

ELY MARKET AREA STUDY

REPORT # 1

ALTERNATIVE MODELS FOR ANALYZING
THE ELY BASE ECONOMY

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I. INTRODUCTION

The Task

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

Under this contract Report No. 1., "Choosing Economic Analysis Methods for Ely, Minnesota," will accomplish the following two tasks taken from Article I of the contract:

1. Review and recommend economic analysis methods available for use on Ely, Minnesota.
2. Demonstrate how the characteristics of Ely make the analysis method appropriate.

The report will consist of the following sections:

- I. Introduction
 - A. The Task
 - B. Overview
 - C. Ely Area Characteristics
- II. Economic Models
 - A. Economic Base
 - B. Input/Output
 - C. The Form of the Proposed Model
 - D. Forecasting, Validation (Estimation) and Operating Costs
- III. Conclusion
- IV. Footnotes and References

Overview

Local, state, and regional officials are often confronted with decisions of significant economic importance. Questions concerning such critical areas as the effects of migration on local employment, the effects of new industry development in the community on the tax, income and employment base of the region, or the effects of closing a major employer in the area on the general level of economic activity in the region, often go unanswered due to a lack of information at the community level. The need to have these questions answered was emphasized in a recent report by the Citizen's League of Minneapolis which states that a crucial need for their community is "...a systematic arrangement for thinking about economic change and the impact of both public and private actions on it."

Most of the regional analysis that has been undertaken emphasizes state or multi-county economies. State or substate regional planning has often overlooked or ignored the economic and social consequences of policies designed to achieve state goals for individual communities. Even data that are already available from such sources as the U.S. Census, the Department of Employment Security, the Federal Reserve System, Federal Tax Sources, and other related centers of secondary information is often reported only at the state or, at best, the county level due to requirements for preventing the disclosure of certain information.

Moreover, the data that are available are often reported for a time frame that is not particularly useful to the local decision maker (e.g., the U.S. Census of Population is taken every ten years). Finally, there is often too little application of known economic analysis tools at the community level, so that what data are available are not used to the fullest potential. The general result is a lack of understanding concerning either the community's

development patterns or the effectiveness of alternative community development strategies.

Economic Base Theory, which will be explained more fully in Section II, suggests that a community's development possibility is highly dependent on the external demand for its products. This external demand is reflected in the export patterns of the community. In essence, exports provide the revenues necessary to pay for local production, which is the basic source of income to local businesses and households. This income is then circulated several times via a local multiplier process, generating still more jobs and income in industries designed to service local demands. In a very real way, these "local service" industries exist because export activity exists.

Every community demonstrates a unique pattern of relationships between export and local service activity. Even though it is generally true that exports generate service activity, it is also likely that different types of exports lead to different service requirements. Input-output analysis, which will also be detailed in Section II, addresses these interrelationships between economic units. It can show, for example, that an exporting industry relating weakly to the local base (purchases few of its semi-finished goods locally) exerts far less of an indirect and induced impact than a smaller industry that is heavily involved in the local economy. Development attention, however, is often directed towards the most obvious economic unit in the economy. Government policies that hurt the smaller but otherwise potent employer are often undertaken without true recognition of the magnitude of impact that is eventually exerted on the economy.

As an adjunct to their declaration of a need for knowing the impacts of economic change at the state and local level, the Citizen's League states that this could best be accomplished by a "...continuing program of economic analysis...designed to identify and analyze crucial state and local economic

issues." The program contained herein will suggest different types of economic analysis tools for communities. The type of tool used by a community will depend on its economic and demographic characteristics and its specific analytical need.

The tools reviewed will have general applicability to regional areas, but the overall plan of this research effort is to select and adapt one of the tools based on the particular needs of Ely, Minnesota, to show how the analysis is applicable to policy questions currently affecting that area. Ely will serve, in this capacity, as a case study area for this kind of research design in terms of the model's applicability to rural development in much of the state.

Issues that may be addressed by such analysis will be detailed in report #3 of this series. That report will also detail how the selected model can be used as a predictive-planning tool for government decision makers through a process of making various assumptions concerning the future pattern of non-resident sales. In this way, local production, consumption and related economic entities can be isolated so that alternative futures can be analyzed.

