USING IMPLAN IN REGIONAL CLASSES

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Introduction

This paper reviews redesigns of the existing *Professional IMPLAN* input-output software and user's guides. These redesigns are oriented toward developing an educational model useful for classroom and workshop purposes. The new system, *Classroom IMPLAN* which is scheduled for release early in 1994, is Windows based.

Current Systems/Texts

There are a few excellent input-output software programs currently available for use in the classroom. One of the most popular of these is the student version of *ADOTMATR* developed at the University of Nebraska—Lincoln (Lamphear, *et al.*, 1986). The *REMI* model also has student-oriented software with an accompanying handbook.

The *ADOTMATR* program allows the user a number of options for constructing input-output systems. These options are especially useful as exercises in learning about uses and misuses of input-output models and how input-output databases are constructed.

The *REMI* model introduces dynamic elements into input-output methodology. For example, the income receipts of the base year convert to the spending of local final demand sectors in the next year.

Professional IMPLAN is a top-down model-building software system. One of the principal strengths of such a system is that it offers an already built database for local and regional impact analysis and prediction. It uses a wide range of data sources for its estimates of county-level economic variables. It allows for multiregion comparisons with widely accepted and comprehensive national databases.

While all of these systems do an excellent job of helping to teach regional impact systems and/or allowing for impact assessments, there is always room for additional educational software that helps the student learn how to use such systems. This paper describes the considerations involved in modifying *Professional IMPLAN* for the classroom. The emphases in *Classroom IMPLAN* initially is on using input-output systems for impact and forecasting purposes and on helping the user learn to avoid common errors in input-output methodology application.

Modifying *IMPLAN* is a part of a larger effort to design classroom demonstrations and workshops to teach input-output methodology as a systems approach to the study of regional economies as they are

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affected by external market conditions and public policies. Our eventual goal is to introduce *Classroom IMPLAN* with several of the other available educational software programs into a demonstration classroom or workshop lesson unit building on the strengths of each model to give each student a more complete understanding of regional economics.

An example of one common mistake made by first time users of regional input-output systems for regional impact assessment centers on a lack of user appreciation for the required inputs into such analyses. While there are several highly regarded texts in input-output use and design (Miller & Blair, 1985; Richardson, 1972; and Miller, *et al.*, 1989), they provide little emphasis on the fact that only net increases in local final demand are relevant to a regional impact assessment and that a reallocation of local spending is not a net increase in local final demand (as would be the case with an increase in exports to markets outside the local area).

A common error of local impact studies is presenting only one set of effects—gains **or** losses—that result from a strict reallocation of local spending. This sorely misinforms the users of such findings.

Further, while there are accurate and useful discussions on why trade margins are used in the retail and wholesale trade industries, little in the way of practical application of, and implications from using, such margins is asked of the student in the exercises at the end of the chapters or in the examples provided in the texts. This type of application is particularly appropriate when the user is attempting to relate variables such as purchaser prices of visitor spending to producer prices of locally produced products.

The current professional input-output software user manuals (including the *Professional IMPLAN*'s *User Guide*) generally follow text organization in discussing these matters. There is nothing contained in either the software or the guides that force the student to return to the data in order to discover misapplication of input-output methodology. Feedback is probably the most important component of any software designed for educational purposes and should be included in any classroom applications software. This is where *ADOTMATR* makes an important classroom contribution—it allows a bottom-up approach as one or more alternative(s) to input-output modeling.

Desired Systems/Materials

One desired quality of an education-oriented input-output program is instruction and exercises on the topic of input-output as a component of larger regional simulation systems. While educational input-output systems can stand on their own, such systems are strengthened when the tables can be demonstrated as components of larger integrated systems. The chance to do hands-on application exercises without

overemphasis on table construction would be useful to future input-output system users.

Current texts adequately provide explanations of the pitfalls associated with using input-output systems. Most of these pitfalls stem from the necessary assumptions associated with such systems. Much work has been done on modifying input-output to offset some of its inherent weaknesses.

A fully functional educational input-output program allows the student to conduct experimental simulations under various system arrangements to see what difference model modifications make to the results. Introductions to sensitivity analysis represent obvious extensions toward a complete educational system.

Finally, any developed software requires two resource manuals to be complete. The first is the student manual, which would read much like current user's manuals and input-output texts. The student manual, however, must be oriented toward both the construction of input-output tables and the alternative applications of these tables in regional analysis. Such a manual should contain exercises with regional and scenario development information for the student to use and manipulate in conjunction with the educational software. The exercises should be designed both to allow for student mistakes and provide feedback from these mistakes. Allowing for mistakes also is required of the software which, in tandem with the manual, walks the student through various regional analysis routines.

