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ELY MARKET AREA STUDY

REPORT # 2

AN ECONOMIC ANALYSIS OF THE ELY BASE ECONOMY

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I. INTRODUCTION

The Task

The present report represents the second of three reports under contract No. 8060 between the University of Minnesota, Duluth and the Minnesota State Planning Agency.

Under this contract, Report No. 2 "Conducting Economic Analysis for Ely, Minnesota: Methods and Results", will accomplish the following task taken from Article I of the contract:

3. Conduct an economic analysis of Ely which will describe the base economics of the area and their relative significance.

The report will consist of the following sections:

I. Introduction

II. Regional Input-Output (Interindustries) Analysis

- A. Input-Output Analysis and General Equilibrium Theory
- B. The Components of Input-Output
  - 1. The Transactions Table
  - 2. The Direct Requirements Table
  - 3. The Direct and Indirect Requirements Table
  - 4. The Mathematics

III. Construction of the Interindustry Model and an Analysis of the Ely Economy

- A. Sampling Procedures for Firms
  - 1. Determination of Sample Design
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  - 1. Construction of Transactions Table
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IV. Conclusion

V. Appendix: Survey Instruments

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II. REGIONAL INPUT-OUTPUT (INTERINDUSTRIES) ANALYSIS

Input-Output Analysis and General Equilibrium Theory

The concept of interindustry analysis has its roots in general equilibrium theory developed to its fullest extent by Leon Walras. General equilibrium theory is best understood in comparison with its alternative, partial equilibrium theory. Partial equilibrium theory, as it applies to supply and demand analysis, investigates the equilibrium price and quantity of a single commodity under the assumption that the prices and influences of all other commodities are constant. In other words, partial equilibrium theory attemts to determine individual prices for commodities and/or resources of production in isolation from the influences of other commodities and/or resources of production. No attempt is made in partial analysis to simultaneously solve for all prices and quantities in the economy.

Leon Walras attempted to generalize equilibrium analysis in this way. The Walrasium system is a set of equations with prices and quantities as the dependent variables and the usual independent variables in demand and supply analysis (including tastes, income, technology, etc.) but also including as independent variables the factors that commodities and resources exert on one another. This system would require a separate equation for every firm in the regional economy, for every resource in the regional economy, and for every consumer in the regional economy. Each equation would require all influencing factors be identifiable and measurable. This means that, for even a very small and rural economy, a massive set of equations and corresponding measurements would be required to operationalize the Walrasium system. It would also mean that computers with massive storage capacities would be required in order to carry out the solution for this set of equations.

While this system of equations may not be operational, the concept involved is quite useful. It casts great doubt on the usefullness of partial analysis even though it is more empirically operational. Walras set in motion an idea in need of operationalization. Input-output analysis is an attempt to empirically measure the economic structures of a society.

Input-output analysis was first developed in 1936 by Wassily Leontief[1]. Forms of input-output analysis were utilized by the United States government in the planning and preparation for the war effort during World War II. Leontief won the Nobel Prize for economics for this particular effort in 1973.

It has already been mentioned that Leontief was attempting to operationalize the concept of general equilibrim. In order to do so, certain assumptions had to be made to reduce the enormous data and computational requirements of a full general equilibrium system. Many of these assumptions can be relaxed as additional information is added to the model. These assumptions are as follows:

1. In order to avoid the requirements of a separate equation for each firm, consumer and resource market in the economy, input-output analysis assumes that firms, consumers, and resources can be usefully aggregated into industrial sectors, households, government, investment, and export market sectors, and finally, into value added or resource earning sectors. This requires that the sectors be so defined as to be relatively homogeneous in their behavior. In other words, this assumption would certainly be shaky if an input-output sector were to include combinations like U.S. Steel and wheat farms. When dealing with industrial sectors, homogeneity requires that firms of a particular sector use similar production processes and sell to similar markets.
2. Input-output analysis cuts down on the computational requirements of the general equilibrium model by assuming prices to be constant.

Prices are, therefore, exogenous to the input-output system. It should be pointed out that the assumption of constant prices is actually an assumption of constant relative prices. In other words, if all prices were to simultaneously increase by the same percentage, this assumption would not be violated.

3. The usual input-output system assumes that technology is constant. This means that the production techniques noted in an input-output table do not vary over time.

4. Input-output assumes that the factor proportions used in production are constant. This assumes away any possible analysis of economies to scale, exonomies of agglomerative factors, or economies resulting from changes in factor input ratios.

5. Input-output assumes that interregional trade patterns are constant. This assumption requires, for example, that if region A imports 20% of its semi-finished goods and services from region B in 1966 (the base year), this same 20% factor would hold for all industries in 1976 (the projected year).

Many of these assumptions can be summarized under the concept of a linear and homogenous production function. A linear and homogeneous production function requires constant input proportions per unit of output for a producing entity. It requires, for example, that a firm utilizing one unit of labor and one unit of capital in order to produce 100 units of output, would require two units of labor and two units of capital to produce 200 units of output, three units of labor and three units of capital to produce 300 units of output, and so on. In input-output analysis the requirement is extended to include the input of intermediate inputs into each producing sector's production function.

These assumptions are highly restrictive. Because of them, input-output is probably most useful for short term analysis. It is probably not too far fetched

to suppose that technology is relatively constant over the short run. Even if technological discovery is occurring at a fast rate, the implementation of this new technology with the implied investment in new capital that this implementation would require probably makes the constant technological assumption useful.

Further, even in periods of rapid inflation, prices probably do not change relative to one another in such massive amounts during the short term as to make this particular assumption a problem.

The existence of contracts and fairly regular suppliers probably indicates that trading substitutions between alternative suppliers do not occur rapidly enough to make this assumption questionable over the short term. When the long term is looked at, however, these assumptions are most probably in serious enough error as to cast serious doubt on the accuracy of input-output solutions and projections.

By narrowing the number of required equations to a finite number of aggregated sectors, by assuming away the need to analyze changing technologies, by assuming away the need to simultaneously solve for resource and product prices, and by assuming away the need to analyze changing trade patterns, input-output analysis does succeed in operationalizing the general equilibrium concept. In other words, under these sets of assumptions, input-output analysis escapes the requirement to study different industries, consuming groups, and resource markets in isolation from one another. Through the input-output system, the notion of economic structure and interdependence are highlighted.

It should be noted that once the input-output system is finalized, certain of these assumptions can be dealt with through further analysis. For example, William Miernyk in a landmark analysis of the West Virginia economy,[2] attempted to construct a dynamic table by including capital coefficients as a part of the table's system of equations. Other reports[3,4] have attempted to systematically analyze the effects of changing prices on particular input-output structures. Still other studies have attempted to find regular ways in which input-output

tables can be updated to take into account changing trade and resource use patterns. Once the problem of identifying economic interdependence was solved, these other important modifications towards reality became possible.

