The Economic Contribution of the Mental Health and Substance Abuse Services Industry to the New Jersey Economy

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Contents

Executive Summary

This report was commissioned by the New Jersey Association of Mental Health and Addiction Agencies (NJAMHAA) to estimate the contribution of the mental health and substance abuse services industry's annual expenditures to the New Jersey economy. The analysis draws on information from the U.S. Census Bureau, the U.S. Bureau of Labor Statistics, tax and other financial document reviews and interviews with staff and membership of NJAMHAA.

The study provides estimates of the economic impacts of the business expenditures made by mental health and substance abuse service agencies and related organizations in the state. *However, it does not quantify the economic benefits of the services provided by these organizations, which consist primarily of improvements in quality of life for patients and their families, and additional benefits resulting from those improvements. These additional benefits may include reductions in productivity losses due to missed work time, as well as reductions in homelessness, incarceration, domestic violence and other issues that can have significant fiscal implications for the state.*

In addition to the benefits of the services they provide, the annual expenditures associated with the operations of agencies within the industry generate an additional contribution to the state economy, both directly through their employment of staff and purchases of materials, equipment and services, and indirectly, through the multiplier or "ripple" effects of these initial expenditures. This analysis estimates both the *direct and indirect* contributions of the industry to the state economy. The estimated contribution to the New Jersey economy resulting from the operational expenditures associated with the provision of mental health and addiction services include:

- 57,579 – 60,665 direct and indirect jobs;
- $3.1 – $3.2 billion in GDP; and
- $2.6 – $2.7 billion in compensation

Introduction

This study provides an analysis of the economic impacts of the operations of mental health and addiction agencies in New Jersey. In addition to the important care and treatment services provided by these facilities, the annual expenditures associated with their operations also constitute a meaningful contribution to the state economy. This report estimates the size of this contribution. The report begins with an explanation of the definition of the industry for purposes of analysis and an assessment of the size of the industry in the state. This is followed by a description of the data, methodology and economic impact model used in the analysis. The estimates of the economic contribution of the industry are then provided.

A Note on the Economic Impacts

While this study provides estimates of the economic impacts of the business and related expenditures made in association with the provision of mental health and substance abuse services in the state, it does not attempt to quantify the broader economic and social benefits of these services, including significant improvements in quality of life for clients and their families. These benefits are the objective of the agencies' activities and in monetary terms would likely far exceed the operational economic benefits estimated in this report. These additional benefits may include reductions in productivity losses due to missed work time, as well as reductions in homelessness, incarceration, domestic violence and other issues that can have significant fiscal implications for the state. There is a broad academic literature examining the societal costs of mental illness and substance abuse, exploring methodologies for estimating those costs, and assessing the economic value of interventions. A brief listing of studies is provided at the end of this report.

Industry Expenditure Data and Methodology

Key to the analysis of the contribution of the mental health and addiction services industry to the state economy are an estimate of the industry's size – i.e., the magnitude of its employment and expenditures – and an estimate of how its expenditures are distributed across various cost items (e.g., payroll, supplies, third-party services, etc.). This section draws on economic data from the U.S. Bureau of Labor Statistics (BLS), as well as discussions with NJAMHAA staff and representatives of member organizations, to establish a definition of the mental health and addiction services "industry," and to estimate its size. The section also describes the review of documents provided by NJAMHAA members, as well as published economic data, used to generate an estimated distribution of expenditures for each of the industry's subsectors. Finally, a description of the economic model and methodology used in the analysis are provided.

Industry Definition and Magnitude

In order to analyze the economic contribution of the industry to the state economy, it is necessary to establish an industry definition encompassing those organizations and activities that fall under the umbrella of mental health and addiction services. Data on the magnitude of the expenditures involved in delivering these services can then be assembled. For purposes of this analysis, the industry is understood to include the community-based non-profit behavioral healthcare providers that comprise NJAMHAA's membership, as well as related organizations. It does not include behavioral health professionals in private practice, such as psychiatrists and psychologists. The NJAMHAA takes a broad view of the industry that includes various types of community and social service interventions for youth, families and the elderly, in addition to more direct treatment facilities. Some of the activities to be included in the analysis are thus clearly delineated and measured in public data on specific economic sectors (e.g., outpatient mental health and addiction centers, psychiatric and substance abuse hospitals). In some cases, however, services may be provided through entities with much broader activities (e.g., mental health wards of general hospitals), or through organizations that fall within broad-based employment sectors (e.g., child and youth services) whose focus in fact aligns closely with the activities of NJAMHAA and its members. The industry definition used in this study thus strives to capture as much of this activity as possible.

Table 1 provides a list of the key sectors fully or partially included in the analysis, along with their employment and payroll levels in 2014, according to the U.S. Bureau of Labor Statistics. (These business sectors are defined by the North American Industry Classification System – NAICS – used by U.S. government agencies in the collection and analysis of economic data. A description of each sector is provided in Appendix A).

Table 1 Mental Health and Substance Abuse Facility Sectors 2014 Industry Profile		
Sector	**Employees**	**Total Payroll ($ 000)**
Psychiatric and substance abuse hospitals	1,897	97,818
Outpatient mental health and substance abuse centers	6,632	249,563
Residential mental and substance abuse care	6,713	243,145
Other Individual and Family Services	13,685	458,374
Child and youth services	4,020	134,297
Temporary Shelters	1,933	63,234
Services for the Elderly and Disabled	16,760	372,175
Total	**51,640**	**$1,618,606**

The first three sectors listed – psychiatric and substance abuse hospitals, outpatient mental health and substance abuse centers, and residential mental health and substance abuse care – form the core of the direct services provided by the industry, and are included in the analysis in their entirety. Facilities within the other individual and family services, child and youth services, temporary shelters and services for the elderly and disabled sectors provide a broad spectrum of services including counseling, guidance, outreach and crisis intervention that fall within the scope of activities of NJAMHAA, its members and related organizations.

To account for the fact that some of the organizations within these sectors may not provide services related to NJAMHAA's activities, adjustments have been made to the magnitude of their employment and payroll for use in the analysis. Much of the activity undertaken by organizations in the other individual and family services and child and youth

sectors services is funded through New Jersey Department of Children and Families (DCF) programs. Through discussions with NJAMHAA representatives, it was determined that they key DCF funding programs that are *not* applicable to NJAMHAA's scope of activities include adoption and foster care services. These services represent approximately 21.5% of the non-administrative DCF budget for fiscal year 2016. As such, for purposes of analysis, the combined employment and payroll totals for the other individual and family services and child and youth services sectors were reduced by 21.5% (from the amounts shown in table 1) prior to inclusion in the economic modeling process. For services for the elderly and disabled, in the absence of direct information indicating the portion of these organizations' services that fall within the scope of NJAMHAA activities, it was determined through discussions with NJAMHAA representatives that a range of 20% - 35% of the sector's activity would be applicable. This range was used to produce two estimates in the analysis.

In addition to the organizations and services captured in the data described in table 1, the analysis also seeks to capture, to the extent possible, the mental health services provided by general hospitals. These services are not separated from other hospital activities in publicly available, consistently measured economic data akin to that provided for the other sectors described above. A comprehensive statewide survey to identify the full magnitude of emergency, outpatient and inpatient mental health services provided by the state's general hospitals, and the resources devoted to those services, is outside the scope of this analysis. However, through a review of documents and follow up conversations with NJAMHAA and hospital representatives, it is estimated that there are approximately 1,340 licensed short-term care facility (SCTF), Children's Crisis Intervention Service (CCIS), voluntary and other behavioral health ward beds in the state's general hospitals. Based on a review of hospital financial documents and BLS data, we estimate payroll of approximately $93,670 per bed annually associated with these services, giving a total annual payroll of approximately $125.5 million and total employment of approximately 2,033 jobs attendant to the hospital-based mental health and addiction related services associated with these bed counts. Again, it is important to note that these totals are based only on those service levels that it was possible to estimate based on specific bed-counts. It may exclude additional emergency, outpatient or other services for which it was not possible to estimate statewide service levels.

