ECONOMETRICS

By Stephen Harrison

Computer generated simulations are being used in nearly every branch of science today. Spurring the growth of mathematical modeling is the capability of modern computers to perform repeating sets of calculations with speed, economy, and flexibility. Simulations of population growth, drag on boat hulls, tidal movements, traffic patterns, nuclear reactions, air pollution levels, and global military interactions are only a few examples of serious mathematical models which have been programmed into computers.

One branch of computer modeling is econometrics, the quantitative study of historic economic trends and relationships and the subsequent projection of these trends and relationships into the future. Essentially, an econometric model is made up of a set of observations about the past and a set of assumptions about the future. Models are expressed in mathematical language to allow efficient test and manipulation.

Several tools are used in the development of an econometric model. Time series data are the most important of these tools. A time series is a record of past changes in the level of a particular economic measurement such as employment, unemployment, government expenditures, pounds of salmon caught, board feet of lumber harvested, etc. Heavy use is also made of a number of statistical methods. Ordinary Least Squares aids in measurement of the constant or linear changes in time series data. Multiple regression techniques allow estimation of the influence of one series upon another. And among many others there are also tests to compare estimates with observations (standard error of estimate, chi square, T-tests and others).

The first step in the development of an econometric model is collection of sets of useful time series data. At this stage, it is important to compensate for changes resulting from revised accounting techniques and collection methods. Substantial changes in Alaska's employment figures were caused by the switch from computing work force employment, a measure of jobs filled where they occur, to computing labor force employment, a measure of employed people counted where they live.

While time series are being organized, the economic structure is studied and competing blueprints of this structure are proposed for testing. These blueprints are first evaluated from a theoretical standpoint, then formulated into equations and checked by performing statistical tests on the time series data to determine whether or not the postulated relationships are supported by the data.

One of the first distinctions which must be made is between those industries which are driven by an economy and those which drive but are not driven by the economy significantly. In Alaska, examples of industries which drive, but are not internally driven by Alaska's economy are widespread. With a total population smaller than that of Seattle proper, Alaska can not possibly consume its own large output of oil, forest products, or fish. Industries which drive an economy but are governed primarily by outside demand or investment are termed 'basic' or 'exogenous' industries while those which respond to internal forces are called 'nonbasic' or 'endogenous' industries. Because basic industries by definition are governed by forces external to the economy being modeled, most model structures require that basic projections be supplied externally. Basic projections can either be calculated beforehand and stored for use by the model or supplied by other models.

Gradually through application of theory and test, the equations begin to take shape as inappropriate variables are dropped and more appropriate variables are added. As the equations emerge, further statistical procedures are utilized to approximate the quantitative effect of each variable on its equation. For example, the hiring of ten new pipeline workers might cause one new job opening in transportation, three new jobs openings in retailing, and perhaps two new openings in contract construction.

The accuracy of econometric equations is usually judged in the following way. The equations are run from points in the more distant past to points in the less distant past and a set of 'projections' results. These 'projections' are compared with the actual data from that period and a measure of the error of estimate can be computed. The causes of non-random errors are studied, corrections are made and retests carries out until a close fit of estimate to historic value is obtained.

After a set of equations has been built up to translate

basic variable levels into corresponding nonbasic variable levels, intensive work on the basic projections begins. Making basic projections is a critical and complex step in econometric modeling. Good forecasting of basic activity must bring together a firm knowledge of historical trends of the basic variables, an analysis of the most likely state policies and their impacts, assumptions about federal policies and national economic activity, a study of the physical limitations to nonrenewable resource extraction, and information concerning the limits on sustained yield harvest of renewable resources.

In projecting basic variables, many decisions must be studied. At each important decision point, many different paths can be chosen. An analysis of the more likely paths must be made; but while researching the various options, it is often found that certain decisions counteract others, or that a number of decisions all produce similar economic results. Decisions which do not cancel one another or have similar effects can often be grouped into consistent scenarios for future development, thus further simplifying the job of projecting the basic variables.

Once projection and checking of basic variables is complete, these forecasted values are coded into computer files for determination of their nonbasic counterparts. The tested econometric equations are now fed the basic forecasts for each quarter to be forecasted and the nonbasic projections result. These projections are then tested for logical consistency, economic sense, adherence to assumption, and reflection of historical trend. After examining the results to make certain that the model is functioning properly and correcting any problems found, one variable at a time is changed during a simulation run and the influence of each variable on the entire simulation is studied.

It cannot be overemphasized that there is no magic or prophetic insight involved in computer modeling. Each phase of computer modeling can be carried out one step at a time. It is our philosophy that econometric assumptions should be clearly stated and understood, that the methods for assembling the equations and combining them to build the model should be straightforward (partially based on economic theory, and partially derived from empirically discovered relationships), that the projections be consistent with observation and theory, and that the results of the simulations be understood. The computer routines can be carried out by hand one operation at a time in the sequence which the computer follows and identical forecasts will result (assuming that no mistakes are made in transcription or arithmetic).