The Components of Input-Output: The Transactions Table

An input-output system generally consists of three interrelated tables highlighting the industrial structure of a regional economy. These are the transactions table, the direct dollar requirements table, and the direct and indirect dollar requirements table.

The dollar transactions table is exemplified by Table 1 below.

TABLE 1

Dollar Value of Transaction for a Hypothetical Regional Economy

	Agriculture	Entertainment	Home Furnishings	Final Sales	Total Output
Agriculture	100	700	000	4,625	5,425
Entertainment	50	200	50	6,400	6,700
Home Furnishings	75	300	75	4,905	5,355
Resource Inputs	5,000	5,500	230	18,000	28,730
Imports	200	000	5,000	000	5,200
Total Inputs	5,425	6,700	5,355	33,930	51,410

As was stated earlier, an input-output table aggregates all of the individual firms of a regional economy into a set of industrial sectors. The industrial sector must be chosen such that they include all of the firms in the area. In the hypothetical example, a highly simplified structure of three industries is presented, Agriculture, Entertainment, and Home Furnishings. In additional to the industrial sectors, there is a component of the table titled Final Sales. This consists of the value of transactions between the noted industrial sectors and the users of the product when such use is not intended to further produce additional products.

Final sales generally consist of the so-called components of Gross National or Gross Regional Product. That is, it consists generally of household purchases of goods and services, government purchases, purchases for the purpose of investment by business units, and purchases of the reference regional products by other regions (exports).

A third section of an input-output table deals with the value added by the resources used by each sector. This generally includes the wages, interest, rents, and profits that are earned by households and by business units in a regional economy as well as the goods and services that are used by a regional economy but produced elsewhere, i.e., imports. The rows of an input-output relationship indicate the sales by industries to one another and to final sales. The columns of an input-output structure highlight the productive inputs of semi-finished goods or resource inputs by each sector.

For example, the 700 total in the Agriculture row and Entertainment column of Table 1 indicates that Agriculture sold $700 worth of intermediate products to Entertainment reading across the row, or it indicates a purchase of $700 by Entertainment from Agriculture reading down the column. The $5,500 total in the fourth figure of the second column indicates that Entertainment purchased $5,500 worth of productive resources in producing its own output. These totals would represent the totals for a period of time such as the year 1976.

Input-output at this level represents, in effect, a cost accounting sheet for a regional economy, treating the industrial sectors of the regional economy like successive departments in an individual firm. As such, the accounting identity of debits equaling credits is required to hold for input-output as it would be required to hold for an individual firm. This is indicated by the fact that the total dollar transaction for the row (e.g., $5,425 of total output for the Agriculture row) is equal to the dollar transaction totals for the corresponding column of that table (e.g., $5,425 total input for the Agriculture column).

The transactions table of an input-output system is, taken by itself, purely descriptive. It is possible to determine from such a table the level of Gross Regional Product for the area under study. It is also possible to get some feel for the level of transactions that take place within that regional economy. It is not generally possible, however, to use this table for detailed analysis of structural impacts that result from such things as changing demands for the regional economy's output. Using the assumptions that were discussed in the first section of this report, a second table can be derived from the transactions table which is more useful for analytic purposes.

The Components of Input-Output: The Direct Requirements Table

A second input-output table can be derived from the transactions table if each entry in any given industry's column of the transactions table is divided by the total for the row of that same industry. The resulting number represents the dollar value of inputs required from the various industries to produce one dollar's worth of output for each industry taken separately. It is a measure of the aggregate contributions to the output of the region by each industry. Table 2 represents a direct requirement based on the data in Table 1.

TABLE 2

Direct Dollar Requirements for a Hypothetical Regional Economy

	Agriculture	Entertainment	Home Furnishings
Agriculture	.018	.104	.000
Entertainment	.009	.030	.009
Home Furnishings	.014	.045	.014
Resource Inputs	.922	.821	.043
Imports	.037	.000	.934
Total Inputs	1.000	1.000	1.000

The direct requirements table is based on the notion that, for example, Agriculture would not have purchased $75 from Home Furnishings during the reference year of this study unless this $75 worth of intermediate input was required in order to produce the $5,425 of total Agricultural output. It may be said, then, that Agriculture required an input of $75 from Home Furnishings to produce the $5,425.

The question may then be asked, "If Agriculture required $75 of intermediate production from Home Furnishings in order to produce $5,425 of total output, what was the requirement from Home Furnishings by Agriculture per dollar of output?" That answer, of course, can be derived by dividing $75 by $5,425. The results of that division appear as .014 in the Home Furnishings row and Agriculture column of Table 2. The interpretation of that figure is as follows, for every dollar of output that Agriculture produced in the reference year, it required 1.4¢ worth of the output of Home Furnishings. Similarly, Entertainment required 3¢ from its own sector for every dollar's worth of output that is produced in the reference year, and so it goes through each column of the direct requirements table.

Some limited analysis is possible with this direct requirements table. For example, Entertainment must purchase 10¢ worth of the output of Agriculture for every dollar's worth of output in Entertainment services. The question might be asked, "What is the effect of an increase in the final sales of Entertainment of $1,000 on the intermediate sales of Agriculture?" The obvious answer is that the direct effect is .10 times $1,000, or $100. For every increase of $1,000 for Entertainment, Agriculture will also feel a direct increase in its sales, and if the assumptions of the model hold, this can also be applied to the sales of all the other industries in the region as well as those of the productive resources of the region.

This is not where the story ends, however. If a change in the sales of one industry exerts direct changes in the sales of all other industries, then the second round industries will also require more inputs from the economy. The third and final table to be discussed takes these "indirect" effects into account, as will be discussed below.

The Components of Input-Output: The Direct and Indirect Dollar Requirements Table

Table 3, the direct and indirect dollar requirements table, is probably the most useful of the three tables. The mathematics of input-output are presented in the following section to this report, so they will not be reviewed here. Rather, a short description of the process by which Table 3 is derived will be presented for those not interested in the technicalities of input-output.

TABLE 3

Direct and Indirect Dollar Requirements for a Hypothetical Regional Economy

	Agriculture	Entertainment	Home Furnishings
Agriculture	1.019	.109	.001
Entertainment	.010	1.032	.010
Home Furnishings	.015	.049	1.015

It was stated in the example above that Entertainment requires 10.4¢ worth of the intermediate output of Agriculture in order to produce $1.00 of Entertainment output. It was also mentioned that, under the specified assumptions, an increase in the final demand requirements of entertainment equal to $1,000 would result in an increase in sales to Entertainment by Agriculture of $104. In order for Agriculture to produce $1.00 of output, that industry requires 1.4¢ of the output of Home Furnishings. So, in order to produce $104 to supply to Entertainment, Home Furnishings would have to provide Agriculture with $1.46 (1.4 x $104) worth of intermediate outputs.