Examples of issues that can be dealt with in the Ely area include:

- (1) the economic impacts of copper-nickel development,
- (2) industrial complexes as they relate to future development patterns in the region, i.e., predictions as to the likely paths of development in industrial setting,
- (3) the economic impacts of work stopages in the region, such as occurred during the recent steel strike in Northeast Minnesota, and
- (4) the economic impacts of proposed change in the logging arrangements of the Boundary Waters Canoe Area.

Ely Area Characteristics (as shown in Figure 1)

Ely's economy is characterized by a dependence on mining, timber, and

tourism. Many individuals in the area are employed by Reserve Mining Company (officials of Ely estimated that over 500 individuals living in Ely are directly employed by Reserve and, of course, the town of Babbitt is heavily dependent on Reserve for its employment levels).

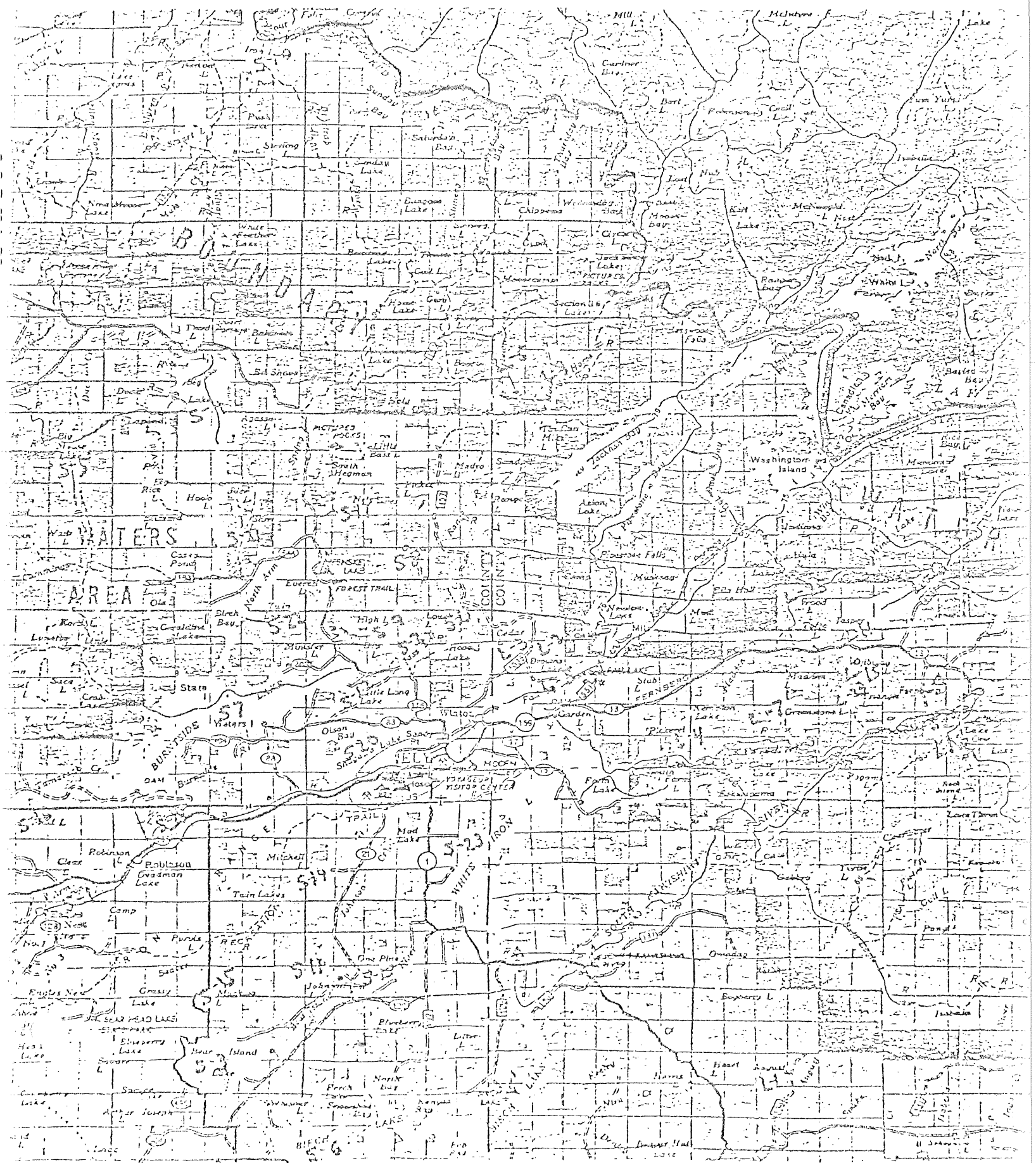
With respect to forestry, the number of firms harvesting in the Ely area in 1971 was given in a DNR study as five small to modest sized firms. There were three harvesters in Tower and two in Babbitt at that time. One major sawmill and two smaller mills were also located in the general area of Ely. Primary wood producing activities thus tend to focus on Ely as the nodal point for flows of resources devoted to forest user.