Taking into account the adjustments described above and the inclusion of hospital-based services, the annual size of the mental health and addiction services industry for purposes of this analysis is estimated to be (depending on the 20% to 35% range of inclusion for the elderly and disabled services sector):

- 36,458 – 38,972 total jobs
- $1.47 and $1.52 billion in total compensation
- $2.03-$2.10 billion in total industry expenditures

Distribution of Industry Expenditures

In addition to an estimate of industry magnitude, the analysis also requires an estimate of how the industry's expenditures are distributed across various cost categories, including direct outlays on salaries, supplies, external healthcare consultants and other third-party service providers, rent and equipment and other expenses. This allocation of the industry's total expenditures determines the magnitude and sector distribution of the total economic contribution. Information about this distribution is in part embodied in state-level economic data adapted from national level industry data maintained by the U.S. Bureau of Economic Analysis. These data – known as input-output accounts or matrices – reflect the inter-relations between economic industries. That is, they embody the purchases that each industry in the economy makes from all other industries, as well as each industry's labor expenditures and profits.

The expenditure distributions for other individual and family services, temporary shelters, and services to the elderly and persons with disabilities are contained in the input-output accounts within the distribution for a broader individual and family services sector. This broader sector embodied in the economic model is used in the analysis to represent those subsectors.

Psychiatric hospitals, outpatient and residential mental health and substance abuse centers are also included in larger aggregate sectors in the model; however, these larger sectors may have significant variation in expenditure patterns across their component subsectors. For example, outpatient mental health and substance abuse centers are included in a broader ambulatory care sector that includes surgical centers and other medical treatment facilities whose supply, staffing and service requirements (i.e., expenditure distributions) could significantly differ from those of mental health facilities. As such, in order to more accurately represent the expenditure distributions of outpatient centers, residential facilities and psychiatric hospitals, as well as the mental health services provided by general hospitals, a review of financial documents (IRS 990 forms, annual Reports of Expenditure, hospital ward budgets) was conducted for a selection of NJAMHAA members organizations. Based on these documents and follow-up discussions with NJAMHAA staff and representatives of member organizations, estimated expenditure distributions were formulated for each of these sectors (psychiatric and substance abuse hospitals, outpatient mental health and substance abuse centers, residential mental health and substance abuse care, and mental health services at general hospitals) for inclusion in the analysis.

Having determined both the magnitude of industry expenditures and a range of distributions over which to allocate these expenditures, the economic contribution of the industry is estimated using an economic input-output model. Economic impact assessment and the New Jersey input-output model used for this analysis are briefly described in the next section.

The R/ECON™ Input-Output Model

The annual expenditures of the mental health and substance abuse services industry in New Jersey generate an annually *recurring* economic contribution to the state economy. Expenditures on staffing, supplies, third-party services and other requirements for the ongoing operations of organizations providing mental health and substance abuse services have both direct economic effects as those expenditures become incomes and revenues for workers and businesses, and subsequent indirect "ripple" or "multiplier" effects, as those workers and businesses then spend those dollars on other consumer goods and business operations and investment expenditures, which, in turn, become income for other workers and businesses. This income gets further spent, and so on.

Economic input-output modeling focuses on the interrelationships of sales and purchases among sectors of the economy. This analytical method measures the effect of changes in expenditures in one industry on economic activity in all other industries, thus capturing both the direct and indirect impacts of any set of initial expenditures in the economy. Input-output models also embody the degree to which supply of locally produced goods and services meets local demand. These measures, known as regional purchase coefficients (RPCs), capture the economic "leakage," as some portion of any investment or expenditure flows out of the region.

The R/ECON™ Input-Output Model developed and maintained at Rutgers University is designed to measure these direct and indirect impacts for New Jersey. The R/ECON™ model consists of 383 individual sectors of the New Jersey economy, and can measure the impacts of investments and expenditures in terms of employment, income, gross domestic product for the state, and state and local tax revenues. It has been used to estimate the economic impacts of a wide array of projects and activities, such as:

- Construction of office buildings
- Manufacture of military technologies
- Upgrading of electric utility infrastructure
- Construction and operation of liquid natural gas terminals
- Government tax incentives

A comprehensive description of input-output modeling and the R/ECON™ Input-Output Model are presented in Appendix B.

Analysis and Results

The R/ECON™ Input-Output Model was used to measure the annual contribution of the mental health and addiction services industry to the New Jersey economy. Two estimates were generated, based on the percentage of the elderly and disabled services sector included in the analysis (20% and 35%).

Table 2 provides the estimated annual economic contribution, both direct and indirect, of the industry to the New Jersey economy, based on an estimated $2.03-2.10 billion in total industry annual operating expenditures. The left panel provides the low estimate based on 20% inclusion of the elderly and disabled services sector, and the right panel gives the higher estimate based on the 35% inclusion.[1]

Table 2
Contribution of the Mental Health and Substance Abuse Services Industry to the New Jersey Economy

	Low Estimate			High Estimate		
	Direct	Indirect	Total	Direct	Indirect	Total
Employment	36,458	21,121	57,579	38,972	21,693	60,665
Gross Domestic Product ($ million)	1,482.9	1,612.0	3,094.9	1,531.0	1,663.6	3,194.6
Compensation ($ million)	1,467.7	1,125.3	2,593.0	1,523.5	1,161.1	2,684.6
State Tax Revenues ($ million)	-	-	102.3	-	-	105.8
Local Tax Revenues	-	-	131.7	-	-	136.5

[1] Impacts per million dollars of expenditure are provided in Appendix C.

In aggregate, based on the higher estimate, the industry's annual operating expenditures and their multiplier effects are estimated to have the following contributions to the New Jersey economy.[2]

- **Employment**

  An estimated 60,665 total (direct and indirect) jobs are estimated to be supported annually by the industry's operations. The direct and indirect employment supported by the expenditures is estimated to continue as long as annual outlays are maintained at a similar level and distribution (and taking into account wage growth over time).

60,665 jobs in New Jersey,
supported annually

  Employment is supported across a wide range of sectors, as the direct expenditures supporting jobs and business revenues in the healthcare, social assistance and related sectors "ripple" through the broader economy, generating indirect employment in other industries such as retail, services, etc.[3] Table 3 provides the estimated sector distribution (job categories are from the U.S. Bureau of Labor Statistics) of the total employment generated by the in-state expenditures.

Table 3
Distribution of Employment Impacts by Sector

Sector	Employment
Services	53,113
Retail Trade	3,162
Financial Activities	2,189
Manufacturing	1,046
Transportation & Public Utilities	694
Wholesale Trade	231
Construction	118
Natural Resources & Mining	112
Total	**60,665**

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[2] The contribution per million dollars of industry expenditures are provided in Appendix C.
[3] The broadly defined service sector includes professional and business services (e.g., management consulting, engineering, architecture, accounting, legal services, etc.), education and health services (including the direct employment in health care and social assistance), leisure and hospitality services, the information sector, and other service industries.

- **Compensation**

  Labor compensation represents the total wages, salaries and wage supplements (i.e., employer contributions to government and private pension funds and social insurance) paid for the direct *and* indirect jobs generated in New Jersey as a result of the industry's expenditures. A total of $2.7 billion in compensation is estimated to be generated annually in compensation.

  $2.7 billion in compensation annually

- **Gross Domestic Product**

  Total gross domestic product (GDP), a measure of the annual value of the new economic output generated in the state as a result of the industry's operating expenditures, is estimated at $3.2 billion.

  $3.2 billion in GDP annually

- **State Government Revenues**

  Estimated annual state revenues comprise the income taxes associated with the salaries paid to the workers in the direct and indirect jobs supported by the industry's operating expenditures, as well as the sales and corporation business taxes associated with the economic output generated by those expenditures. In total, the industry's annual operating expenditures are estimated to generate approximately $105.8 million in state tax revenues.