This means that Home Furnishings would have to increase its output by $1.46, which would increase its requirements from the Entertainment industry of .009 times $1.04, or .01. The process that is described above continues until all of the interactive forces have played themselves out.

It would be quite cumbersome to determine the total of these rounds of impact through a step by step process as is used in the example immediately above. This would be cumbersome for a three sector table, and the difficulty would increase proportionately with increasing numbers of sectors used in an actual table. Fortunately, this solution can be obtained through the use of high speed computer technology. Table 3 summarizes the results of this type of interactive process.

Table 3 is interpreted as providing the direct impact (found in Table 2) along with the additional indirect impact of a dollar of final sales per industry. It is used in the following manner: if Agriculture produces $1.00 worth of output, it requires 1.8¢ directly from itself, .9¢ directly from Entertainment, 1.4¢ from Home Furnishings. This is in addition to the $1.00 of output that was already attributed to the Agriculture industry.

It might be said, therefore, that Agriculture directly requires $1.018 from itself in order to produce $1.00 worth of output. In addition, it required indirectly (according to Table 3) another .001¢ to produce that dollar because it has to service itself and the other firms that are involved in supplying intermediate goods for that dollar's worth of input. The total impact, direct and indirect, of a $1.00 level of output by Agriculture on itself is $1.019. In a similar fashion, in order to produce that dollar's worth of output, 9¢ is required from Entertainment directly, and an additional .1¢ is required indirectly as Entertainment services itself and other firms servicing Agriculture. And so it goes throughout the Agriculture column.

These figures down the column of Table 3 may be interpreted as interindustry multipliers for the hypothetical regional economy. If the column is summed, the resulting figure would be the total impact of a $1.00 change in the final output of the reference industry on itself and on all the other industries in the region due to the trade relationships that were specified in Tables 1 and 2. It is generally this table that is used for impact analysis as these impacts stem from changing levels of final sales for regional industry's outputs.

The Components of Input-Output: The Mathematics

The previous section of this report provided a descriptive version of the input-output tables. The current section will provide the mathematics of these tables. For the reader that is not interested in the technicalities of input-output, this section may be skipped with no attending loss of understanding.

As a reminder, the Walrasian system of equations basically attempts to determine equilibrium prices and quantities of goods, services, and productive resources as they are produced, consumed, or employed in a given economy. Input-output analysis assumes prices to be given, technology to be fixed, and the pattern of trade with other economies to be established. It then goes on to determine the required size of output from each individual industry in order to satisfy a particular set of final demands.

The determination of output requirements allows for the analysis of two important, related magnitudes. If output produced by various public and non-public agencies of production is known, then various resources needed for production, plus required semi-finished products (intermediate inputs), may be specified in terms of the magnitudes of this output. In other words, a specified regional production function of the form:

$$(1)\quad v_j = x_{1j} + x_{2j} + x_{3j} + \ldots + x_{ij} + F$$

where v_j is the value of the output of the jth industrial sector,

x_{ij} is the sale of intermediate inputs

from the ith sector to the jth sector, where i = (1,2,. ..., n) and j = (1,2, . . .,m)

and F represents regional industry purchases of the

services of productive resources or of intermediate products from other regions (imports).

In fact, for any one industry, the inputs form a column vector which we may call L

$$L_j = \begin{pmatrix} x_{1j} \\ x_{2j} \\ x_{3j} \\ F \end{pmatrix}$$

On the sales side, the total product of an industry is the summation of its output that will serve as intermediate inputs to other industries plus its output that will serve the final demand.

$$(2)\quad v_i = (x_{i1} + x_{i2} + x_{i3} + D_i),$$

where v_i is as before,

x_{ij} is the sale from the ith to the jth sector

as before, and D_i is the final demand for the

ith sector's output.

The final value of the output of this region represents the value of all intermediate outputs of the various industries (which are, in turn, a function of the input-output requirements of all regional industries) plus final demand.

The thrust of interindustry analysis is economic interdependence. In order for one industry to produce its output it must utilize basic resources as well as intermediate goods produced by other industries. This isolates the linkage effects of a particular economic phenomenon. These linkages manifest themselves through various stages of production that any particular product must go though.

The identity equation can now be carried one step further. It is known that x_{ij} represents the dollar value of intermediate outputs that are sold by industry i to industry j and that v_j represents the value of total inputs for industry j. Therefore

(3) $\left[a_{ij} = \frac{x_{ij}}{v_j}\right]$ is the dollar value of intermediate inputs that industry j requires from industry i in order to produce one dollar of final output. Also, $a_{ij}\, v_j = x_{ij}$ is the required dollar value of input that industry j needs from industry i in order to produce v_j worth of output. Since $v_i = \sum_{i=j}^{n} x_{ij} + D_i$, it follows that $v_i = \sum_{i=1}^{n} a_{ij}\, v_j + D_i$.

The above equation can now be put in matrix form to note that the total output of the regional economy is the simultaneous summation of all individual outputs, or:

$$(4)\quad V = \begin{bmatrix} v_1 \\ v_2 \\ \cdot \\ \cdot \\ v_n \end{bmatrix} = \begin{bmatrix} \sum_{j=1}^{n} a_{1j}\, v_j \\ \sum_{j=1}^{n} a_{2j}\, v_j \\ \cdot \\ \cdot \\ \sum_{j=1}^{n} a_{Aj}\, v_j \end{bmatrix} + \begin{bmatrix} D_1 \\ D_2 \\ \cdot \\ \cdot \\ D_n \end{bmatrix}$$

If we put the a_{ij} coefficients into a matrix format, i.e.,

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ a_{n1} & a_{n2} & & a_{nm} \end{bmatrix}$$

we can write the structural equation as $V = AV + D$.

Solving for D,

$$(5) \quad D = V - AV$$
$$= V (I - A)$$

where I is an identity matrix with the same number of rows and columns as A.

Solving for V,

$$(6) \quad V = D(I - A)^{-1} .$$

What is the dollar value of output each industrial sector needs to produce in order to satisfy a given demand for final goods and services? The answer, including the requirements for intermediate inputs by the various industries, may be obtained from the above equation.

The $(I - A)^{-1}$ factor is generally referred to as the Leontief inverse. It represents the matrix of coeffecients that is given by Table 3 in the example presented in the previous section of this report. When multiplied by the column vector of final demands, the result is another column vector of outputs, by industry, for the reference economy.