One of the final features of the Ely area is also a feature that truly differentiates this area from much of the rest of Northeast Minnesota, that being, those tourist types and activities that are unique to the area. Professor Uel Blank has already conducted meaningful research in the region being considered as a study area [7].

In analyzing recreation in Northeast Minnesota, Professor Blank found that an area which includes the counties of St. Louis, Lake and Cook could be further subdivided into "focal areas" containing differing mixes of recreation activities and different demand reactions to those capacities. Of particular interest here is the description of the Ely area as, "...the major focal point for the lake-resort area along the western part of BWCA."

In this connection, it was found that the tourists using the area had a high degree of identification with the name Ely in terms of the recreation activities provided, that the area can be classified as being primarily associated with fishing and wilderness activities, that the users of these recreation services tend to be less mobile with respect to length of stay in the area than was true for some of the other identified focal areas, that the users of the recreation services provided at the Ely focal area tended to have incomes in

FIGURE 1: Map of Ely, Minnesota Study Area



excess of \$15,000 (1972 data) to a greater extent than the average for all identified focal areas, and that a significant number of the users of these services come from the states of Minnesota, Indiana, and Illinois.

In short, it was found that the Ely focal area did have a pattern of recreational use and user characteristics that were different than many of the other identified recreation focal areas in the broader region. This, in turn, implies that the Ely focal area is sufficiently significant in its own characteristics to have separate meaning beyond any conclusions arrived at through larger geographic area analysis.

All of these features tend to make the area a unique one for economic base modeling. In spite of the rural nature of the area, it is diverse in its economy with strong orientation towards resources, services and trade. Manufacturing plays a minor role in the employment pattern of the area. This is indicated by the fact that there are only 5 out of 314 firms in the region engaged in manufacturing (according to a preliminary survey of the firms in the region by Professors Lichty and Steinnes).

II. ECONOMIC MODELS

Discussion of an economic model will be oriented towards either the multiplier estimation technique that is generally termed as economic base or an alternative technique commonly termed input/output analysis. Each has its own set of assumptions, methods of multiplier estimation, levels of detail and techniques of application. Both are currently in wide spread use, however, which in itself attests to their general success in attracting a following. Each will be discussed in terms of the approaches towards implementation, assumptions required, strengths, weaknesses, probable costs associated with implementation and maintenance, and their usefulness for rural economic decision making.

It should be pointed-out that these models do not exhaust the possibilities for multiplier estimation. Multiple equation econometric models have been employed for multiplier estimation. These have been used to the greatest extent at the national level and generally rely heavily on the demand oriented macro models of John Maynard Keynes. They have, more recently, been employed at the regional level. It is the opinion of the authors of this paper that the data requirements of such models and the very recent appearance of such attempts at the regional level warrants their being excluded from the current discussion. Research (Maki, Lichty, and Dorf [19]) that compares these with the input/output and economic base concepts is currently in progress, however. Should this indicate that econometric modeling is, in fact, superior to the alternative, a second review will be undertaken.

ECONOMIC BASE MODELS

The variety of economic base models that have been developed and employed for small area economies is beyond description in any paper that hopes to be less than book length. Classic works on the topic include those of Andrews [1, 2, 3, 4, & 5], Tiebout [23, 24, & 25], and Levin [17 & 18].

Although the models are many, the concept is basically the same. That is, that the prosperity of a region is determined by the strength of its exporting industries. The income generated by these industries is coupled with the household income elasticity of demand for the outputs of local industries, which then filters through the local economy as local firms sell to the exporting industries or to the employees of those industries.

From this relationship stems the base multiplier. Similar in concept to the Keynesian multiplier, the economic base multiplier is constructed as $\Delta T = k\Delta X$, where k represents the multiplier (i.e., T/X , the total economic activity divided by exports), ΔT represent the total change in economic activity as represented by a measurable concept (usually employment), and ΔX

represents the change in export activity. In other words, changes in total activity for the region, as measured by employment, income, output, or some other indicator of economic performance, is some multiple of the change in export activity.

