

Confessions of an International Forecaster

By **Thomas M. Fullerton, Jr. ***

issues associated with international forecasting in Latin America and discuss several ways in which personal computers provide essential links to analysts.

MODELING AND FORECASTING

Macroeconometric modeling in Latin America is conducted somewhat differently than it is in OECD countries such as the United States or Japan. Data are either monthly or annual, but quarterly estimates for national income and product accounts are virtually nonexistent. As a result, rigorous time series analyses must focus on either short-run issues or long-run trends, but nothing in between. In spite of the lack of quarterly statistics, sophisticated quantitative studies of the regional economies are still conducted. As a result, numerous sales and research publication possibilities exist for business economists who study this area of the world.

Macroeconometric forecasting models for individual countries involve systems of simultaneous equations that typically contain 100 equations or more. Of these, more than half of the model equations are usually stochastic. Sectors covered include aggregate supply, aggregate demand, fiscal monetary interactions, inflation, exchange rates, merchandise trade, current account balance, capital account balance, and external debt. Incomplete statistical coverage may prevent implementing the most recent theoretical specifications in all individual equations. The structures of the models themselves, however, are fairly intricate. PC econometric programs such as AREMOS or Micro-TSP also allow the application of advanced estimators when model parameters are calculated.

The high degree of uncertainty present in Latin American economies has caused more than one business manager to remark that the long-run is only six months away. As a result, much of the research agenda in forecasting is now oriented toward the development of high-frequency data models. Initially, these efforts involved univariate time series models for exchange rates and inflation.

AS OTHER ARTICLES in this issue have discussed, Latin American countries were racked by the international debt crisis of the 1980s. This crisis further complicated all types of standard economic analyses for a region traditionally characterized by relatively high levels of uncertainty. Volatile commodity export markets, rapidly changing policy environments, and unstable inflationary conditions mandated the usage of flexible analytical tools that are typically associated with microcomputers. As International Economist with The WEFA Group (formerly Wharton Econometrics) during much of this period, I dealt with these issues from the context of macroeconometric forecasting and policy analysis.

At WEFA, I was in charge of all modeling and forecasting for Colombia, Ecuador, and Venezuela. One of my first steps was to rebuild the models for Ecuador and Venezuela on a personal computer using The WEFA Group's proprietary software package AREMOS. Eventually, all of the South American models were transferred from a mainframe computing environment to microcomputers. This transition resulted in a dual savings of both time and money. It also permitted WEFA to generate additional revenues through software and model sales. This paper will review some of the practical

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Transfer ARMA and vector autoregression analysis have become increasingly popular as investigators attempt to model more than just single variables in isolation from everything else.

Research programs are turning to the estimation of complex systems of equations designed to generate complete short-run economic and financial forecasts. At the University of Florida, I recently developed a 100-equation short-run forecasting system for South American economies. This type of analysis is ideally suited to user-friendly microcomputer software packages whose low cost makes them available to researchers throughout the region. Monthly statistical series are generally available for sectors such as money, banking, interest rates, equity markets, inflation, exchange rates, government, merchandise trade, balance of payments, industrial production, and commercial activity. What is encouraging about this line of investigation is that initial dynamic simulation tests for individual economies indicate realistic forecasting behavior is easily attainable. This despite the significant structural and cyclical changes that occurred in the 1980s.

PERSONAL JUDGMENT

One of the most significant policy efforts posing a challenge to international forecasters in recent years was Treasury Secretary Brady's March 1989 proposal to ease commercial debt burdens of countries that introduced market reforms in their economies. As previous authors have noted, adjustment factors are often a forecaster's best friend, especially when analyzing policy innovations.

One of the first economies to benefit from the Brady initiative was Venezuela. The second quarter 1989 WEFA Latin America Economic Outlook included a surprisingly accurate depiction of the debt reduction menu eventually negotiated between Venezuelan officials and their foreign creditors. To anticipate many of the capital flow reversals that subsequently occurred required introducing a variety of add factors. Having access to rapidly generated PC-based simulation tests was essential to accomplish this task. Instinctual fortitude was another component required in publishing one of the first forecasts of the actual macroeconomic impacts of this widely publicized international policy effort.