  $105.8 million in state taxes

- **<u>Local Government Revenues</u>**

  Estimated local government revenues primarily comprise direct and indirect property tax revenues that accrue to county and municipal governments and local school districts over time, as a result of improvements to existing property or construction of new property afforded by the personal and business incomes generated directly and indirectly by the industry's operating expenditures. These local annual government revenues are estimated at $136.5 million statewide. *Unlike the other impacts, the increase in property tax revenues occurs over a considerably longer period (see Appendix D for additional detail).*

$136.5 million in local government revenues (statewide)

Appendix A: Sector Descriptions

The following descriptions of the business sectors included in the definition of the mental health and substance abuse treatment industry in New Jersey are taken from the North American Industry Classification System database maintained by the U.S. Census Bureau, available at http://www.census.gov/eos/www/naics/index.html.

621420 Outpatient Mental Health and Substance Abuse Centers

This industry comprises establishments with medical staff primarily engaged in providing outpatient services related to the diagnosis and treatment of mental health disorders and alcohol and other substance abuse. These establishments generally treat patients who do not require inpatient treatment. They may provide a counseling staff and information regarding a wide range of mental health and substance abuse issues and/or refer patients to more extensive treatment programs, if necessary.

Illustrative Examples:

Outpatient alcoholism treatment centers and clinics (except hospitals)
Outpatient mental health centers and clinics (except hospitals)
Outpatient detoxification centers and clinics (except hospitals)
Outpatient substance abuse treatment centers and clinics (except hospitals)
Outpatient drug addiction treatment centers and clinics (except hospitals)

Cross-References.

- Establishments known and licensed as hospitals primarily engaged in the inpatient treatment of mental health and substance abuse illnesses with an emphasis on medical treatment and monitoring are classified in Industry 622210, Psychiatric and Substance Abuse Hospitals; and
- Establishments primarily engaged in the inpatient treatment of mental health and substance abuse illness with an emphasis on residential care and counseling rather than medical treatment are classified in Industry 623220, Residential Mental Health and Substance Abuse Facilities.

2012 NAICS	Corresponding Index Entries
621420	Alcoholism treatment centers and clinics (except hospitals), outpatient
621420	Detoxification centers and clinics (except hospitals), outpatient
621420	Drug addiction treatment centers and clinics (except hospitals), outpatient
621420	Mental health centers and clinics (except hospitals), outpatient
621420	Outpatient mental health centers and clinics (except hospitals)
621420	Outpatient treatment centers and clinics (except hospitals) for substance abuse (i.e., alcoholism, drug addiction)
621420	Outpatient treatment centers and clinics for alcoholism
621420	Outpatient treatment centers and clinics for drug addiction
621420	Psychiatric centers and clinics (except hospitals), outpatient
621420	Substance abuse treatment centers and clinics (except hospitals), outpatient

622210 Psychiatric and Substance Abuse Hospitals

This industry comprises establishments known and licensed as psychiatric and substance abuse hospitals primarily engaged in providing diagnostic, medical treatment, and monitoring services for inpatients who suffer from mental illness or substance abuse disorders. The treatment often requires an extended stay in the hospital. These establishments maintain inpatient beds and provide patients with food services that meet their nutritional requirements. They have an organized staff of physicians and other medical staff to provide patient care services. Psychiatric, psychological, and social work services are available at the facility. These hospitals usually provide other services, such as outpatient services, clinical laboratory services, diagnostic X-ray services, and electroencephalograph services.

Cross-References.

- Establishments primarily engaged in providing treatment of mental health and substance abuse illnesses on an exclusively outpatient basis are classified in Industry 621420, Outpatient Mental Health and Substance Abuse Centers;
- Establishments referred to as hospitals but are primarily engaged in providing inpatient treatment of mental health and substance abuse illness with the emphasis on counseling rather than medical treatment are classified in Industry 623220, Residential Mental Health and Substance Abuse Facilities; and
- Establishments referred to as hospitals but are primarily engaged in providing residential care for persons diagnosed with intellectual and developmental disabilities are classified in Industry 623210, Residential Intellectual and Developmental Disability Facilities.

2012 NAICS	Corresponding Index Entries
622210	Alcoholism rehabilitation hospitals
622210	Children's hospitals, psychiatric or substance abuse
622210	Detoxification hospitals
622210	Drug addiction rehabilitation hospitals
622210	Hospitals for alcoholics
622210	Hospitals, addiction
622210	Hospitals, mental (except intellectual and developmental disability)
622210	Hospitals, psychiatric (except convalescent)
622210	Hospitals, psychiatric pediatric
622210	Hospitals, substance abuse
622210	Mental (except intellectual and developmental disability) hospitals
622210	Mental health hospitals
622210	Psychiatric hospitals (except convalescent)
622210	Rehabilitation hospitals, alcoholism and drug addiction

623220 Residential Mental Health and Substance Abuse Facilities

This industry comprises establishments primarily engaged in providing residential care and treatment for patients with mental health and substance abuse illnesses. These establishments provide room, board, supervision, and counseling services. Although medical services may be available at these establishments, they are incidental to the counseling, mental rehabilitation, and support services offered. These establishments generally provide a wide range of social services in addition to counseling.

Illustrative Examples:

Alcoholism or drug addiction rehabilitation facilities (except licensed hospitals)
Psychiatric convalescent homes or hospitals
Mental health halfway houses
Residential group homes for the emotionally disturbed

Cross-References.

- Establishments primarily engaged in providing treatment of mental health and substance abuse illnesses on an exclusively outpatient basis are classified in Industry 621420, Outpatient Mental Health and Substance Abuse Centers;
- Establishments primarily engaged in providing residential care for persons diagnosed with intellectual and developmental disabilities are classified in Industry 623210, Residential Intellectual and Developmental Disability Facilities; and
- Establishments known and licensed as hospitals primarily engaged in providing inpatient treatment of mental health and substance abuse illnesses with an emphasis on medical treatment and monitoring are classified in Industry 622210, Psychiatric and Substance Abuse Hospitals.

2012 NAICS	Corresponding Index Entries
623220	Alcoholism rehabilitation facilities (except licensed hospitals), residential
623220	Convalescent homes or hospitals for psychiatric patients
623220	Drug addiction rehabilitation facilities (except licensed hospitals), residential
623220	Halfway houses for patients with mental health illnesses
623220	Halfway houses, substance abuse (e.g., alcoholism, drug addiction)
623220	Homes for emotionally disturbed adults or children
623220	Homes, psychiatric convalescent
623220	Hospitals, psychiatric convalescent
623220	Mental health facilities, residential
623220	Mental health halfway houses
623220	Psychiatric convalescent homes or hospitals
623220	Residential group homes for the emotionally disturbed
623220	Substance abuse (i.e., alcoholism, drug addiction) halfway houses
623220	Substance abuse facilities, residential

624110 Child and Youth Services

This industry comprises establishments primarily engaged in providing nonresidential social assistance services for children and youth. These establishments provide for the welfare of children in such areas as adoption and foster care, drug prevention, life skills training, and positive social development.

Illustrative Examples:

Adoption agencies
Youth centers (except recreational only)
Child guidance organizations
Youth self-help organizations
Foster care placement services

Cross-References.

- Youth recreational centers are classified in Industry 713940, Fitness and Recreational Sports Centers;
- Youth recreational sports teams and leagues are classified in Industry 713990, All Other Amusement and Recreation Industries;
- Scouting organizations are classified in Industry 813410, Civic and Social Organizations; and
- Establishments primarily engaged in providing day care services for children are classified in Industry 624410, Child Day Care Services.

2012 NAICS	Corresponding Index Entries
624110	Adoption agencies
624110	Adoption services, child
624110	Aid to families with dependent children (AFDC)
624110	Child guidance agencies
624110	Child welfare services
624110	Community centers (except recreational only), youth
624110	Foster care placement agencies
624110	Foster home placement services
624110	Self-help organizations, youth
624110	Teen outreach services
624110	Youth centers (except recreational only)
624110	Youth guidance organizations
624110	Youth self-help organizations

624120 Services for the Elderly and Persons with Disabilities

This industry comprises establishments primarily engaged in providing nonresidential social assistance services to improve the quality of life for the elderly, persons diagnosed with intellectual and developmental disabilities, or persons with disabilities. These establishments provide for the welfare of these individuals in such areas as day care, nonmedical home care or homemaker services, social activities, group support, and companionship.