Accordingly, if there is a postulated change in the final demand for regional industries' output, the inverse may be applied to estimate the resulting direct and indirect effect of that change as all regional industrial outputs respond to that initial change as described in the example in the previous section of this report.

The transactions table, the direct table, and the direct and indirect table will be presented in this report for the Ely area economy. Later reports will demonstrate some of the uses to which such analysis can be put.

This, then, is the model that will be employed with reference to the Ely area economy. If was not long after Leontief's pioneering work that applications of this form of analysis to the various economic problems of sub-national regions

were realized. These regions were traditionally plagued with data limitations in arriving at the decision that would, in large measure, determine the path and level of their growth. The direction of this growth, in turn, determined the resource use of the region through the production requirements of the industries that settled in that region. Input-output analysis is currently among the favorite approaches to regional accounts and growth (impact) analysis. Existing tables range from national tables[5] to state tables[6] to sub-state regional tables[7] and to urban tables.[8]

III. CONSTRUCTION OF THE INTERINDUSTRY MODEL AND AN ANALYSIS OF THE ELY ECONOMY

Sampling Procedures For Firms

Given the selection of the Ely study area for the reasons delineated in Report # 1, the first step prior to surveying was to complie a listing of all business firms in the area. The final list of firms, which consititutes the population for this study, was developed from three basic sources. They are: (1) the 1977 telephone directory of Ely, Minnesota, (2) information on new firms and firms not in business obtained from the Minnesota Department of Employment Services, Ely, and (3) new firms and firms not in business discovered during the process of surveying. The final population consisted of 264 firms.

Each of the firms in the population was then assigned to the appropriate sector. These sectors of the model, which were chosen so as to have reasonable homogeneity within sectors and so that all Ely firms were covered by a sector definition, are summarized in Table 4 along with examples of the types of firms in each sector. Because of Ely's unique economy there are few manufacturing sectors but several retail goods/service sectors. Some of the disaggregation of these latter sectors (e.g. Sectors 5 and 6 and Sectors 12 and 13) are necessary in order to later estimate the effect of tourism/recreation on the Ely economy. While the Household Sector is included in Table 4, the sampling procedures for households will be discussed in detail later. Any firm with multiple economic activities, such as selling canoes and provided outfitting services, was placed in the sector that accounted for the largest share of its income or sales.

Determination of the Sample Design

In order to estimate the sample size required to obtain a specified amount

TABLE 4

DESCRIPTION OF THE SECTORS IN THE ELY AREA MODEL

Sector Number	Sector Title	Sector Description
1.	Construction	Building and special contractors, excavators, electrical, plumbing and heating contractors, concrete manufacturing, roofing and painting contractors, machine and welding.
2.	Lumber & Wood Products	Logging, wholesale lumber and wood products, pulp and papers.
3.	Communication, Transportation & Utilities	Newspapers, weekly shoppers, printed media advertising, railroad, local transportation by bus and air, motor freight, television, radio and cable-TV, electrical, gas and sanitary services, electronic media advertising.
4.	Wholesale Trade	Wholesale grocery, dairy, confection and refershment firms.
5.	Durable Retail	Retail building and hardware, department stores, clothing and variety stores, furniture and home furnishings, TV and radio sales.
6.	Non-Durable Retail	Drug stores, off-sale liquors, book and record sales, sporting goods, bait and tackle, floral, hobby, craft and gift stores.
7.	Grocery	Grocery stores, meat and dairy stores, bakeries.
8.	Cafes & Taverns	Businesses that sell beverages and prepared foods that may be consumed on the premises.
9.	Automotive, Service Stations	Automobile parts and sales, service stations, heating, fuel oils and bulk gas distributors, marine sales and service.
10.	Financial & Insurance	Banks, credit unions, insurance and real estate agencies, apartments.

TABLE 4 (Continued)

DESCRIPTION OF THE SECTORS IN THE ELY AREA MODEL

Sector Number	Sector Title	Sector Descrition
11.	Lodging	Hotels, motels, lodges, resorts, camps, trailer courts, ski resorts.
12.	Personal & Recreational Services	Laundromats, beauty and barber shops, upholsters, auto repair shops (exclusive of service stations) household repairs, recreational outfitters.
13.	Professional Services	Doctors, dentists, chiropractors, lawyers, veterinarians, clinics, hospitals.
14.	Service-Oriented	School districts, colleges, churches, non-profit service and fraternal organizations, accounting services, surveyors.
	Households	All private individuals.

of precision (e.g., to construct an interval estimate of a certain length and at a certain level of confidence), the variances of the variables to be estimated must be known. Since estimates of the variances were not available, other techniques had to be used to determine the sample size. Three factors were considered. The first was the amount of funds available for collecting the data; the second was the limited time (and the survey dates) available to conduct the survey; and third was the sampling rate used in previous input-output studies. In previous comparable small area studies (e.g., Bromley and Stovener) a sampling rate between 24 and 30 percent of the total population was used. In well known larger statewide studies (e.g., Miernyck and Emerson) rates as low as 3 percent have been employed.

After considering these factors (primarily the third) it was determined that a response or sampling rate of at least 30% should be achieved. It was realized that the non-response rate would be high during the time we would be in the field because of the off-season (i.e., some seasonal businesses were closed) and because of several recent surveys conducted in the area (e.g., a mail business survey had been sent to over 100 firms shortly before we entered the field to survey). Other inherent reasons for non-response in any input-output firm survey will be delineated later. While we might have randomly selected a 50-60% sample in hopes of getting a 30% response rate, it was decided to proceed with a census (i.e., a sample of the entire population of business firms) on the expectation that this would insure the desired response rate. One reason for doing this was that, given that the population for the Ely area was relatively small, it was less expensive to do a census that to develop elaborate initial and followup random sampling procedures. Even more importantly, proceeding with a census could be done in less time that a staged (i.e., draw first random sample and then draw second random sample based on analysis for the first sample, etc.)

sampling design. And as it turned out, time was the major constraint in the survey, since all field work was to be completed prior to the heavy Christmas (1977) season when many firms are busy.

Firm Survey Results

The final population and sample respondent sizes for each sector are summarized in Table 5 along with sample respondent percentage (of population) for each sector. These percentages also represent the response rates for each sector, since a census was taken of the population. They are quite comparable to the previously noted input-output studies. For example, Miernyck had sector samples ranging from .2 to 33.3 percent. Our rates vary from 11% for construction to 75% for wholesale, with the overall rate being 37%. While the response rate of 37% is rather low, as the sampling rate (sample as percentage of population) it is higher than the rate achieved in many of the input-output studies noted earlier. Aside from the unique problems in Ely noted earlier and which contributed to the low response rate, there are other factors which make surveying firms more difficult than a typical (e.g., household) survey. First, the type of data being collected being financial makes it of a confidential nature. This problem is compounded when the firms are small, as in Ely, since the information tends to pertain to a single self-employed individual. Large firms or corporations are more inclined to disclose financial information given their public ownership.

