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Input-Output as a Method of Evaluahon of the Economic Impact of Water Resources Development

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- Full Text

In this report the results of a study of the use of input-output analysis to evaluate the economic impact of water resources development are presented. Blackburn Crossing reservoir on the Upper Neches river was the subject development) and the Leontief system of input-output accounts is the basic tool of the analysis.

In previous research, unrelated to water resources development, Carter and Martin developed the idea of using a matrix of primary resource coefficients to determine resource requirements necessary to sustain a given level of final demand and with it, total economic output.. By specifying the relationship between resource requirements and output, total resource requirements can be computed given either final demand or total output. In this study the possibility of inverting the process and determining final demand or total output, given the level of primary resources, was investigated.

Data for the period 1952 were assembled to build the basic inputoutput model of the economic activity, of the watershed. The functional relationship of water as a resource and total output was then determined and the model was employed to forecast the impact on the watershed of an increase in the supply of water. A check on the forecast was provided by data assembled for the 1958 period which were descriptive of total output following an enlargement of Blackburn Crossing reservoir which yielded increased water supplies.

The results of the forecasting activity were sufficient to conclude that the analytical tool employed along with the water use-output relationship is useful in estimating impact of water developments. Problems encountered can be resolved so that the accuracy of the technique is acceptable.

Introduction

The needs of water resource planners for projections of economic activity by planning areas has stimulated the application of new techniques of regional economic analysis. Many of these techniques rely heavily on the computer for analysis of the large amounts of population, employment, and industrial output data.

The regional input-output model is one important new method that has been developed by econometricians and regional analysts for projecting regional economic activity. The first objective of this study, therefore, is to build an input-output model of the economic activity of the watershed under study.

Once input-output models have been built, it is important that the relationship between various sectors of the economy and water use be built into these models. The second objective of this study, then, will be to determine the relationship between the use of water as a resource and the economic activity of the various sectors.

A third objective is to estimate the influence of an additional water supply on the level of economic activity in the watershed. Since a development of this resource is underway, a method of estimation of impact will be useful.

Summary & Conclusions

The origin of the idea for this study comes from several sources. Leontief has provided the basic work on input-output as a tool for economic analysis. Moore and Peteresen in their study show how the national input coefficients can be modified so as to be more characteristic of the regional and subregional levels. Carter and Martin furnished the idea of using a matrix of primary resource coefficients to determine resource requirements necessary to sustain a given level of final demand and with it total economic output. Thus by specifying the relationship between resource requirements and output total resource requirements may be computed given either final demand or total output. Carter and Martin accomplish this by multiplying the matrix of primary resource technical coefficients times the matrix of interdependency coefficients.

One of the basic assumptions of input-output analysis is that the technical and interdependency coefficients are relatively fixed. This same assumption applies as well to the primary resource technical coefficients and consequently to the inverse of these coefficients. These primary resource technical coefficients used by Carter and Martin when inverted become the output of water per acre foot.

The basic mathematical model was presented in Chapter IV. The important point here is that it is possible to determine the relationship between output and primary resource requirements. This relationship as stated in the assumptions is relatively stable. If, once this relationship has been specified, it can be used to determine the resource requirements given final demand or total output, then it should theoretically be possible to invert the process and determine the final demand or total output given the level of primary resources. The object of this study has been to test just such a theoretical possibility.

The input-output tables were developed in the earlier stages of this study. First, it was necessary to develop output totals for all sectors. The flow tables were developed from these totals by multiplying the output totals times the national input coefficients for each sector. These flow tables were then adjusted to reflect the local and regional trade, and input-output patterns. The accuracy of the flow tables and the over-all output totals were checked against published data. The accuracy was determined to be well within acceptable limits. It was from these flow tables that the technical input coefficients and interdependency coefficients were derived. In the second stage a matrix of primary resource technical coefficients was developed. The primary resource used was water/ The primary resource technical coefficient expresses in decimal form the amount of water in acre feet required to produce one thousand dollars of output in each sector. When inverted the coefficients show the amount of output produced by one acre foot of water.

In the third stage of this study a forecast of the economic activity of the area was made. This was accomplished by using the results of the first two stages. The inverse of the primary resources technical coefficient (output per acre foot of water), for 1958 was multiplied by the estimated water use for each sector in 1963. Since there were only 17 water-using sectors it was necessary to use estimates of output for the other 14 sectors of the area economy. The forecast based on this method places the total output of the area economy at $1,22O,732,585 (see Table 4.4, Chapter IV). This figure, as pointed out in the discussion of results in Chapter IV, exceeds actual output of the economy by only 8^5 per cent o In Table 4 o 5 a comparison is made between the forecasted and actual output of the water using sectors only. The forecast based on water use exceeds actual output by 25 per cent. This is not considered to be a gross overestimation error. Much of this error is attributed to changes in the productivity of water from 1958 to 1963, and is explained in the discussion of source and magnitude of error. While much of the error in the forecast is explained by changes in the productivity, it does not tell why economic activity did not develop or expand a,s estimated, Location theory can shed light on this aspect of the problem.

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