Cross-References. Establishments primarily engaged in—

- Providing job training for persons diagnosed with intellectual and developmental disabilities or persons with disabilities--are classified in Industry624310, Vocational Rehabilitation Services;
- Providing residential care for the elderly, persons diagnosed with intellectual and developmental disabilities or persons with disabilities--are classified in Subsector 623, Nursing and Residential Care Facilities; and
- Providing in-home health care services--are classified in Subsector 621, Ambulatory Health Care Services.

2012 NAICS	Corresponding Index Entries
624120	Activity centers for disabled persons, the elderly, and persons diagnosed with intellectual and developmental disabilities
624120	Centers, senior citizens'
624120	Community centers (except recreational only), adult
624120	Companion services for disabled persons, the elderly, and persons diagnosed with intellectual and developmental disabilities
624120	Day care centers for disabled persons, the elderly, and persons diagnosed with intellectual and developmental disabilities
624120	Day care centers, adult
624120	Disability support groups
624120	Home care of elderly, non-medical
624120	Homemaker's service for elderly or disabled persons, non-medical
624120	Self-help organizations for disabled persons, the elderly, and persons diagnosed with intellectual and developmental disabilities
624120	Senior citizens activity centers
624120	Senior citizens centers

624190 Other Individual and Family Services

This industry comprises establishments primarily engaged in providing nonresidential individual and family social assistance services (except those specifically directed toward children, the elderly, persons diagnosed with intellectual and developmental disabilities, or persons with disabilities).

Illustrative Examples:

Community action services agencies
Marriage counseling services (except by offices of mental health practitioners)
Crisis intervention centers
Multipurpose social services centers
Family social services agencies
Self-help organizations (except for disabled persons, the elderly, persons diagnosed with intellectual and developmental disabilities)
Family welfare services
Suicide crisis centers
Hotline centers
Telephone counseling services

Cross-References. Establishments primarily engaged in--

- Providing clinical psychological and psychiatric social counseling services--are classified in Industry 621330, Offices of Mental Health Practitioners (except Physicians);
- Providing child and youth social assistance services (except day care)--are classified in Industry 624110, Child and Youth Services;
- Providing child day care services--are classified in Industry 624410, Child Day Care Services;
- Providing social assistance services for the elderly, persons diagnosed with intellectual and developmental disabilities, and persons with disabilities--are classified in Industry 624120, Services for the Elderly and Persons with Disabilities;
- Community action advocacy--are classified in U.S. Industry 813319, Other Social Advocacy Organizations; and
- Providing in-home health care services--are classified in Subsector 621, Ambulatory Health Care Services.

2012 NAICS	Corresponding Index Entries
624190	Alcoholism and drug addiction self-help organizations
624190	Alcoholism counseling (except medical treatment), nonresidential
624190	Alcoholism self-help organizations
624190	Community action service agencies
624190	Counseling services
624190	Crisis intervention centers
624190	Drug addiction self-help organizations
624190	Exoffender rehabilitation agencies

624190	Exoffender self-help organizations
624190	Family social service agencies
624190	Family welfare services
624190	Hotline centers
624190	Individual and family social services, multi-purpose
624190	Marriage counseling services (except by offices of mental health practitioners)
624190	Mediation, social service, family, agencies
624190	Multiservice centers, neighborhood
624190	Offender self-help organizations
624190	Parenting support services
624190	Parole offices, privately operated
624190	Probation offices, privately operated
624190	Rape crisis centers
624190	Referral services for personal and social problems
624190	Rehabilitation agencies for offenders
624190	Self-help organizations (except for disabled persons, the elderly, persons diagnosed with intellectual and developmental disabilities)
624190	Social service agencies, family
624190	Social service centers, multipurpose
624190	Suicide crisis centers
624190	Support group services
624190	Telephone counseling services
624190	Travelers' aid centers
624190	Welfare service centers, multi-program

624221 Temporary Shelters

This U.S. industry comprises establishments primarily engaged in providing (1) short term emergency shelter for victims of domestic violence, sexual assault, or child abuse and/or (2) temporary residential shelter for homeless individuals or families, runaway youth, and patients and families caught in medical crises. These establishments may operate their own shelters or may subsidize housing using existing homes, apartments, hotels, or motels.

Cross-References.

Establishments primarily engaged in providing emergency shelter for victims of domestic or international disasters or conflicts are classified in Industry 624230, Emergency and Other Relief Services.

Establishments primarily engaged in providing emergency shelter for victims of domestic or international disasters or conflicts are classified in Industry 624230, Emergency and Other Relief Services.

2012 NAICS	Corresponding Index Entries
624221	Battered women's shelters
624221	Emergency shelters (except for victims of domestic or international disasters or conflicts)
624221	Homeless shelters
624221	Runaway youth shelters
624221	Shelters (except for victims of domestic or international disasters or conflicts), emergency
624221	Shelters, battered women's
624221	Shelters, homeless
624221	Shelters, runaway youth
624221	Shelters, temporary (e.g., battered women's, homeless, runaway youth)
624221	Temporary housing for families of medical patients
624221	Temporary shelters (e.g., battered women's, homeless, runaway youth)
624221	Women's shelters, battered

Appendix B: Input-Output Modeling and the R/ECON™ Input-Output Model

This appendix discusses the history and application of input-output analysis and details the input-output model, called the R/ECON™ I-O model, developed by Rutgers University. This model offers significant advantages in detailing the total economic effects of an activity (such as historic rehabilitation and heritage tourism), including multiplier effects.

Estimating Multipliers

The fundamental issue determining the size of the multiplier effect is the "openness" of regional economies. Regions that are more "open" are those that import their required inputs from other regions. Imports can be thought of as substitutes for local production. Thus, the more a region depends on imported goods and services instead of its own production, the more economic activity leaks away from the local economy. Businessmen noted this phenomenon and formed local chambers of commerce with the explicit goal of stopping such leakage by instituting a "buy local" policy among their membership. In addition, during the 1970s, as an import invasion was under way, businessmen and union leaders announced a "buy American" policy in the hope of regaining ground lost to international economic competition. Therefore, one of the main goals of regional economic multiplier research has been to discover better ways to estimate the leakage of purchases out of a region or, relatedly, to determine the region's level of self-sufficiency.

The earliest attempts to systematize the procedure for estimating multiplier effects used the economic base model, still in use in many econometric models today. This approach assumes that all economic activities in a region can be divided into two categories: "basic" activities that produce exclusively for export, and region-serving or "local" activities that produce strictly for internal regional consumption. Since this approach is simpler but similar to the approach used by regional input-output analysis, let us explain briefly how multiplier effects are estimated using the economic base approach.

If we let **x** be export employment, **l** be local employment, and **t** be total employment, then

$$\mathbf{t = x + l}$$

For simplification, we create the ratio **a** as

$$\mathbf{a = l/t}$$

so that

$$\mathbf{l = at}$$

then substituting into the first equation, we obtain

$$\mathbf{t = x + at}$$

By bringing all of the terms with t to one side of the equation, we get

$$\mathbf{t - at = x} \text{ or } \mathbf{t}\,(1-\mathbf{a}) = \mathbf{x}$$

Solving for **t,** we get $\mathbf{t} = \mathbf{x}/(1-\mathbf{a})$

Thus, if we know the amount of export-oriented employment, **x,** and the ratio of local to total employment, **a**, we can readily calculate total employment by applying the economic base multiplier, 1/(1-**a**), which is embedded in the above formula. Thus, if 40 percent of all regional employment is used to produce exports, the regional multiplier would be 2.5. The assumption behind this multiplier is that all remaining regional employment is required to support the export employment. Thus, the 2.5 can be decomposed into two parts the direct effect of the exports, which is always 1.0, and the indirect and induced effects, which is the remainder—in this case 1.5. Hence, the multiplier can be read as telling us that for each export-oriented job another 1.5 jobs are needed to support it.