The key to export base measurement, then, is the estimation of regional activity that is oriented towards export generation. A number of export models have been established in this regard that have had varying degrees of success with respect to the ability to detail economic activity for a regional economy.

Location Quotients

Probably the simplest of export estimation is that of the location quotient, such as used in Jesswein and Lichty [15]. This device for estimating export activity assumes that local production and consumption activity is exactly like that of a national average counterpart.¹ This tends to mask the differences in production or consumption patterns that are associated with such obvious factors as climate, recreation resource availabilities or resource productivity levels. There has been no known test for the extent to which this assumption describes reality for a regional economy. In fact, its accuracy probably varies with the region being studied. In spite of this, the location quotient is in widespread use as a separate approach to economic base design and as a component of adjustment for related models, such as secondary data input/output models.

Since location quotients depend on such restrictive assumptions and because it is difficult to obtain secondary information for income, value added, or output (measures that are in many ways preferable to the more often used employment as explained in Levin [18]) it's recommended that the quotients be used, if at all, as a source check data for comparison with more elaborate models.

Methodology of Economic Base Modeling

The preferred method of economic base analysis would necessitate a survey of the economic institutions within the region. The most direct of these methods would be to question the economic enterprises as to the percentage of their activity (sales, income, purchases, or what have you) that goes to exports as opposed to the percentage that is sold locally.² The export component of this activity would then serve as the denominator to the multiplier equation.

Another more complicated approach, that overcomes some of the more obvious difficulties associated with economic base, estimates multipliers for specific industrial groupings. (Weiss and Gooding [26]).

Although it would be counterproductive to discuss this form of the economic base model in great detail, a few words concerning the essential differences between this more disaggregated approach and the normal approach may be in order. Whereas traditional economic base breaks the economy into two sectors, export and service, and aggregates all activity to these sectors, the Weiss-Gooding analysis further disaggregates economic activity into "key" export industries along with their direct service support.

The statistical equation for the traditional model might be $T = S + X$, $S = a + hT$, so $S = a + hS + hX$ where S represents service employment, T represents total employment, X represents export employment, a is the intercept, and h is equal to $\Delta S/\Delta T$. Working through the reduced form in the usual manner gives:

$$S = \frac{a}{1-h} + \frac{h}{1-h} X$$

With $\frac{h}{1-h}$ being the base multiplier.

Assuming that the differentiated exporting industries are independent of one another (i.e., that they do not interact as purchasers or sellers of one another's products, and that direct service industries can be identified that

are homogeneous in their product characteristics), the traditional equation noted above can be changed to read, $S_i = a_i + h_s S_i + h_x X_i$. In this new equation, S_i represents the service employment that is directly or indirectly associated with the exports of industry i and X_i is obviously the export activity of that industry i .

The level of disaggregation that is possible along these lines is limited by the assumptions listed directly above. It would be possible to disaggregate out a relatively homogeneous set of firms, such as lumber and wood products, for example, but very difficult to apply this technique to the much more heterogeneous characteristics of the so-called recreation or tourist industry.

Strengths

The most obvious strength of economic base modeling is its simplicity. Ranging from the very low costs associated with the location quotient to the relatively intermediate expense associated with survey techniques, economic base is generally thought to provide reasonable aggregate estimates of regional multipliers. The strength (and expense) of such modeling is further enhanced when the base of an economy is estimated over time.

Economic base modeling is thought to more accurately reflect small area as opposed to large area economies. This is due to the fact that smaller areas are generally dependent on one or two major exporting firms, that changes in internal trading patterns due to rapid economic growth are less likely than for larger regions, and that changes that do occur in such economies are easier to discern and correct should the occasion require.

Weaknesses

The restrictions of economic base stem from the assumptions that such models are forced to make. For example, economic base analysis assumes that there is a fixed relationship between service and export employment. This

means that no new jobs, income, or output can occur in these industries independent of changes in export activity. Some would contend that this leads to the well known chicken and egg problem. Is it export activity that induces similar levels of activity from the service sector, or does the service sector provide the base upon which exporting industries depend for their own existence?