Another factor contributing to the low response rate was that many businesses in the area are sub-divisions of larger companies and did not have detailed information available in their Ely office. Some attempts were made to contact such companies by mail but most firms did not reply to the mail request for information.

Following the initial census by the interview team, several followup approaches were used to increase the rate of response or sample size. First, the interview

TABLE 5

DISTRIBUTION OF THE SAMPLE AMONG THE SECTORS OF THE MODEL

		NUMBER OF FIRMS		
		Population	Respondents	Sampling Rate
1.	Construction	18	2	.11
2.	Lumber & Wood Products	5	2	.40
3.	Communications, Transportation, Utilities	19	12	.63
4.	Wholesale Trade	4	3	.75
5.	Durable Retail	22	10	.45
6.	Non-Durable Retail	21	5	.24
7.	Grocery	4	1	.25
8.	Cafes and Taverns	13	7	.54
9.	Automotive, Service Stations	16	8	.50
10.	Finance and Insurance	15	9	.60
11.	Lodging	55	15	.27
12.	Personal & Recreational Services	32	9	.28
13.	Professional Services	20	11	.55
14.	Service-Oriented	20	4	.20
	Total Economy	264	98	.37

service which conducted the household survey (Lakehead Interviewing Service Associates) made contact with firms who had promised to mail in their survey when first contacted. Some the these requiring help in filling out the survey were then interviewed by the principal investigators. The investigators also were able to complete surveys for some firms that had been contacted by mail by another research team (one of the problems noted earlier) but had refused on our first contact. Furthermore, a mail and phone follow-up of firms who were left a survey to fill out resulted in additional responses.

At final count 98 completed interviews were obtained which represents over 37 percent of 264 firms in the area. In the judgement of the research team, this represents an acceptable sample size for an input-output study of this type. This judgement is based on statistical considerations, comparable studies in the literature, and the constraints of the project.

Sampling Procedures and Results for Households

A household survey was conducted by a subcontractor, Lakehead Interviewing Services Associates, for the purpose of constructing the final demand portion of the input-output table. This household survey was a cluster random sample, rather than a census, which resulted in 263 completed surveys. For the population (total number of households) the sample of 263 represents a sampling rate of approximately 15%. The response rate for this survey was in excess of 90% and so is quite acceptable in the judgement of the research team.

Construction of the Transactions Table

TABLE 6. nsactions Matrix Showing Interindustry Flows in Dollars, Ely Area, 1976 (Rounded to Nearest $1,000)

SELLING SECTOR \ PURCHASING SECTOR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Summation	FINAL SALES: Households 15	Gov't Servs. 16	Exports 17	Total 18
1. Construction.....	261	0	0	0	0	0	0	0	0	0	0	2	0	0	263	586	762	135	1,746
2. Lumber & Wood Products....	0	0	0	0	0	0	0	0	0	0	0	18	0	0	18	3,056	70	347	3,491
3. Communication, Trans, Utilities.	5	66	195	7	76	31	212	14	5	122	272	32	370	45	1,452	917	2	27	2,398
4. Wholesale Trade...	171	0	*	3	5	124	115	75	8	0	0	14	230	0	745	251	0	282	1,278
5. Durable Retail...	*	2	19	13	4	49	0	1	246	118	121	10	49	71	703	1,999	913	990	4,605
6. Non-Durable Retail	0	0	0	0	0	33	0	0	0	0	89	*	168	1	291	607	17	810	1,725
7. Grocery.....	0	0	0	0	0	0	0	0	0	0	77	64	183	27	351	3,494	204	739	4,788
8. Cafes & Taverns...	0	0	0	*	0	1	0	20	0	0	0	0	0	0	21	515	46	714	1,296
9. Automotive, Service Stations.	0	44	0	0	0	8	0	0	1,404	16	111	5	103	0	1,691	3,466	187	704	6,048
10. Finance & Insurance	20	17	28	6	47	45	7	75	114	103	208	9	243	65	987	2,863	196	3,732	7,778
11. Lodging.....	0	0	0	0	0	0	0	0	0	0	59	0	0	0	59	139	38	1,090	1,326
12. Personal & Recreation Services..	97	34	0	5	26	9	0	9	4	15	74	21	33	26	353	347	2	552	1,254
13. Professional Services.....	*	0	8	0	24	0	0	0	1	13	1	0	0	0	47	475	3,100	12,401	16,023
14. Service-Oriented.	0	9	34	0	0	0	0	0	0	0	24	*	317	8	392	312	0	2,985	3,689
SUMMATION	554	172	284	34	182	300	334	194	1,782	387	1,036	175	1,696	243	7,373	19,027	5,537	25,508	57,445
15. Households.....	834	333	928	252	3,686	467	1,774	218	1,706	6,352	-228	860	12,919	2,502					32,623
16. Government Services.....	10	254	159	28	63	42	191	53	144	206	299	41	619	49					2,158
17. Imports.....	348	2,732	1,027	964	674	916	2,489	831	2,416	833	219	178	789	895					15,311
18. TOTAL INPUTS...	1,746	3,491	2,398	1,278	4,605	1,725	4,788	1,296	6,048	7,778	1,326	1,254	16,023	3,689	57,445	19,027	5,537	25,508	107,517

*Number in cell rounds to zero.

indicates that it sold $171,000 worth of goods and services to construction (1), $124,000 to non-durable retail (7), and so on across the row. Likewise, the purchases of each sector can be determined by reading down the column of a sector.

Description of Characteristics of Ely Economy

The first 14 rows, or columns, of the table comprise the interindustry or endogenous part of the table. Also, below row 14 there is a subtotal row which indicates the total value of goods and services each sector purchased within the local Ely economy. These figures provide a general indication of how much the sector depends on the local economy. The larger the figure, relative to the total purchases, the greater the magnitude of dependence of that sector, in terms of its impacts, upon the other sectors of the local economy.

The import row indicates the purchses of goods and services from outside the Ely economy and provides a measure of self-sufficiency for each sector of the economy. Obviously, being a small area, the Ely economy has a large volume of imports and is not really self-sufficient. The government row indicates payments made to local, state, and federal governments by each sector. The remaining row for each sector includes salaries and other forms of value added. These other components of value added include interest, dividends, and returns to entrepreneur services.

Beyond column 14 are the various components (household, government, and exports) of final demand (or sales) for goods and services sold by the sectors listed at the left of the matrix. These columns indicate the relative importance of each market (or component of final demand) for each sector. For example, most of the lodging sales (row) are made to the export sector.