This notion of the multiplier has been extended so that **x** is understood to represent an economic change demanded by an organization or institution outside of an economy—so-called final demand. Such changes can be those effected by government, households, or even by an outside firm. Changes in the economy can therefore be calculated by a minor alteration in the multiplier formula:

$$\Delta\mathbf{t} = \Delta\mathbf{x}/(1-\mathbf{a})$$

The high level of industry aggregation and the rigidity of the economic assumptions that permit the application of the economic base multiplier have caused this approach to be subject to extensive criticism. Most of the discussion has focused on the estimation of the parameter **a**. Estimating this parameter requires that one be able to distinguish those parts of the economy that produce for local consumption from those that do not. Indeed, virtually all industries, even services, sell to customers both inside and outside the region. As a result, regional economists devised an approach by which to measure the *degree* to which each industry is involved in the nonbase activities of the region, better known as the industry's *regional purchase coefficient (r).* Thus, they expanded the above formulations by calculating for each ***i*** industry

$$\mathbf{l}_i = \mathbf{r}_i\mathbf{d}_i$$

and

$$\mathbf{x}_i = \boldsymbol{t}_i - \mathbf{r}_i\mathbf{d}_i$$

given that $\mathbf{d}_i$ is the total regional demand for industry ***i***'s product. Given the above formulae and data on regional demands by industry, one can calculate an accurate traditional aggregate economic base parameter by the following:

$$\mathbf{a} = \mathbf{l}/\mathbf{t} = \Sigma\mathbf{l}_i/\Sigma\mathbf{t}_i$$

Although accurate, this approach only facilitates the calculation of an aggregate multiplier for the entire region. That is, we cannot determine from this approach what the effects are on the various sectors of an economy. This is despite the fact that one must painstakingly calculate the regional demand as well as the degree to which each industry is involved in nonbase activity in the region.

As a result, a different approach to multiplier estimation that takes advantage of detailed demand and trade data was developed. This approach is called input-output analysis.

Regional Input-Output Analysis: A Brief History

The basic framework for input-output analysis originated nearly 250 years ago when François Quesenay published *Tableau Economique* in 1758. Quesenay's "tableau" graphically and numerically portrayed the relationships between sales and purchases of the various industries of an economy. More than a century later, his description was adapted by Leon Walras, who advanced input-output modeling by providing a concise theoretical formulation of an economic system (including consumer purchases and the economic representation of "technology").

It was not until the twentieth century, however, that economists advanced and tested Walras's work. Wassily Leontief greatly simplified Walras's theoretical formulation by applying the Nobel prize–winning assumptions that both technology and trading patterns were fixed over time. These two assumptions meant that the pattern of flows among industries in an area could be considered stable. These assumptions permitted Walras's formulation to use data from a single time period, which generated a great reduction in data requirements.

Although Leontief won the Nobel Prize in 1973, he first used his approach in 1936 when he developed a model of the 1919 and 1929 U.S. economies to estimate the effects of the end of World War I on national employment. Recognition of his work in terms of its wider acceptance and use meant development of a standardized procedure for compiling the requisite data (today's national economic census of industries) and enhanced capability for calculations (i.e., the computer).

The federal government immediately recognized the importance of Leontief's development and has been publishing input-output tables of the U.S. economy since 1939. The most recently published tables are those for 2007. Other nations followed suit. Indeed, the United Nations maintains a bank of tables from most member nations with a uniform accounting scheme.

Framework

Input-output modeling focuses on the interrelationships of sales and purchases among sectors of the economy. Input-output is best understood through its most basic form, the *interindustry transactions table* or matrix. In this table (see table C-1 for an example), the column industries are consuming sectors (or markets) and the row industries are producing sectors. The content of a matrix cell is the value of shipments that the row industry delivers to the column industry. Conversely, it is the value of shipments that the column industry receives from the row industry. Hence, the interindustry transactions table is a detailed accounting of the disposition of the value of shipments in an economy. Indeed, the detailed accounting of the interindustry transactions at the national level is performed not so much to facilitate calculation of national economic impacts as it is to back out an estimate of the nation's gross domestic product.

Table B-1
Interindustry Transactions Matrix (Values)

	Agriculture	Manufact-uring	Services	Other	Final Demand	Total Output
Agriculture	10	65	10	5	10	$100
Manufacturing	40	25	35	75	25	$200
Services	15	5	5	5	90	$120
Other	15	10	50	50	100	$225
Value Added	20	95	20	90		
Total Input	100	200	120	225		

For example, in table B-1, agriculture, as a producing industry sector, is depicted as selling $65 million of goods to manufacturing. Conversely, the table depicts that the manufacturing industry purchased $65 million of agricultural production. The sum across columns of the interindustry transaction matrix is called the *intermediate outputs vector*. The sum across rows is called the *intermediate inputs vector*.

A single *final demand* column is also included in table B-1. Final demand, which is outside the square interindustry matrix, includes imports, exports, government purchases, changes in inventory, private investment, and sometimes household purchases.

The *value added* row, which is also outside the square interindustry matrix, includes wages and salaries, profit-type income, interest, dividends, rents, royalties, capital consumption allowances, and taxes. It is called value added because it is the difference between the total value of the industry's production and the value of the goods and nonlabor services that it

requires to produce. Thus, it is the *value* that an industry *adds* to the goods and services it uses as inputs in order to produce output.

The value added row measures each industry's contribution to wealth accumulation. In a national model, therefore, its sum is better known as the gross domestic product (GDP). At the state level, this is known as the gross state product—a series produced by the U.S. Bureau of Economic Analysis and published in the Regional Economic Information System. Below the state level, it is known simply as the regional equivalent of the GDP—the gross regional product.

Input-output economic impact modelers now tend to include the household industry within the square interindustry matrix. In this case, the "consuming industry" is the household itself. Its spending is extracted from the final demand column and is appended as a separate column in the interindustry matrix. To maintain a balance, the income of households must be appended as a row. The main income of households is labor income, which is extracted from the value-added row. Modelers tend not to include other sources of household income in the household industry's row. This is not because such income is not attributed to households but rather because much of this other income derives from sources outside of the economy that is being modeled.

The next step in producing input-output multipliers is to calculate the *direct requirements matrix*, which is also called the technology matrix. The calculations are based entirely on data from table B-1. As shown in table B-2, the values of the cells in the direct requirements matrix are derived by dividing each cell in a column of table B-1, the interindustry transactions matrix, by its column total. For example, the cell for manufacturing's purchases from agriculture is 65/200 = .33. Each cell in a column of the direct requirements matrix shows how many cents of each producing industry's goods and/or services are required to produce one dollar of the consuming industry's production and are called *technical coefficients*. The use of the terms "technology" and "technical" derive from the fact that a column of this matrix represents a recipe for a unit of an industry's production. It, therefore, shows the needs of each industry's production process or "technology."

Table B-2
Direct Requirements Matrix

	Agriculture	Manufact-uring	Services	Other
Agriculture	.10	.33	.08	.02
Manufacturing	.40	.13	.29	.33
Services	.15	.03	.04	.02
Other	.15	.05	.42	.22

Next in the process of producing input-output multipliers, the *Leontief Inverse* is calculated. To explain what the Leontief Inverse is, let us temporarily turn to equations. Now, from table B-1 we know that the sum across both the columns of the square interindustry transactions matrix (**Z**) and the final demand vector (**y**) is equal to vector of production by industry (**x**). That is,

$$\mathbf{x} = \mathbf{Zi} + \mathbf{y}$$

where **i** is a summation vector of ones. Now, we calculate the direct requirements matrix (**A**) by dividing the interindustry transactions matrix by the production vector or

$$\mathbf{A} = \mathbf{Z}\mathbf{X}^{-1}$$

where $\mathbf{X}^{-1}$ is a square matrix with inverse of each element in the vector **x** on the diagonal and the rest of the elements equal to zero. Rearranging the above equation yields

$$\mathbf{Z} = \mathbf{AX}$$

where **X** is a square matrix with the elements of the vector **x** on the diagonal and zeros elsewhere. Thus,

$$\mathbf{x} = (\mathbf{AX})\mathbf{i} + \mathbf{y}$$

or, alternatively,

$$\mathbf{x} = \mathbf{Ax} + \mathbf{y}$$

solving this equation for **x** yields

x	=	$(\mathbf{I}-\mathbf{A})^{-1}$		**y**
Total Output	=	Total Requirements	*	Final Demand

The Leontief Inverse is the matrix $(\mathbf{I}-\mathbf{A})^{-1}$. It portrays the relationships between final demand and production. This set of relationships is exactly what is needed to identify the economic impacts of an event external to an economy.