Probably the biggest problem with economic base analysis is in its level of aggregation, however. The derived multiplier is based on aggregate levels of export and service activity. In other words, the same multiplier would be used to assess the impact of a change in the sales of a recreation industry as would be used for a change in the sales of a timber operation. In short, the inter-industry activity that takes place within any functioning regional economy is clouded over by an aggregate multiplier. Disaggregation to meaningful levels would be impossible and tenuous in its results. Even the Weiss-Gooding methodology is limited to three or four industries due to the assumptions that are required for its model's implementation. Since Ely is characterized by a set of diverse trade sectors relating differentially to outside demands, the limit to three sectors would not be very useful for general development analysis and planning.

INPUT/OUTPUT (I/O) MODELS

Background

Since its creation in the 1940's by Leontief [16] , I/O has become one of the most widely used models for economic forecasting and planning in the world today. Although there are weaknesses that are associated mainly with the assumptions that are required to construct such a model, it is probably as close to a general equilibrium picture of a functioning economy as has yet been developed.³

Briefly, the input/output model divides an economy into homogeneous industrial sectors (or as homogeneous of sectors as is possible given data and

financial constraints). The pattern of trade between these sectors is then determined and reported in a linear matrix format. Assuming fixed production technique (i.e., assuming a linear and homogeneous production function to the first degree) and a constant trading relationship between the region being studied and the rest of the world, interindustry multipliers can be estimated and related to levels of final demand.⁴ It is important to note that, as long as the assumptions are valid, projection of regional activity can be made on the basis of separately determined or assumed changes in the levels of final demand components.

Input/output models, like economic base, can be constructed on the basis of either primary or secondary data. Secondary data tables can be constructed in a variety of ways,⁵ but they all have common requirements of a current table for the nation or at least for a larger region, such as a state table. The coefficients of the larger table are then adjusted for observed local tendencies. The easiest basis for adjustment along these lines utilize location quotient values discussed in the economic base section of this report. In at least one case, this method proved to be more successful than other more elaborate methodologies.⁶

Primary data tables, on the other hand, require detailed accounting information from a representative sample of regional industries. This data would include the purchases of intermediate goods, of services and of resource inputs by source of purchase along with the dispensation of the output that these industries produce. The collected data is summarized, using appropriate control totals for total industry output in the region, in a cost-accounting framework, with debits equaling credits throughout the purchase/sale matrix. This summary serves as the basis for the analytics of input/output that follow.

Accuracy

The accuracy of such methodologies has been the subject of serious concern in the literature. The most common form of test for accuracy has been to compare the coefficients of secondary data tables with those of primary data tables for the same region. By necessity, these types of tests assume that the primary data tables are accurate (i.e., that there is no problem associated with data collection or organization, and that therefore, any differences noted between survey and nonsurvey tables denotes a problem with nonsurvey techniques).⁷

Even with the assumption that a table based on primary or survey data is accurate, there is the very serious question concerning the stability of the coefficients over time. Little empirical work has been done concerning this question since tests of this type require tables for a given economy over two periods of time.

One such test was conducted at the state level, however, by Beyers [6]. The conclusions of this experiment were summarized as follows, "This analysis of structural change suggests that the 1963 Washington interindustry structure was a reasonably accurate aid in estimating gross state output in 1967, but that there were large errors in estimates of individual sector outputs," (Beyers [6, p. 373]).

The stability of internal coefficients depends very much on the stability of trading coefficients between the reference region and the rest of the world. This, in turn, depends on the elasticity of substitution between local products and "foreign" produced products.

The possibility for such substitution should be inversely related to the relative isolation for the area being investigated since the elasticity of substitution (i.e., the propensity to change sources of supply as a result of changes in a determining economic variable such as prices) depends on the

availability of alternatives. On strictly a priori grounds, the Ely market area would seem to be isolated to a great enough of an extent to make input substitution a slow process to say the very least. It should be emphasized that the coefficients of I/O tables are not generally based on probability analysis and are not, therefore, subject to traditional tests using the t or F distribution.⁸

Finally, I/O tables should be developed over time as opposed to once-and-for-all. Coefficient instability requires this if nothing else does. This actually follows a pattern of research development that consists of (1) Framework Development, (2) Validation and (3) Adjustment and Revision with ongoing interaction between the latter two stages being crucial to input/output related techniques.