The second manual is the teacher's guide. The teacher's guide should contain additional detail concerning the exercises themselves. It also should highlight and explain the subtleties of the student input-output system, review the study area and data files associated with the system, show how the software develops the input-output and social account systems, and provide details about how reports are constructed and used. Of course, detailed answers to student simulation exercises would be part of the teacher's guide.

At this stage in the *Classroom IMPLAN* program's development, the emphasis is not so much on the construction of input-output systems but on the use of such systems. Future development may include alternative input-output table construction designs to provide the most complete educational input-output system possible.

A Teaching Experience With IMPLAN

Most regional economics courses include some discussion of input-output models, but few provide students with a hands-on experience with input-output modeling. Last spring we conducted an experiment to find out why input-output theory is more popular than input-output practice in classroom settings. We piloted a one credit master's level course including both the theory and the practice of input-output

models. The course title was "Regional Economic Impact Analysis and Forecasting."

The initial phase of the course focused on theory. In the introduction we discussed various uses and abuses of input-output models. The next few lectures were standard input-output theory lectures supplemented with readings from Miller and Blair, Richardson, and other sources. Where several methods commonly are employed, i.e. estimation of regional purchase coefficients or top-down versus bottom-up models, the *Professional IMPLAN* approach was identified and discussed in more detail than alternative methods.

Next, we asked students to browse a list of studies that have been done using the *IMPLAN* database and software package and choose a study to replicate using Minnesota data. Some students identified new problems to examine using methods similar to those used in prior studies. We provided each student with the *IMPLAN* database appropriate to his or her study area. Some students chose to aggregate over several counties; others focused on one county only. Similarly, students chose varying levels of sectoral aggregation. This provided a context for review of aggregation problems.

Once students had identified their problem and study area, the class moved to a computer laboratory. Each student was assigned a machine. Students did not install the *IMPLAN* software, but put their individualized databases onto their machines and did all the necessary steps for *IMPLAN*-based impact analysis during regular classroom hours. A video projection system allowed us to demonstrate each step involved in the *IMPLAN* system. The final classroom lecture focused on advantages and disadvantages of input-output vis-à-vis alternative modeling methods such as social account matrices and computable general equilibrium models. Feedback to students took the form of a midterm test and an evaluation of their write-up of model results.

Student evaluations of the course were mixed. We designed a special evaluation form that allowed us to separate comments on the lecture aspects of the course from comments on the lab parts. The lectures received favorable reviews, but students were frustrated by the laboratory portion of the course. One specific and correctable problem was that some machines were slower than others in processing due to lack of math co-processors; insufficient available hard disk space slowed work on other machines. Another complaint was that "being told what button to push" was a waste of classroom time. Students liked the opportunity to work with a model of their own choosing, but at the same time they would have preferred more lecture and less laboratory time.

Next spring we plan to offer the course again, but as a regular three credit course. We will provide more detail on input-output modeling theory, but also will walk the students through several examples of applications. We also plan to explore the alternatives to input-output in

regional impact modeling more fully. There will be no laboratory portion to the course. Instead, we will present a video screen demonstration of *Classroom IMPLAN* during one or two lecture periods. We will install *Classroom IMPLAN* on an adequate computer that students can access on their own time. Access will be based on a sign-up sheet. Each student will be assigned a personal subdirectory for storing files. Students who have computers with adequate capacity will have the option of installing *Classroom IMPLAN* on their own machines.

The IMPLAN Model

History and Purpose

The IMPLAN system has been in existence since 1979. It has evolved from a main-frame, non-interactive application that ran in batch mode to a menu-driven microcomputer program that is completely interactive. New features have been added since the first release of the *Professional IMPLAN* in 1989. The user interface has been replaced by a friendlier, comprehensive menu system. In summary, *Professional IMPLAN* features includes:

- A menu-driven, professional quality, user interface that is easy to learn and use;
- An extensive on-line context-sensitive help facility allowing access help from anywhere in the program;
- A directory structure that takes advantage of PC directory facilities and allows easy storage, archival, and retrieval of models and data files;
- Greatly expanded impact analysis procedures that allow the user to input choices through data entry screens and pick lists, thus eliminating the need for user-created input files; and
- Comprehensive county-level current database for all U.S. counties that allows the model user to concentrate on model applications rather than model construction.

Current applications of *Professional IMPLAN* cover a wide range of topics, with the largest concentration in predicting the local or regional effects of a particular federal policy proposal or program. An increasingly popular application is prediction of the effects of an opening or closure of a large production facility or the expansion or contraction of a particular industry in the economic base of a locality or region.

Model Construction

The first step in using IMPLAN, following its installation, is choosing or creating a model. This step establishes the industry structure of the IMPLAN application. It sets the number and composition of industry groups in the economic impact analysis and forecast. *Classroom IMPLAN* confines these choices to selected aggregated models that conform to the industry classifications in readily available county-level and U.S. data series. By eliminating the number of available options,

Classroom IMPLAN avoids many pages of documentation and unnecessary complications that can stand in the way of student understanding of key concepts.