Because it does translate the direct economic effects of an event into the total economic effects on the modeled economy, the Leontief Inverse is also called the *total requirements matrix*. The total requirements matrix resulting from the direct requirements matrix in the example is shown in table B-3.

Table B-3 Total Requirements Matrix				
	Agriculture	**Manufact-uring**	**Services**	**Other**
Agriculture	1.5	.6	.4	.3
Manufacturing	1.0	1.6	.9	.7
Services	.3	.1	1.2	.1
Other	.5	.3	.8	1.4
Industry Multipliers	.33	2.6	3.3	2.5

In the direct or technical requirements matrix in table B-2, the technical coefficient for the manufacturing sector's purchase from the agricultural sector was .33, indicating the 33 cents of agricultural products must be directly purchased to produce a dollar's worth of manufacturing products. The same "cell" in table B-3 has a value of .6. This indicates that for every dollar's worth of product that manufacturing ships out of the economy (i.e., to the government or for export), agriculture will end up increasing its production by 60 cents. The sum of each column in the total requirements matrix is the *output multiplier* for that industry.

Multipliers

A *multiplier* is defined as the system of economic transactions that follow a disturbance in an economy. Any economic disturbance affects an economy in the same way as does a drop of water in a still pond. It creates a large primary "ripple" by causing a *direct* change in the purchasing patterns of affected firms and institutions. The suppliers of the affected firms and institutions must change their purchasing patterns to meet the demands placed upon them by the firms originally affected by the economic disturbance, thereby creating a smaller secondary "ripple." In turn, those who meet the needs of the suppliers must change their purchasing patterns to meet the demands placed upon them by the suppliers of the original firms, and so on; thus, a number of subsequent "ripples" are created in the economy.

The multiplier effect has three components—direct, indirect, and induced effects. Because of the pond analogy, it is also sometimes referred to as the *ripple effect*.

- A *direct effect* (the initial drop causing the ripple effects) is the change in purchases due to a change in economic activity.

- An *indirect effect* is the change in the purchases of suppliers to those economic activities directly experiencing change.

- An *induced effect* is the change in consumer spending that is generated by changes in labor income within the region as a result of the direct and indirect effects of the economic activity. Including households as a column and row in the interindustry matrix allows this effect to be captured.

Extending the Leontief Inverse to pertain not only to relationships between *total* production and final demand of the economy but also to *change*s in each permits its multipliers to be applied to many types of economic impacts. Indeed, in impact analysis the Leontief Inverse lends itself to the drop-in-a-pond analogy discussed earlier. This is because the Leontief Inverse multiplied by a change in final demand can be estimated by a power series. That is,

$$(\mathbf{I}-\mathbf{A})^{-1}\,\Delta\mathbf{y} = \Delta\mathbf{y} + \mathbf{A}\,\Delta\mathbf{y} + \mathbf{A}(\mathbf{A}\,\Delta\mathbf{y}) + \mathbf{A}(\mathbf{A}(\mathbf{A}\,\Delta\mathbf{y})) + \mathbf{A}(\mathbf{A}(\mathbf{A}(\mathbf{A}\,\Delta\mathbf{y}))) + \ldots$$

Assuming that $\Delta\mathbf{y}$—the change in final demand—is the "drop in the pond," then succeeding terms are the ripples. Each "ripple" term is calculated as the previous "pond disturbance" multiplied by the direct requirements matrix. Thus, since each element in the direct requirements matrix is less than one, each ripple term is smaller than its predecessor. Indeed, it has been shown that after calculating about seven of these ripple terms that the power series approximation of impacts very closely estimates those produced by the Leontief Inverse directly.

In impacts analysis practice, $\Delta\mathbf{y}$ is a single column of expenditures with the same number of elements as there are rows or columns in the direct or technical requirements matrix. This set of elements is called an *impact vector*. This term is used because it is the *vector* of numbers that is used to estimate the *economic impacts* of the investment.

There are two types of changes in investments, and consequently economic impacts, generally associated with projects—*one-time impacts* and *recurring impacts*. One-time impacts are impacts that are attributable to an expenditure that occurs once over a limited period of time. For example, the impacts resulting from the construction of a project are one-time impacts. Recurring impacts are impacts that continue permanently as a result of new or expanded ongoing expenditures. The ongoing operation of a new train station, for example, generates recurring impacts to the economy. Examples of changes in economic activity are investments in the preservation of old homes, tourist expenditures, or the expenditures required to run a historical site. Such activities are considered changes in final demand and can be either positive or negative. When the activity is not made in an industry, it is generally not well represented by the input-output model. Nonetheless, the activity can be represented by a special set of elements that are similar to a column of the transactions matrix. This set

of elements is called an economic disturbance or impact vector. The latter term is used because it is the vector of numbers that is used to estimate the impacts. In this study, the impact vector is estimated by multiplying one or more economic *translators* by a dollar figure that represents an investment in one or more projects. The term translator is derived from the fact that such a vector *translates* a dollar amount of an activity into its constituent purchases by industry.

One example of an industry multiplier is shown in table B-4. In this example, the activity is the preservation of a historic home. The *direct impact* component consists of purchases made specifically for the construction project from the producing industries. The *indirect impact* component consists of expenditures made by producing industries to support the purchases made for this project. Finally, the *induced impact* component focuses on the expenditures made by workers involved in the activity on-site and in the supplying industries.

Table B-4
Components of the Multiplier for the Historic Rehabilitation of a Single-Family Residence

Direct Impact	Indirect Impact	Induced Impact
Excavation/Construction Labor	Production Labor	Expenditures by wage earners on-site and in the supplying industries for food, clothing, durable goods, entertainment
Concrete	Steel Fabrication	
Wood	Concrete Mixing	
Bricks	Factory and Office Expenses	
Equipment	Equipment Components	
Finance and Insurance		

Regional Input-Output Analysis

Because of data limitations, regional input-output analysis has some considerations beyond those for the nation. The main considerations concern the depiction of regional technology and the adjustment of the technology to account for interregional trade by industry.

In the regional setting, local technology matrices are not readily available. An accurate region-specific technology matrix requires a survey of a representative sample of organizations for each industry to be depicted in the model. Such surveys are extremely

expensive.[4] Because of the expense, regional analysts have tended to use national technology as a surrogate for regional technology. This substitution does not affect the accuracy of the model as long as local industry technology does not vary widely from the nation's average.[5]

Even when local technology varies widely from the nation's average for one or more industries, model accuracy may not be affected much. This is because interregional trade may mitigate the error that would be induced by the technology. That is, in estimating economic impacts via a regional input-output model, national technology must be regionalized by a vector of regional purchase coefficients,[6] **r**, in the following manner:

$$(\mathbf{I}-\mathbf{rA})^{-1}\,\mathbf{r}\cdot\Delta\mathbf{y}$$

or

$$\mathbf{r}\cdot\Delta\mathbf{y} + \mathbf{rA}\,(\mathbf{r}\cdot\Delta\mathbf{y}) + \mathbf{rA}(\mathbf{rA}\,(\mathbf{r}\cdot\Delta\mathbf{y})) + \mathbf{rA}(\mathbf{rA}(\mathbf{rA}\,(\mathbf{r}\cdot\Delta\mathbf{y}))) + \ldots$$

where the vector-matrix product **rA** is an estimate of the region's direct requirements matrix. Thus, if national technology coefficients—which vary widely from their local equivalents—are multiplied by small RPCs, the error transferred to the direct requirements matrices will be relatively small. Indeed, since most manufacturing industries have small RPCs and since technology differences tend to arise due to substitution in the use of manufactured goods, technology differences have generally been found to be minor source error in economic impact measurement. Instead, RPCs and their measurement error due to industry aggregation have been the focus of research on regional input-output model accuracy.