Weaknesses

Input/Output models require a great amount of detailed information in order to be implemented. Secondary data tables for very small areas would be difficult to construct as opposed to similar tables for larger areas. Primary data collection tends to involve lengthy interviews and, therefore, they tend to be relatively expensive. Input/Output is based on a number of "status quo" assumptions that either requires frequent updating or hoping for gross output projection accuracy.

All of the above represents known weaknesses of the method. Why, then, are such tables in such widespread use? It is somewhat trite to say that they are used because nothing better has come along, but the truth of such a statement warrants further investigation.

Economic base suffers the weakness that it is an aggregate, ball-park type of an approach that provides relatively little detail for specific questions such as were outlined in the introduction to this paper. Econometric analysis, although not discussed in this report, requires extensive data inputs

(often beyond the requirements of Input/Output) usually over long periods of time. These latter kinds of models have been highly questionable in terms of their accuracy for national projection and probably need further refinement before they are really useful for small area economies. Their flexibility is also subject to some question.

Strengths

Details of the type that are addressed by interindustry analysis are particularly useful for analyzing the way in which changes in the external demand for one sector's output influences the other sectors of an economy. This means that such questions as, "What does an increase in the sales by resorts in the Ely area mean to the retail trade sector in the region?" can be analyzed with rather minor additions to the I/O model. This type of question could be addressed not only in terms of retail sales, but also in terms of income earned or employment generated.

Specific analysis of this type isolates the "who is affected" type of question that is important to planners in their concern for changes in regional economic activity. No other model provides the potential for isolating those that are the recipients of economic impacts as does the input/output framework.

This, coupled with new techniques for updating tables and for monitoring the seriousness of the model's assumptions over time, makes such tables a worthy approach to impact estimating. The ideal case would find a basic, primary data table that is monitored over time for assumption problems and that is updated totally, or perhaps on a more partial basis if total update does not seem to be required, on at least a five year basis. Of course, this "ideal" is also the most expensive approach to input/output possibilities.

What is saved and what is lost with movements away from this ideal? One of the more obvious savings can be found in the cost of the table and its use.

What is lost in such a procedure is hard to determine. In the limited literature presented as evidence for the arguments made in this report, secondary data tables give results that are inconsistent with primary data results in the majority of cases (although the differences are always less than 100%). Other tests have found that gross output projections through five year spans are fairly consistent, but that individual sector projections are weaker for that period of time.

Recommendation

Because of the complexity of the issues that are involved with developmental decision making in the Ely area (e.g., the copper/nickel question), the authors recommend that the input/output method be chosen over the simpler form of economic base. By emphasizing the export component of final demand and by detailing the sectors serving the recreational user, all of the good features of economic base will be realized with the structural detail that is offered by input/output as a bonus. In order to be as sure of the results of such a modeling effort as possible, it is recommended that the table incorporate survey data and that at least one planned update be considered. The table should be constructed on the basis of sectors that are crucial to the investigation at hand. The details of this recommended format follows for a specific investigational use of the model.

The Form of the Proposed Model

The general form of input/output is fairly well known and will not be discussed in detail here.⁹ Suffice it to remind the reader that it represents a production function¹⁰ for a regional economy that traces through the resource and semi-finished goods input into specified industrial sectors as they carry on the production process. It also traces through the levels and direction of these sector's sales of semi-finished and final goods and services. One of

the crucial assumptions to input/output analysis concerns the form of the production function (i.e., that it is linear and homogenous to the first degree).¹¹

The key demand components for the model here being discussed are those in the household and export sectors of the economy. The model should also emphasize those industries that are most germane to the Ely regional economy (i.e., the recreation and forestry oriented industries). The final demand columns of the table will, therefore, need to be constructed in such a manner as to detail the relationship between these industries and the final users of their products.

The input/output model that is being recommended for this paper will take the form that is shown in Figure 2. It will contain between fifteen and thirty-five sectors (the goal being maximum detail and minimum disclosure). The final demand component of the table will be subdivided between local household demand, non-local or export household demand, all other export demands, investment and government.

Construction of the table in this particular manner would also permit one important additional step to be taken. The local household demand column of the table actually represents a regional consumption function (linear and homogenous assumptions hold here as well as for the production function). The information that this function contains allows the researcher to close the table with respect to households, and thereby, to predict the consumption effects of changes in business activity.