Furthermore, by totaling sales across (column) the first 14 columns of each row one obtains interindustry sales (i.e., sales to local industry) which can be

compared to total sales for each sector. In the future the export column may be broken into two columns - tourist and non-tourist exports in order to analyze the impact of tourism on the Ely economy.

Aside from the information already brought to light for each sector by the transactions table, it is possible to determine the relative significance of each sector from the table as well. This has been done by taking the total sales of each sector and determining what percentage each is of the overall Ely economy. The last two columns of Table 7 provide this information. An alternative measure of relative importance might be what percentage of total employment is provided by each sector. Though this information is not directly contained in the transactions table, one might obtain a proxy for such a measure by finding each sector's percentage of value added.

Technical (Direct) Coefficients Matrix

Table 8 provides the technical coefficients matrix (A) for the Ely economy which was defined in general terms earlier in this report. Each element of this matrix, a_{ij}, was obtained by dividing the corresponding element x_{ij} of the transactions matrix (Table 6) by the total output of sector j. The matrix is utilized by reading down the columns in order to determine the input structure (or production function) of each sector. In most cases, the a_{ij}'s, which represent sector j's purchases per dollar of output, reveal more clearly the structure of a sector than the absolute magnitude of interindustry sales (i.e., x_{ij}) depicted in the transactions matrix. The first column of the A matrix shows that construction must purchase 14.98 cents worth of goods and services from itself if it is to increase its output by one dollar. Likewise, in order to produce the additional dollar of output it must also purchase .27 cents from Communications, Transportation, and Utilities sector (3); and so on down the column. If we were to take the sum of

TABLE 7

RELATIVE SIZE OF SECTORS OF THE ELY ECONOMY

		Sales (Output)	
		Dollars (000)	Percent
1.	Construction	1746	3.04
2.	Lumber & Wood Products	3491	6.08
3.	Communication, Transportation, Utilities	2398	4.17
4.	Wholesale Trade	1278	2.22
5.	Durable Retail	4605	8.02
6.	Non-Durable Retail	1725	3.00
7.	Grocery	4788	8.33
8.	Cafes & Taverns	1296	2.26
9.	Automotive, Service Stations	6048	10.5
10.	Finance & Insurance	7778	13.5
11.	Lodging	1326	2.31
12.	Personal & Recreation Service	1254	2.18
13.	Professional Services	16023	27.9
14.	Service-Oriented	3689	6.42
	Total Economy	57445	100.00

Table 8. Technical(Direct) Coefficients Matrix (A), Ely Area, 1976

SELLING SECTOR \ PURCHASING SECTOR	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Construction.....	.14987	0	0	0	0	0	0	0	0	0	0	.00097	0	0
2. Lumber & Wood Products..	0	0	0	0	0	0	0	0	0	0	0	.01404	0	0
3. Communication, Transportation, Utilities.....	.00277	.01889	.08387	.00556	.01648	.01845	.04463	.01093	.00089	.01561	.20536	.02495	.02314	.01213
4. Wholesale Trade.....	.09782	0	.00010	.00261	.00102	.07215	.02418	.05766	.00132	0	0	.01208	.01434	0
5. Durable Retail.....	.00004	.00061	.00846	.01028	.00094	.02816	0	.00055	.04065	.01518	.09096	.00874	.00304	.01922
6. Non-Durable Retail.....	0	0	0	0	0	.01898	0	0	0	0	.06733	.00069	.01046	.00014
7. Grocery.....	0	0	0	0	0	0	0	0	0	0	.05797	.05189	.01145	.00720
8. Cafes & Taverns.....	0	0	0	.00019	0	.00032	0	.01539	0	0	0	0	0	0
9. Automotive, Service Station.....	0	.01267	0	0	0	.00479	0	0	.23206	.00202	.08345	.00407	.00643	0
10. Finance & Insurance.....	.01134	.00491	.01257	.00438	.01015	.02630	.00143	.05815	.01889	.01326	.15654	.00646	.01517	.01763
11. Lodging.....	0	0	0	0	0	0	0	0	0	0	.04439	0	0	0
12. Personal and Recreation Serv.....	.05536	.00960	0	.00401	.00556	.00524	0	.00668	.00071	.00199	.05586	.01642	.00207	.00697
13. Professional Services...	.00005	0	.00295	0	.00531	0	0	0	.00019	.00164	.00081	0	0	0
14. Service-Oriented.....	0	.00260	.01477	0	0	0	0	0	0	0	.01822	.00014	.01979	.00294

all a_{ij}'s in a column (j) of Table 8 this would indicate the total worth of goods and services that would be directly required from the local Ely economy to add one dollar of output in sector j. Such a sum would be larger, for sectors (columns) which require the most from other industries in the local economy to produce their output. It follows that increases in output in such industries will have the greatest direct impact on the Ely economy.

The Direct and Indirect Coefficients Matrix

However, as was explained earlier in this report input-output analysis is capable of measuring not only these direct impacts of an increase (or decrease) in the output of any sector but it can also reveal what the indirect effects will be as well. The combined direct and indirect effects are presented in Table 9, the $(I-A)^{-1}$ or direct and indirect coefficients matrix. It contains 14 rows and 14 columns, as did Table 8, one for each sector of the economy. The coefficients in the $(I-A)^{-1}$ matrix are larger than those in the corresponding cells of the direct coefficients matrix, A. That is, the coefficients in the $(I-A)^{-1}$ matrix indicate the total increase in output of a sector (i=row) resulting from a change in output of a sector (j=column). For example, assume there is a one dollar increase in the output of Construction. This sets into motion a series of changes in the output of all the sectors of the local economy. When the change has worked itself out (the details of this process were explained in an earlier section of this report), Construction's output will have increased $1.176; Wholesale Trade 11 cents; and so on (down the Construction's column).