[4]The most recent statewide survey-based model was developed for the State of Kansas in 1986 and cost on the order of $60,000 (in 1990 dollars). The development of this model, however, leaned heavily on work done in 1965 for the same state. In addition the model was aggregated to the 35-sector level, making it inappropriate for many possible applications since the industries in the model do not represent the very detailed sectors that are generally analyzed.

[5]Only recently have researchers studied the validity of this assumption. They have found that large urban areas may have technology in some manufacturing industries that differs in a statistically significant way from the national average. As will be discussed in a subsequent paragraph, such differences may be unimportant after accounting for trade patterns.

[6]A regional purchase coefficient (RPC) for an industry is the proportion of the region's demand for a good or service that is fulfilled by local production. Thus, each industry's RPC varies between zero (0) and one (1), with one implying that all local demand is fulfilled by local suppliers. As a general rule, agriculture, mining, and manufacturing industries tend to have low RPCs, and both service and construction industries tend to have high RPCs.

A Comparison of Three Major Regional Economic Impact Models

In the United States there are three major vendors of regional input-output models. They are U.S. Bureau of Economic Analysis's (BEA) RIMS II multipliers, Minnesota IMPLAN Group Inc.'s (MIG) IMPLAN Pro model, and CUPR's own RECON™ I–O model. CUPR has had the privilege of using them all. (R/ECON™ I–O builds from the PC I–O model produced by the Regional Science Research Corporation (RSRC).)

Although the three systems have important similarities, there are also significant differences that should be considered before deciding which system to use in a particular study. This document compares the features of the three systems. Further discussion can be found in Brucker, Hastings, and Latham's article in the Summer 1987 issue of *The Review of Regional Studies* entitled "Regional Input-Output Analysis: A Comparison of Five Ready-Made Model Systems." Since that date, CUPR and MIG have added a significant number of new features to PC I–O (now, R/ECON™ I–O) and IMPLAN, respectively.

Model Accuracy

RIMS II, IMPLAN, and RECON™ I–O all employ input-output (I–O) models for estimating impacts. All three regionalize the U.S. national I–O technology coefficients table at the highest levels of disaggregation. Since aggregation of sectors has been shown to be an important source of error in the calculation of impact multipliers, the retention of maximum industrial detail in these regional systems is a positive feature that they share. The systems diverge in their regionalization approaches, however. The difference is in the manner that they estimate regional purchase coefficients (RPCs), which are used to regionalize the technology matrix. An RPC is the proportion of the region's demand for a good or service that is fulfilled by the region's own producers rather than by imports from producers in other areas. Thus, it expresses the proportion of the purchases of the good or service that do not leak out of the region, but rather feed back to its economy, with corresponding multiplier effects. Thus, the accuracy of the RPC is crucial to the accuracy of a regional I–O model, since the regional multiplier effects of a sector vary directly with its RPC.

The techniques for estimating the RPCs used by CUPR and MIG in their models are theoretically more appealing than the location quotient (LQ) approach used in RIMS II. This is because the former two allow for crosshauling of a good or service among regions and the latter does not. Since crosshauling of the same general class of goods or services among regions is quite common, the CUPR-MIG approach should provide better estimates of regional imports and exports. Statistical results reported in Stevens, Treyz, and Lahr (1989) confirm that LQ methods tend to overestimate RPCs. By extension, inaccurate RPCs may lead to inaccurately estimated impact estimates.

Further, the estimating equation used by CUPR to produce RPCs should be more accurate than that used by MIG. The difference between the two approaches is that MIG estimates RPCs at a more aggregated level (two-digit SICs, or about 86 industries) and applies them at a disaggregate level (over 500 industries). CUPR both estimates and applies

the RPCs at the most detailed industry level. The application of aggregate RPCs can induce as much as 50 percent error in impact estimates (Lahr and Stevens, 2002).

Although both RECON™ I–O and IMPLAN use an RPC-estimating technique that is theoretically sound and update it using the most recent economic data, some practitioners question their accuracy. The reasons for doing so are three-fold. First, the observations currently used to estimate their implemented RPCs are based on 20-years old trade relationships—the Commodity Transportation Survey (CTS) from the 1977 Census of Transportation. Second, the CTS observations are at the state level. Therefore, RPC's estimated for substate areas are extrapolated. Hence, there is the potential that RPCs for counties and metropolitan areas are not as accurate as might be expected. Third, the observed CTS RPCs are only for shipments of goods. The interstate provision of services is unmeasured by the CTS. IMPLAN replies on relationships from the 1977 U.S. Multiregional Input-Output Model that are not clearly documented. RECON™ I–O relies on the same econometric relationships that it does for manufacturing industries but employs expert judgment to construct weight/value ratios (a critical variable in the RPC-estimating equation) for the nonmanufacturing industries.

The fact that BEA creates the RIMS II multipliers gives it the advantage of being constructed from the full set of the most recent regional earnings data available. BEA is the main federal government purveyor of employment and earnings data by detailed industry. It therefore has access to the fully disclosed and disaggregated versions of these data. The other two model systems rely on older data from *County Business Patterns* and Bureau of Labor Statistic's ES202 forms, which have been "improved" by filling-in for any industries that have disclosure problems (this occurs when three or fewer firms exist in an industry or a region).

Model Flexibility

For the typical user, the most apparent differences among the three modeling systems are the level of flexibility they enable and the type of results that they yield. R/ECON™ I–O allows the user to make changes in individual cells of the 383-by-383 technology matrix as well as in the 11 383-sector vectors of region-specific data that are used to produce the regionalized model. The 11 sectors are: output, demand, employment per unit output, labor income per unit output, total value added per unit of output, taxes per unit of output (state and local), nontax value added per unit output, administrative and auxiliary output per unit output, household consumption per unit of labor income, and the RPCs. The PC I–O model tends to be simple to use. Its User's Guide is straightforward and concise, providing instruction about the proper implementation of the model as well as the interpretation of the model's results.

The software for IMPLAN Pro is Windows-based, and its User's Guide is more formalized. Of the three modeling systems, it is the most user-friendly. The Windows orientation has enabled MIG to provide many more options in IMPLAN without increasing

the complexity of use. Like R/ECON™ I–O, IMPLAN's regional data on RPCs, output, labor compensation, industry average margins, and employment can be revised. It does not have complete information on tax revenues other than those from indirect business taxes (excise and sales taxes), and those cannot be altered. Also like R/ECON™, IMPLAN allows users to modify the cells of the 538-by-538 technology matrix. It also permits the user to change and apply price deflators so that dollar figures can be updated from the default year, which may be as many as four years prior to the current year. The plethora of options, which are advantageous to the advanced user, can be extremely confusing to the novice. Although default values are provided for most of the options, the accompanying documentation does not clearly point out which items should get the most attention. Further, the calculations needed to make any requisite changes can be more complex than those needed for the R/ECON™ I–O model. Much of the documentation for the model dwells on technical issues regarding the guts of the model. For example, while one can aggregate the 538-sector impacts to the one- and two-digit SIC level, the current documentation does not discuss that possibility. Instead, the user is advised by the Users Guide to produce an aggregate model to achieve this end. Such a model, as was discussed earlier, is likely to be error ridden.

For a region, RIMS II typically delivers a set of 38-by-471 tables of multipliers for output, earnings, and employment; supplementary multipliers for taxes are available at additional cost. Although the model's documentation is generally excellent, use of RIMS II alone will not provide proper estimates of a region's economic impacts from a change in regional demand. This is because no RPC estimates are supplied with the model. For example, in order to estimate the impacts of rehabilitation, one not only needs to be able to convert the engineering cost estimates into demands for labor as well as for materials and services by industry, but must also be able to estimate the percentage of the labor income, materials, and services which will be provided by the region's households and industries (the RPCs for the demanded goods and services). In most cases, such percentages are difficult to ascertain; however, they are provided in the R/ECON™ I–O and IMPLAN models with simple triggering of an option. Further, it is impossible to change any of the model's parameters if superior data are known. This model ought not to be used for evaluating any project or event where superior data are available or where the evaluation is for a change in regional demand (a construction project or an event) as opposed to a change in regional supply (the operation of a new establishment).