Most input/output efforts stop short of this additional possibility due to data limitations. They provide reasonably good estimates of the direct and indirect effects of changes in regional activity that stem from interindustry interactions, but they attempt to estimate the greater effects that result from changes in consumption activity. The step towards closing the table allows the calculations of the direct-indirect and induced effects resulting from assumed changes in the level of final demand.¹²

SECTOR

1 2 3 . . .

LOCAL HOUSEHOLD
DEMAND

NON-LOCAL HOUSEHOLD
DEMAND

OTHER EXPORT

GOVERNMENT

INVESTMENT

1 2 3	INTERINDUSTRY TRANSACTIONS	FINAL DEMAND
	FINAL PAYMENTS	

HOUSEHOLD
OTHER VALUE-
ADDED
IMPORTS

FIGURE 2 PROPOSED FORM OF INPUT/OUTPUT TABLE FOR

STUDY IN ELY MARKET AREA.

This step should be possible for one very important reason, that is, the size of the region permits consideration of household surveys of the type that would provide consumption or expenditure pattern information. In fact, surveys of this general nature are currently being conducted as part of the Environmental Quality Board's larger effort in the reference area. Because of the detailed nature of such data, most analysis involving larger areas have avoided household surveys in favor of secondary data consumption estimates.

The Ely economy is characterized by a significant trade sector as opposed to manufacturing. The purpose of this project is to highlight that particular economic structure. Therefore, the table will take the somewhat unusual form of using purchasers' as opposed to producers' price and a direct routing of the sales to the next user. This will serve to inflate the size of the input-output multiplier over what is more normal for such analysis, but it will also serve to isolate in the clearest form possible the trading relationships of the region.

In addition, the survey itself will emphasize the purchases of industries from one another (in the region) and will ask for sales only as they relate to final demand sectors. This emphasis on purchases is due to the expectation that trade sectors selling to a variety of consumers will be better able to detail their purchases than their sales. It will also shorten the survey form and, hopefully, increase the rate of responses as a result.

FORECASTING ERROR, VALIDATION AND OPERATING COSTS

In the course of the previous two sections, attempts have been made continually to discuss the pros and cons of the alternative models reviewed. Particular attention has been paid to the problems of data collection (and consequent survey costs), forecasting error, forecasting validation or estimation and the flexibility of the models to make predictions given various

assumptions and time frames (i.e., long vs. short run forecasts). In this section some general comments on these topics will be offered.

The alternative economic impact models are ways of describing the structure of a regional economy. Input/output by being more detailed is preferred if interactions, or economic tradeoffs, are to be analyzed. If the only concern were to estimate the impact of alternative development strategies, and ignore tradeoffs, then either input/output or economic base might be used, though the former would still have advantages. What these models do, as explained earlier, is determine or forecast the indirect or multiplier effect of a change in the economic system (e.g., CU/NI development). Such forecasts cannot be made in the form of an interval estimate and so these predictions cannot be discussed in statistical terms.

A major consideration of both impact and econometric models has to do with data needs. Each model will require sample data (of firms, lakes and individuals) taken at one point (current) in time. Obviously, the further in the future that forecasts are attempted, the greater the chances for error. This is simply because the models estimate the present structure (e.g., input/output coefficients) and the further ahead one predicts, the more likely it is that structure will have changed. This problem may be overcome by re-estimating the model at some time in the future where a new survey could be taken.

As with input/output or economic base models, forecasts made with econometric models will be better in the short run than the long run unless the model is re-estimated or updated with new survey and/or secondary data. If the same estimated model is used the cost of making forecasts for alternative assumptions (i.e., operating costs) would be quite minimal (roughly \$1-2/forecast in computer time) for either economic impact or econometric models.

III. CONCLUSION

The research team makes the following recommendations:

1. That an integrated model be applied to the Ely market area that focuses on the tourist and timber characteristics.
2. That input/output techniques be applied to assess the current influences of tourism and recreation industries on the Ely area economy.
3. That this input/output table be presented in such a way as to acquaint local decision makers with its information and projection capabilities as well as the manner in which this information can be used by decision makers.

Issues that are germane to this analysis include:

1. Consideration of the possibility for regular updating of the developed model taking into account known new conditions as they arise (this is the only way that confidence can be placed in projections made over the longer term).
2. Development of an export prediction mechanism to assess the performance of the model as this performance relates to known past events.
3. Development of projection on the basis of Ely coefficients for other regional areas of similar size, on an export basis, in order to test for the generality of such coefficients.
4. Consideration of linking the analysis for the Ely area to the development of SIMLAB technologies currently under way on the St. Paul Campus of the University of Minnesota.