The fifteenth row, summation, of the $(I-A)^{-1}$ matrix is the sum of the first 14 rows of each column. These figures represent the change in total output of the economy resulting from a one-dollar change in final demand (output) of the sector listed at the top of the column. For example, a one-dollar increase

Table 9. Direct and Indirect Coefficients Matrix $(I-A)^{-1}$, Ely Area, 1976

SELLING SECTOR \ PURCHASING SECTOR	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Construction.....	1.17636	.00001	.00000	.00000	.00001	.00001	.00000	.00001	.00000	.00000	.00007	.00116	.00000	.00001
2. Lumber & Wood Products.	.00094	1.00014	.00000	.00006	.00008	.00008	.00000	.00010	.00002	.00003	.00086	.01428	.00003	.00010
3. Communication, Transportation, Utilities..	.00657	.02110	1.09228	.00648	.01852	.02221	.04893	.01377	.00273	.01768	.24627	.03099	.02685	.01452
4. Wholesale Trade.....	.11628	.00016	.00018	1.00269	.00119	.07389	.02425	.05802	.00181	.00008	.00782	.01378	.01548	.00031
5. Durable Retail.....	.00213	.00169	.00980	.01048	1.00136	.03043	.00071	.00227	.05343	.01569	.10779	.00969	.00474	.01976
6. Non-Durable Retail....	.00005	.00001	.00004	.00000	.00006	1.01935	.00000	.00001	.00001	.00002	.07189	.00072	.01067	.00015
7. Grocery.....	.00347	.00053	.00017	.00022	.00036	.00032	1.00001	.00038	.00007	.00013	.06403	.05278	.01172	.00760
8. Cafes & Taverns.....	.00002	.00000	.00000	.00019	.00000	.00034	.00000	1.01564	.00000	.00000	.00002	.00000	.00001	.00000
9. Automotive, Service Station.....	.00041	.01657	.00007	.00004	.00011	.00647	.00001	.00020	1.30227	.00269	.11498	.00566	.00850	.00009
10. Finance & Insurance...	.01461	.00570	.01436	.00469	.01067	.02828	.00221	.06037	.02554	1.01392	.17535	.00751	.01667	.01837
11. Lodging.....	0	0	0	0	0	0	0	0	0	0	1.04645	0	0	0
12. Personal & Recreation Serv....	.06673	.00982	.00021	.00416	.00571	.00597	.00011	.00727	.00130	.00214	.06107	1.01703	.00243	.00726
13. Professional Services	.00012	.00008	.00330	.00008	.00539	.00027	.00015	.00015	.00058	.00180	.00245	.00016	1.00013	.00018
14. Service-Oriented.....	.00011	.00292	.01624	.00010	.00038	.00034	.00073	.00021	.00005	.00030	.02282	.00064	.02024	1.00247
15. SUMMATION	1.38779	1.05874	1.13665	1.02919	1.04382	1.18797	1.07712	1.15920	1.38782	1.05450	1.92189	1.15441	1.11749	1.07082

in final demand for Construction will cause output of the entire economy to increase $1.39 (the initial dollar plus 39 cents of direct and indirect requirements). This is called the (output) multiplier of the sector. The magnitude of these multipliers serve as an indication of the relative impacts of an increase in output for each sector. For instance, the impact of Sector 11, Lodging, is $1.92 and this is greater than the impact of Sector 4, Wholesale Trade, which is only $1.03. In the final report emphasis will be placed on the importance of these multipliers for policymakers who must make decisions involving economic development.

IV. CONCLUSION

This report presents the basic information for understanding the current economy of Ely, Minnesota in terms of its internal and external relationships. Another report will focus on the applications that can be made of this analysis and will suggest future reserach directions along these lines.

This report is intended to serve as the technical aspect of this series of reports and as a reference for the analysis that follows. It also stands as a descriptive report with respect to the structure of the Ely economy and can be used, therefore, by other reserachers in areas of particular interest along these general research lines.

V. Appendix: Survey Instruments

THE ELY AREA

SURVEY QUESTIONNAIRE

GENERAL INDUSTRY

CONFIDENTIAL

This questionnaire is asking for data from your business operation for the year 1976. If you are not able to provide any information for that year, please choose a year as close to 1976 as is possible and indicate that year in this space: 19_____.

Please refer to the instructions in this questionnaire for the specifics involved in answering any given question, and please call collect:

Dr. Richard W. Lichty
Department of Economics
University of Minnesota-Duluth
726-7219 (Office)
726-7284 (Secretary)

if there are any questions.

Thank you in advance for your cooperation on this most important study. After the data contained in this questionnaire has been properly coded, this sheet will be destroyed in order to protect the confidential aspects of this survey.

Name of Firm: _____

Address of Firm: _____

Name of Respondent: _____

Respondent's Title: _____

Respondent's Office Phone: _____

Please answer all questions. If you do not have the specific answer at hand, please provide us with your best estimate of what the answer would be.

Definitions and specific instructions for filling out the individual questionnaire items are presented below. Any other questions should be referred to Richard Lichty as specified on the first page of this questionnaire.

1. Average Annual Employment, as defined by the U.S. Bureau of the Census, includes all full and part-time employees who received pay for any portion of the pay period ending nearest to the months of March, May, August, and November.

2. Total Annual Wages and Salaries: this is the same information that was asked of you on the federal withholding tax report.

3. Self-explanatory.

4A. All Federal Taxes, including excise taxes, social security, etc.

4B. All State Taxes, including sales taxes.

4C. All Local Taxes, including property taxes.

1. 1976 Annual Employment of Firm: March _____ May _____

August _____ November _____

2. Total Annual Wage and Salaries: _____

_____

3. Value of Change in Inventory for 1976: _____

4. Taxes Paid To:

A. Federal Government _____

B. State Government _____

C. Local Government _____

The purchasing industries may be classified by s.i.c. number or by the following industry groups if you choose not to list companies:

Sector

1. Livestock and products
2. All other agricultural products
3. Forestry and fishery products
4. Agricultural, forestry, and fishery services
5. Food and kindred products
6. Broad and narrow fabrics, yarn and thread mills
7. Miscellaneous textile goods, including floor coverings
8. Apparel
9. Miscellaneous fabricated textile products
10. Lumber and products, except wooden containers
11. Wooden containers
12. Household Furniture
13. Other furniture and fixtures
14. Paper and allied products, except paperboard containers and boxes
15. Paperboard containers and boxes
16. Printing and publishing
17. Chemicals
    a) Mining
    b) Manufacturing
18. Plastics and synthetics
19. Drugs and toilet preparations
20. Paint and allied products
21. Petroleum and related products
    a) Mining
    b) Manufacturing
22. Rubber and miscellaneous plastic products
23. Industrial leather
24. Other leather products
25. Glass and glass products
26. Stone and clay and their products
    a) Mining
    b) Manufacturing
27. Iron and Steel
    a) Mining
    b) Manufacturing
28. Nonferrous metals
    a) Mining
    b) Manufacturing
29. Metal cans, shipping barrels, drums, kegs, and pails
30. Heating, plumbing and fabricated structural metal products
31. Screw machine products, stampings and bolts, nuts, etc.
32. Other fabricated metal products