The second step in *IMPLAN* implementation is fitting the selected model with actual data for one or more U.S. counties and for a given year. *Classroom IMPLAN* aggregates the industries in the selected database for the next step—constructing the 22 variable income and product accounts for the selected study area.

Study area selection is a vastly underrated task in regional economic forecasting. Combining counties into a study area without consideration of the spatial-economic structure that contains them can lead to later difficulties in the interpretation of the study findings. A common denominator for all potential study areas is the local labor market and its geographic boundaries. These typically coincide with the daily commuting zones of the larger urban centers. One or more labor market areas (LMAs) form economic regions that represent the principal domestic trading partners of U.S. interregional trade. One system of 29 airnode-centered economic regions available with *Classroom IMPLAN* has each airnode labor market area serve as its core area.

The third step in IMPLAN model implementation is to construct the social accounts. The 22 IMPLAN income, product, and employment accounts establish the overall dimensions of economic activity in the study area. These are the exogenous accounts. They are of two types: demand-side and supply-side. The base period demands are predetermined. They are specified in the initial database for the study area. The base period production and its primary input requirements also are predetermined and specified in the initial database. The social accounts thus establish the principal parameters of study area activity of the endogenously determined activities.

Disbursement of the study area product between the local intermediate and final demand sectors and exports at this point in model implementation remains its principal task. Two sets of relationships—the propensity to import (and its dual, the regional purchase coefficient) and the directly allocated exports—limit the range of available choices for this task. Once established, the given values for these relationships determine the balances of interregional and intraregional transactions between the study area and rest of world.

The fourth step in *IMPLAN* model implementation—to construct the input-output accounts—prepares the tables of interindustry transactions derived from the exogenously determined economic activity within the study area and between the study area and rest of world. *Classroom IMPLAN* makes much of this step automatic and, hence, it becomes of minimal importance in model implementation.

The fifth step in *IMPLAN* model implementation—to estimate the multipliers—builds on the interindustry transaction tables for the study

area and the Leontief inverses derived from these tables. It also depends on the value-added accounts for the derivation of personal income, total income, and value-added multipliers and the employment accounts for the employment multipliers. The type III multipliers also require the final demand accounts to calculate additional impact of recycling of the changes in household and investment spending associated with the corresponding changes in industry output values.

Impact Analysis

Impact analysis is one objective of *IMPLAN* model construction. Another is impact forecasting. Scenario construction is the first step in implementing the use of the *IMPLAN* model and database in both impact analysis and impact forecasting.

The Leontief matrices calculated from the interindustry transactions tables and the social accounts provide the technical means for converting each scenario into a set of area impact forecasts. In all cases, exogenously introduced changes are converted into corresponding changes in one or more final demand variables. *IMPLAN* is a demand-driven forecasting model. Use of multiple scenarios, however, provides a means of introducing changes in final demands based on differing assumptions about their determinants, either external or internal to the study area.

The technology for estimating regional impacts is the central contribution of the *IMPLAN* regional impact analysis and forecasting system. Helping practitioners understand and be able to use input-output technology is the central purpose of *Classroom IMPLAN*. An internal approach to scenario construction, however, is implemented only partially in the *IMPLAN* system. Each final purchase item, for example, is identified by its producing sector rather than the purchased item, which includes portions of several commodity groups.

The current *IMPLAN* analysis is in producer prices. Purchased items in purchaser prices must be margined to convert these prices to equivalent producer prices. The margined purchaser price is reduced by the value of the marketing margins accumulated by the original product as it moves from production site to place of final sale. Final sales composed of several commodities [such as food eaten at home (resident households) or away from home (visitors)] introduces additional complexity and tedium into the computational procedures.

Both *Professional* and *Classroom IMPLAN* handle this difficulty by providing the option to convert expenditures to impact activities. Impact activities are summaries of expenditures on commodities or services by some outside institution or person. For example, impact activities could include expenditures on lodging, transportation, meals, or equipment by a tourist visiting the study region. A scenario represents a collection of such activities for impact forecasting purposes. Future versions of

IMPLAN will introduce a matrix of such expenditures in purchaser prices that convert a uniquely specified mix of purchases into producer prices.

The Student Manual

The student manual contains a short review of input-output systems. This review is not unlike most reviews on the topic contained in standard texts, although it is perhaps a bit shorter than is traditional.

The student manual also reviews *IMPLAN* as an input-output system. This review includes a generalized discussion on secondary data based input-output systems. It then relates the discussion of secondary data based input-output systems to *IMPLAN*'s methodology. Some of the strengths and weaknesses of secondary data input-output systems in general and of *IMPLAN*'s methodology in particular are included in this review.