Some persons disclaim econometrics on the basis that subjective assumptions on the part of the econometrician enter into a model. Agreed, subjectivity is one of the limitations of econometrics which must be recognized and taken into account not only during the development and maintenance of a model but also while using the projections from a model. However, it should not be ignored that nearly all decision making which affects future operation involves implicit and or explicit forecast. Problems with subjectivity can be effectively reduced by keeping a close record of assumptions utilized in model building. In this way, the assumptions can be rechecked periodically against the actual course of events, logic, and economic sense.

One econometric project dealing with Alaska is currently being carried on within Alaska's Department of Labor. Because the Department of Labor was chartered to promote and develop the welfare of Alaskan wage earners, these modeling efforts center around projection of employment by industry and unemployment. This econometric research is aimed towards the testing of policy effectiveness in further stabilization of the Alaska labor force and further reduction of Alaskan unemployment.

Because of the importance of this task, conscious effort is made to sustain a healthy amount of scientific skepticism during our research. There is constant striving to maintain the ability to distinguish assumptions from facts and projections from actual data so that when the forecasts are output from the computer, the assumptions upon which the projections are based can still be rationally reassessed.

Given the limitations of econometric models, they are still highly valuable tools. The Department of Labor is currently researching various strategies for optimum labor force utilization. One tack which shows promise is an attempt to anticipate significant layoffs and to promote the start of new projects with these anticipated layoffs. Econometric research is also providing valuable information about the different approaches to management of Alaska's Unemployment Insurance Fund. Along with these and other projects which are being undertaken, the

benefit derived from gaining a better understanding of the Alaska economy should not be underestimated.

As a brief synopsis of our research, Alaska's economy is very young and vital. Nonbasic industries will continue to claim an increasing share of this expanding economy, and this will continue to bring about a reduction in Alaska's historically high degree of seasonality.

Note: The publication Economic Forecasts 1976–1978 has been produced through the use of an econometric model. This publication may be obtained by contacting the Research and Analysis Section of the Department of Labor; P. O. Box 3–7000; Juneau, 99811.

ALASKA LABOR MARKET IN JULY

Employment–Unemployment: The unemployment rate for July dropped sharply from the June rate of 9.5 percent to 7.8 percent. This marked improvement in the July unemployment rate was the result of a combination of several different seasonal trends, and employment expectations.

Canneries in July continued to hire more employees to help process the much improved salmon catch in southcentral and western Alaska. By July many of the students who entered the labor market in May or June have either found employment or have dropped out of the labor force. As a result of the anticipated completion of the oil pipeline, many people from outside Alaska have decided against coming to the state to seek employment. These factors have come together to increase total employment while actually reducing the total number of people in the civilian labor force.

Mining: In contrast to the atypical increase in employment experienced during the month of June, employment in the mining industry during July returned to a more normal seasonal pattern with a decrease of 2 percent in the number of those employed.

Construction: The rate of growth of employment in the construction industry has definitely turned the corner during the past months of June and July. In the month of June, employment rose about 3 percent, followed by an increase of only 2 percent in July. As in the past months, the Trans-Alaska Pipeline still is a major factor in employment in this industry. New hires are still being accepted by contractors along the pipeline, however, they are mainly being used to fill replacement positions rather than as additional manpower for the project.

Manufacturing: With an increase of 18 percent in the number of employed, the manufacturing industry was the most active industry during the month of July. A major portion of this growth was in the food processing industry which experienced an increase in employment of 37 percent when compared to the previous month. This large jump in employment in this industry is typical for this time of year as many canneries take on a large number of workers in anticipation of the fishing season and the heavy work load experienced as the catch is brought in.

Transportation: The transportation industry during July showed a modest gain in employment of 5 percent. Trucking and water transportation continued to show employment levels below that of one year ago, however, they did experience moderate gains in employment during the month of July. The "other" industry category which includes firms in the communications field continues to experience moderate gains in employment and is the only sector in this industry which is experiencing employment gains over one year ago.

Trade: The trade industry showed an atypical movement in employment during the month of July experiencing a one percent decline in employment. Employment declines were experienced in general merchandise and apparel, and "other" retail trade stores which include gift shops and souvenir stores. Food stores and eating and drinking establishments remained relatively stable with little or no change over the previous month.

Finance, Insurance and Real Estate: This industry experienced a 4 percent decline in employment from June to July. Employment in the banking sector remained relatively stable, however, the number of employed in the insurance and real estate sectors of this industry did experience a moderate drop in employment.

Services and Miscellaneous: Employment gains in this industry leveled out during the month of July