33. Engines and turbines
34. Construction and mining machinery and equipment
35. Materials handling equipment
36. Special and general industry machinery and equipment
    a) Metalworking machinery and equipment
    b) Special industry machinery and equipment
    c) General industrial machinery and equipment
    d) Miscellaneous machinery
37. Office, computing and accounting machines
38. Service industry machines
39. Electric transmission and distribution equipment and other industrial apparatus
40. Electric lighting and wiring equipment
41. Communications equipment
42. Electronic components and accessories
43. Miscellaneous electrical machinery, equipment and supplies
44. Motor vehicles and equipment
45. Aircraft and parts
46. Other transportation equipment
47. Professional, scientific and controlling instruments and supplies, including watches and clocks
48. Miscellaneous manufacturing
49. Ordnance
50. Gas and electric power and water service
51. Transportation (and warehousing)
52. Trade (including esting and drinking places)

10. List the major products or services you produce: _____

11. Indicate the 1976 sales of your establishments that are located in the region:

Total Sales $_____ Number of Establishments Covered _____

	Total Sales	(%) Capital Goods	Are transportation costs included?	Ely Area Sales	Out of Ely Area Sales
Household Consumers					
State Government					
Local Government (County)					
Local Government (City)					
Federal Government (Defense)					
Federal Government (Other)					
Foreign Export					

12. Please indicate the approximate cost of the materials, parts, supplies, and business services you purchased from other establishments in 1976:

$_____ OR _____% of your sales dollar.

13. Allocate your purchases according to industries and the location of these industries. Please estimate the percentage of dollar totals if you cannot provide exact data.

Purchased Products and/or Materials	Total Purchases	Ely: Firms	U. S. Firms	Foreign Firms	(I) Supplied by Industrie (W) Supplied by Wholesa
(Example: Structural Steel)	($250,000)	(35%)	(35%)	(30%)	(W-100%)
Purchased Services					

ELY AREA ECONOMIC BASE STUDY

C O N F I D E N T I A L

For Authorized Personnel Only

University of Minnesota, Duluth
Department of Economics
Duluth, Minnesota 55812

Households
1. Town & Village _____
2. Non-farm Rural
Permanent _____

Location: _____

Interviewer: _____

I am employed by the Department of Economics at the University of Minnesota, Duluth, in order to conduct an economic survey in the Ely area. The information we would like you to provide us with has to do with the economic aspects, e.g., expenditures and sources of income, of your household. With this household information and similar economic information we are collecting from firms in Ely we will be able to develop an understanding of the Ely economy that will be useful in local decision making. All information obtained in the survey will be kept strictly confidential, that is, no information will be released which will identify individual responses or individual respondents in any way. Your household has been randomly selected to be included in the survey. The survey will take about 20 minutes to complete. If you have any questions about the survey, I will be happy to try to answer them. Your participation in the survey is entirely voluntary--you may withdraw from participation in the survey at any time during the interview. May I ask you the following questions?

1. Could you approximate your 1976 household expenditures for the following items by checking (x) the appropriate category.

ITEM	Sector #	TOTAL 1976 EXPENDITURE												
		$0-200	$200-400	$400-600	$600-800	$800-1000	$1000-1500	$1500-2000	$2000-3000	$3000-4000	$4000-5000	$5000-10,000	Over $10,000	% spent in FL
Home improvements(contracted)	2													
Electricity	5													
Telephone	5													
Water and sewerage	5													
Heating costs	7													
Clothing and apparel	7													
Furniture and appliances	7													
General retail (hardware, etc.)	7													
Food and groceries	8													
Auto and vehicle purchase	9													
Eating and drinking	10													
Misc. tourist retail (bait, gift)	11													
Insurance premiums	12													
Rent	12													
Mortgage payment	12													
Other loan payment	12													
Personal and repair service	14													
Amusement and recreation service	15													
Medical and legal	16													
Education	17													
Contributions	17													
Household & domestic help	18													
Support of other persons	18													
County and local taxes														
State and federal taxes														

2. How many miles per year do you drive your car (or cars)? _____ What proportion of your gas, oil and and vehicle repairs do you purchase in the Ely area?_____

3. Could you approximate your 1976 household income from the following sources by checking (x) the appropriate category

SOURCE	TOTAL 1976 INCOME											% coming from Ely
	$0-500	$500-1000	$1000-2000	$2000-5000	$5000-10,000	$10,000-15,000	$15,000-20,000	$20,000-30,000	$30,000-40,000	$40,000-50,000	over $50,000	
Gross earnings												
Financial (saving interest, dividends)												
Gifts, awards & prizes												
Income (rent) from real estate												
Maintenance expense												
Mortgage expense												
Other business interest												
Gov't. assistance, pension Social Security												

4. Number of adults _____ children _____ in household.

INFORMATION FOR THOSE (1,2 or 3) IN HOUSEHOLD WHO WORKED IN 1976

5. Months worked in 1976 (1)_____ (2)_____ (3) _____

6. Place of employement (city) (1)_____ (2)_____ (3) _____

7. Occupation (1)_____ (2)_____ (3) _____

8. Sex (1)_____ (2)_____ (3) _____

VI. Footnotes and References

1. Wassily W. Leontief, "Quantitative Input-Output Relations in the Economic System of the United States", The Review of Economic Statistics 18:105-125.

2. William H. Miernyk, Simulating Regional Economic Development , Regional Research Institute, West Virginia University, Morgantown, West Virginia (June, 1969).

3. Edward A. Hudson and Dale W. Jorgenson, "Tax Policy and Energy Conservation".

4. Christensen, Jorgenson and Lau (reference incomplete - further information is currently being sought).

5. A modest national table was published in 1964 for the year 1958, see Morris Goldman, Martin Marimont, and Beatrice H. Vaccara, "The Interindustry Structure of the United States," Survey of Current Business, Vol. 44, No. 11 (November, 1964). Since then, tables for 1963, 1967 and 1970 have been completed.

6. Many state tables are either in preparation or completed. One that is of particular interest for its experiment with dynamic coefficients is Miernyk, op cit.

Another state table of particular interest was prepared by M. Jarvin Emerson, Kansas Interindustry Study, Topeka: State of Kansas, 1969.

7. Numerous county tables or multi-county tables have been constructed. Two of particular interest might be cited here.

The first is a Ph.D. dissertation by Jack J. McCullic, The Economic Impact of Irrigation on Selected Southwestern Kansas Counties: An Input-Output Approach. This study is of interest because of its use of data from a larger regional study for small region analysis.

Also, see Jay M. Hughes, Forestry in Itasca County's Economy: An Input-Output Analysis. Agricultural Experiment Station, University of Minnesota, Miscellaneous Report 95, 1970.

8. Many urban tables have been produced, the most ambitious of which is Walter Issard, et al. Philadelphia Region Input-Output Study, Regional Science Institute, 1966, Vol, 1, 2 and 3. Another study by J. David Reed, "The Measurement of the Economic Structure and Performance of an Urban Economy by use of an Input-Output Model" was presented at the 1969 meetings of the Mid-Continent Regional Science Association Meetings in Iowa City, Iowa.

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