Most importantly, the student manual includes a step by step outline for using *IMPLAN* to construct regional input-output accounts. Included are discussions on such topics as: selecting a region for analysis, problems and opportunities associated with sectoring an input-output system, and the construction and interpretation of social accounts matrixes using *IMPLAN* methodology. All of these *IMPLAN*-specific explanations are related to the input-output presentation at the beginning of the manual. All of these explanations are followed by *IMPLAN* software exercises. The exercises include all necessary data for performing the required analyses.

In short, the student manual is less of a text than it is a practical user's guide for input-output analysis. Its emphasis is short explanations followed by multiple exercise possibilities. The entire system is built for both hands-on experience and educational feedback from the software.

Because the manual is not intended to be a complete text on input-output methodology, it can be used most appropriately in conjunction with other works on the topic. We are attempting, however, to make it complete enough to be used in workshops and refresher courses in addition to formal courses in regional studies.

The Educator's Manual

Teaching Goals, Objectives and Methods

Current *IMPLAN* models, like input-output models generally, are demand-driven. Changes in local industry outputs are in response to changes in local final demand and exports. The important distinction between local final sales and export sales is discussed with the backward linkages of local businesses to their input supply sources. Both sets of relationships—the demand-side and the supply-side—have important implications for local labor markets affected by various market and governmental policy and program changes.

Classroom IMPLAN is designed to provide a practical starting place for instruction by offering immediate opportunities for hands-on experiences in managing a widely used regional impact analysis and forecast system. Flow-charting the use of *Classroom IMPLAN* and its database is an important first step in setting the parameters of the course or workshop. Flow-charting highlights how to:

- Start with existing or new model;
- Select and define study area and related data files;
- Prepare social accounts, initial or hybrid, using existing or modified regional purchase/regional export coefficients;
- Prepare input-output accounts, unaggregated or aggregated, using template or aggregation schemes;
- Three templates include an 85 sector identical to the U.S. input-output model published in the *Survey of Current Business*; a 56 sector identical to OBERS projection series to 2040 for individual states; and a 12 sector (missing word? model?) identical to OBERS projection series for individual MSAs and BEA economic areas;
- Prepare regional multipliers; and
- Prepare *IMPLAN* reports. This section provides for specific reports and report formats for classroom use.

Following discussions of *Classroom IMPLAN* and hands-on experience with the model, other models and databases currently used in regional impact analysis and forecasting are examined. These include *REMI* (a dynamic regional forecasting model from Regional Economic Models, Inc.) and *IPASS* (University of Minnesota Interactive Policy Analysis Simulation System) as well as brief discussions of a shift-share model, a quarterly Minnesota economic forecasting model, and the growth model from the U.S. Bureau of Labor Statistics.

Outcome-Based Evaluations

The goal statement for the use of the *Classroom IMPLAN* manual also defines the measurable objectives of the *IMPLAN* learning activity. Attainment of goals defines success. Lack of goal attainment defines failure. Both successes and failures are scored against an accepted performance standard.

The contents of lectures or workshops relate to the goal statement and the accompanying performance standards, including competency measures. Problem assignments address decision situations that can benefit from the use of regional economic analysis and forecasts. The problem assignment includes:

- Discussion of the uses of regional impact analysis and forecasts in a given decision situation;
- Specific information gaps addressed by the problem assignment and the actual information to reduce gaps;
- Validation of this information (in regard to accuracy and reliability); and;

- Interpretation of the given information and the probable value of the information to the decision maker.

The entry examination identifies the areas of interest, related competencies, and likely learning difficulties of the student. The exit examinations attempt to establish levels of competency attainment of each student.

Summary and Future Plans

Classroom IMPLAN offers an opportunity to prevent the kinds of mistakes that input-output practitioners tend to make with current systems.

The streamlined system providing hands-on exercises and feedback about mistakes should prepare learners better for professional applications. The fact that *Classroom IMPLAN* is less complex than *Professional IMPLAN* should facilitate its introduction into existing regional courses. Teaching faculty and others may want to participate in an off-campus *Classroom IMPLAN* workshop offered on demand.

Prospective employers can play a critical role in helping to establish competency standards in *IMPLAN* analysis and forecasting. Such standards could address expectations of employers about the contributions of regional economic analysis and forecasts to their company or agency. This information should be central in course design and implementation.

Teaching *IMPLAN* in regional classes includes comparison of the *IMPLAN* system with other modeling systems, specifically *ADOTMATR* and *REMI*. The comparisons are part of a learning process in the interpretation of available selected findings based on the three types of economic impact analysis and forecasting systems. This process extends to the application of findings in private and public decisions.

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