Model Results

Detailed total economic impacts for about 400 industries can be calculated for jobs, labor income, and output from R/ECON™ I–O and IMPLAN only. These two modeling systems can also provide total impacts as well as impacts at the one- and two-digit industry levels. RIMS II provides total impacts and impacts on only 38 industries for these same three measures. Only the manual for R/ECON™ I–O warns about the problems of interpreting and comparing multipliers and any measures of output, also known as the value of shipments.

As an alternative to the conventional measures and their multipliers, R/ECON™ I–O and IMPLAN provide results on a measure known as "value added." It is the region's contribution to the nation's gross domestic product (GDP) and consists of labor income, nonmonetary labor compensation, proprietors' income, profit-type income, dividends, interest, rents, capital consumption allowances, and taxes paid. It is, thus, the region's production of wealth and is the single best economic measure of the total economic impacts of an economic disturbance.

In addition to impacts in terms of jobs, employee compensation, output, and value added, IMPLAN provides information on impacts in terms of personal income, proprietor income, other property-type income, and indirect business taxes. R/ECON™ I–O breaks out impacts into taxes collected by the local, state, and federal governments. It also provides the jobs impacts in terms of either about 90 or 400 occupations at the users request. It goes a step further by also providing a return-on-investment-type multiplier measure, which compares the total impacts on all of the main measures to the total original expenditure that caused the impacts. Although these latter can be readily calculated by the user using results of the other two modeling systems, they are rarely used in impact analysis despite their obvious value.

In terms of the format of the results, both R/ECON™ I–O and IMPLAN are flexible. On request, they print the results directly or into a file (Excel® 4.0, Lotus 123®, Word® 6.0, tab delimited, or ASCII text). It can also permit previewing of the results on the computer's monitor. Both now offer the option of printing out the job impacts in either or both levels of occupational detail.

RSRC Equation

The equation currently used by RSRC in estimating RPCs is reported in Treyz and Stevens (1985). In this paper, the authors show that they estimated the RPC from the 1977 CTS data by estimating the demands for an industry's production of goods or services that are fulfilled by local suppliers (*LS*) as

$$LS = D^{e(-1/x)}$$

and where for a given industry

$x = k\, Z_1^{a1} Z_2^{a2}\, P_j\, Z_j^{aj}$ and D is its total local demand.

Since for a given industry RPC = LS/D then

$$\ln\{-1/[\ln(\ln LS/\ln D)]\} = \ln k + a_1 \ln Z_1 + a_2 \ln Z_2 + S_j a_j \ln Z_j$$

which was the equation that was estimated for each industry.

This odd nonlinear form not only yielded high correlations between the estimated and actual values of the RPCs, it also assured that the RPC value ranges strictly between 0 and 1. The results of the empirical implementation of this equation are shown in Treyz and Stevens (1985, table 1). The table shows that total local industry demand (Z_1), the supply/demand ratio (Z_2), the weight/value ratio of the good (Z_3), the region's size in square miles (Z_4), and the region's average establishment size in terms of employees for the industry compared to the nation's (Z_5) are the variables that influence the value of the RPC across all regions and industries. The latter of these maintain the least leverage on RPC values.

Because the CTS data are at the state level only, it is important for the purposes of this study that the local industry demand, the supply/demand ratio, and the region's size in square miles are included in the equation. They allow the equation to extrapolate the estimation of RPCs for areas smaller than states. It should also be noted here that the CTS data only cover manufactured goods. Thus, although calculated effectively making them equal to unity via the above equation, RPC estimates for services drop on the weight/value ratios. A very high weight/value ratio like this forces the industry to meet this demand through local production. Hence, it is no surprise that a region's RPC for this sector is often very high (0.89). Similarly, hotels and motels tend to be used by visitors from outside the area. Thus, a weight/value ratio on the order of that for industry production would be expected. Hence, an RPC for this sector is often about 0.25.

The accuracy of CUPR's estimating approach is exemplified best by this last example. Ordinary location quotient approaches would show hotel and motel services serving local residents. Similarly, IMPLAN RPCs are built from data that combine this industry with eating and drinking establishments (among others). The results of such aggregation process is an RPC that represents neither industry (a value of about 0.50) but which is applied to both. In the end, not only is the CUPR's RPC-estimating approach the most sound, but it is also widely acknowledged by researchers in the field as being state of the art.

Advantages and Limitations of Input-Output Analysis

Input-output modeling is one of the most accepted means for estimating economic impacts. This is because it provides a concise and accurate means for articulating the interrelationships among industries. The models can be quite detailed. For example, the current U.S. model currently has more than 500 industries representing many six-digit North American Industrial Classification System (NAICS) codes. The R/ECON™ model used in this study has 383 sectors. Further, the industry detail of input-output models provides not only a consistent and systematic approach but also more accurately assesses multiplier effects of changes in economic activity. Research has shown that results from more aggregated economic models can have as much as 50 percent error inherent in them. Such large errors are generally attributed to poor estimation of regional trade flows resulting from the aggregation process.

Input-output models also can be set up to capture the flows among economic regions. For example, the model used in this study can calculate impacts for a county, as well as a metropolitan area or a state economy.

The limitations of input-output modeling should also be recognized. The approach makes several key assumptions. First, the input-output model approach assumes that there are no economies of scale to production in an industry; that is, the proportion of inputs used in an industry's production process does not change regardless of the level of production. This assumption will not work if the technology matrix depicts an economy of a recessional economy (e.g., 1982) and the analyst is attempting to model activity in a peak economic year (e.g., 1989). In a recession year, the labor-to-output ratio tends to be excessive because firms are generally reluctant to lay off workers when they believe an economic turnaround is about to occur.

A less-restrictive assumption of the input-output approach is that technology is not permitted to change over time. It is less restrictive because the technology matrix in the United States is updated frequently and, in general, production technology does not radically change over short periods.

Finally, the technical coefficients used in most regional models are based on the assumption that production processes are spatially invariant and are well represented by the nation's average technology. In a region as large and diverse as New Jersey, this assumption is likely to hold true.

Appendix C: Per-Million-Dollar Impacts

In accordance with standard practice, economic impacts per million dollars of expenditure are calculated on the base of total operating expenditures. The relationship between spending and impacts is linear – that is, for each million dollar increase or decrease in the industry's operating expenditures, the estimated increase or decrease in economic impacts would be those presented in the following tables, *assuming that the distribution of expenditures is the same or similar to that of the expenditures on which the impact calculations are based.*

Table C-1 presents the estimated contribution to the New Jersey economy per $1 million dollars of expenditure by the mental health and addiction services industry.

Table C-1
Per-Million-Dollar Economic Impacts in New Jersey of Mental Health and Addiction Services Industry Operating Expenditures

Indicator	Impact
Employment (annual)	**29**
Gross Domestic Product	**$1,523,125**
Compensation	**$1,279,989**

Appendix D: Derivation of Local Property Tax Impacts

The estimated local tax revenues for the state estimated in this analysis represent property tax revenues that accrue, in part, over time, as a result of improvements to existing or construction of new property. This activity is afforded by the personal and business incomes generated directly and indirectly by the operating expenditures of the industry.

Local tax revenues result from the expenditures generated from the income for workers and revenues for business.[7] The personal incomes and business revenues are, in part, used to pay property taxes and to improve properties (both residential and commercial). Thus, households and businesses that benefit from the operating expenditures acquire and/or improve residential and commercial properties or alternatively are able to pay rents that include associated property taxes.

Historical New Jersey fiscal and economic data are used to measure the relationship between business revenues and the amount of commercial property tax revenues collected, and between household incomes and the amount of residential property tax revenues collected.[8] Given both household income and business revenues associated with industry expenditures, the R/ECON™ Input-Output Model invokes the known statistical relation of increases in local property tax revenues to both increases in household income and business revenues in order to estimate the addition to local tax revenues attributable to the expenditures. These revenues accrue over of time as the improvements and additions to properties become embodied in the property tax base of local governments.

[7] For businesses, the revenue increase is measured in terms of value-added, and it is the change in value added in the business sector that is the basis for the estimated change in property tax revenues.
[8] For the entire state, approximately 76% of total local property tax revenues are attributable to residential property; with approximately 21% derived primarily from commercial and industrial property.

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