by each industry and the use of these goods and services by industries and final users.

Inputs
Intermediate inputs and labor used by an industry to produce output.

Intermediate inputs
Goods and services used by an industry to produce output. Intermediate inputs exclude investment purchases and labor costs.

Investment purchases
Investment in new buildings, equipment, and software by businesses, and investment in new housing by households.

Leakages
Money that no longer circulates in an economy because of savings, taxes, or imports.

Make table
Table that shows the goods and services made by industries.

Margins
Value of wholesale, retail, and transportation costs involved in the delivery of goods and services to industries and final users.

Producer values
Payments received by the producers of goods and services less trade (wholesale and retail) mark-ups and transportation costs.

Purchaser values
Payments made by industries and final users for goods and services. Purchaser values equal producer values plus trade (wholesale and retail) mark-ups and transportation costs.

Total requirements table
Table that shows the initial and subsequent rounds of inputs required to produce a dollar of output.

Type I multipliers
Multipliers that account for only the interindustry effects (direct and indirect) of a final-demand change.

Type II multipliers
Multipliers that account for both the interindustry effects (direct and indirect) and household-spending effects (induced) of a final-demand change.

Use table
Table that shows the goods and services used by industries and final users.

Value added
Total value of income generated from production. This income consists of payments to labor (compensation of employees), payments to government (taxes on production and imports), and returns on investment (gross operating surplus). It is equivalent to gross domestic product.

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