The accomplishment of these tasks should provide an acceptable set of projections as to the impact that the various economic development alternatives, e.g., copper/nickel mining in the Ely area, would exert on existing industrial (economic) patterns.

IV. FOOTNOTES

1. Location quotients assume also that the national economy is basically a closed economy (i.e., the level of national exports and imports is not of concern). With these assumptions, the regional economy is assumed to require the same percentage of activity in a given industry for self-sufficiency, as is true for the nation as a whole.

Primarily due to the availability of secondary data, employment is the most often chosen basis for measuring economic performance. The location quotient then become:

$$L = \frac{E_i/E}{N_i/N}$$

where E_i represents the regional employment in industry i ; E represent the *regional* employment in all industries; N_i represents the employment in industry i for the nation and N represents total national employment. If $L > 1$, the region has excess employment relative to the nation. The economic base multiplier is then E/e where E is as before and e represents the excess employment level as calculated from the location quotient value.

2. In constructing either economic base or in an input/output table, certain industries (e.g., gas stations, restaurants, etc.) which serve both tourists and non-tourists (export) will present unique problems. Since only a sample of non-tourists, i.e., local household expenditure patterns, will be taken it will be necessary to estimate final demand. This will be done on the basis of the known population in the area for non-tourists. The tourist portion of final demand for various sectors will be estimated using a procedure advocated by Uel Blank which involves surveying customers or sales of businesses on selected days during the year. Professor Blank and members of the Copper/Nickel Task

Force have already initiated such a procedure and plan to provide the information thus obtained to this project.

3. There are, in general, two broad approaches to economic reasoning, the partial and the general. Of these two, the partial approach has been preferred due to the manageability of such models. A classic example of such an approach can be found in demand analysis. Consumer demand for a given commodity is assumed to be related to such variables as the price of the commodity, of competing commodities, of consumer tastes and of consumer income.

From the individual demand relationship can be derived the market demand, or the summation of all individual demand schedules. When combined with the concept of supply, commodity price is determined.

To say that such a series of statements is partial in scope is to say that products, productions, prices, and costs are not unidimensional. They all influence one another so that changes in any one commodity's relationship will induce changes in all others. Price is but one of the determining variables in this regard.

Leon Walrus hypothesized the series of equations that would be required to take into account all of these influences. When simultaneously solved, equilibrium prices and quantities would be determined for all commodities and for all resources. Although eloquent in conception the data and computational requirements of such a model made it totally nonoperational.

Wassily Leontief assumed portions of the Walras model to be constant and production/trading relationships to be stable. With these assumptions, and through the input/output model, equilibrium outputs could be determined for an economy under varying assumptions concerning the structure of demand for output oriented towards final use. This set of assumptions and modeling efforts stand as the basis for the discussion of input/output in this report.

4. Final demand is comprised of the components of Gross National or Gross Regional Product. It represents the purchase of a commodity for final use as opposed to the purchase of a commodity for the purpose of employing it in a new stage of production. Although the details vary, the basic components of final demand include household consumption, State, Federal and Local Government Consumption, Investment and Net Exports (Exports minus Imports).
5. See, for example Morrison and Smith, [22].
6. This is explained in detail in Morrison and Smith [22].
7. See, for example, McMenamin and Haring [20].
8. Very recently, Gerking [11 and 12] has proposed a stochastic formulation for input/output which has been subject to criticism in the literature (e.g., Miernyk [21]).
9. See, for example, Emerson and Lamphear [10] for a more complete discussion of the model and its implications.
10. A production function relates input to output. The most common form of production function is for the firm and is of the form $Q = f(N, L, C, E)$ where Q represents the firm's output level, N represents labor inputs, L represents land inputs, C represents capital inputs and E represents the input of management and ownership.
11. A linear-homogeneous production function represents constant returns to scale. This means that it represents a non-varying relationship between inputs and outputs. In order to double outputs, the firm (or in this case, the region) is assumed to require twice the inputs. Tripling the output requires tripling the inputs, and so on. This means that there are assumed to be no economies to scale (i.e., there is no possibility for lower per unit costs with increases

in the size of the plant). This assumption is common to most empirical production models in economics.

12. A discussion and demonstration of this possibility can be found in Emerson [9].

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