In countries where economic policies change substantially over short periods of time, flexible econometric software that permits rapid analysis of alternative scenarios is a key element in assessing the potential impacts of new legislation or executive decisions. Many times it is necessary to estimate not only the ultimate consequences of given policy

choices, but also the likelihood of desired or targeted outcomes. This usually entails two types of simulation exercises. The first involves estimating the most likely results associated with any given government action. The second requires the development of implicit model adjustment factors to calculate different econometric policy corridors to desired goals of the government. Assessments can then be made with respect to the political feasibility of any reform packages or the projected speed of adjustment implied by a new plan.

Add factors are also necessitated by the same modeling shortfalls that confront forecasters in OECD economies. Every stochastic equation estimated in an econometric model has residuals associated with it. These residuals frequently provide the starting points for adjustment factor calculations in South American macroeconomic forecasts. Unfortunately, model misspecification (often due to data gaps, "occasionally" due to modeler ignorance and/or commercial time constraints) also forces the adoption of adjustment factors to arrive at reasonable projections of many variables. No matter how many equations I estimated for Colombian mining sector output, I never achieved a specification with acceptable simulation behavior. Indeed, every one that I tested always suggested stratospheric growth rates would take place under any set of circumstances implied by The WEFA Group's alternative world outlook scenarios.

Another example of specification error that may force the incorporation of forecast add factors is widespread serial correlation. For the Colombian, Ecuadorian, and Venezuelan models, approximately 20 percent of the sixty or more stochastic equations in use at any point in time in each model contained either autoregressive or moving average ARMAX parameters to control for autocorrelated residuals. While these parameters insure against misleading t-coefficients in individual equations, model bias may not be completely eliminated from subsequent simulations. Nearly every forecaster is also aware of the Lucas critique of standard econometric policy evaluations. Not surprisingly, in an area marked by frequent policy reversals, simulation results are carefully monitored and adjusted when necessary to reflect concerns over potential dynamic reaction to administrative innovations in a given economy or market.

Under the most ideal circumstances, i.e., the stable and easy-to-forecast OECD countries where R-squared coefficients of determination routinely exceed 99 percent, forecasting often seems like an exercise in chasing moving targets. In Latin America, it is common for data revisions to render seem-

ingly robust equation specifications useless overnight. Specification fragility makes it very difficult to divine correctly what will be published in the next issue of the IMF's *International Financial Statistics*. The most gifted of econometricians (even Bayesians) quickly learn to manhandle simulation results in order to avoid the wrath and/or ridicule of veteran clients who understand the vagaries of the region.

Of course, internally consistent technical analyses of any new policy or business cycle development in South America cannot be accomplished in isolation in front of a computer screen in Philadelphia or London. News outlets and technical journals from the region must be monitored. Telephone conversations and telephone transmissions to local clients and other experts become weekly rituals. As Professors Lawrence Klein and F. Gerard Adams frequently told the Global Outlook Committee at WEFA, good forecasts always rely upon local observations as much as they do strong theoretical and empirical frameworks. Even in an era of unprecedented computational advances, a successful business economist always has an ear to the ground.

To ensure that judgments remain valid, periodic trips to the countries under study are necessary. There is no substitute for actually traveling to a region and gathering first-hand observations of local conditions. This also permits personal contacts to be strengthened and new sources of information to be discovered. Hard to obtain data series frequently materialize once a visitor calls upon the government agency or trade association that collects the estimates. In short, research problems and client needs, both here and abroad, are better addressed after on-site visits.

Forecasting models developed for Latin America generally have a number of linkages to OECD and world economic variables. Series such as Libor and other short-term international interest rates, benchmark crude oil prices, and world GDP play important roles as exogenous variables in models of these semiopen economies. Because even the smallest Latin American economies are not truly "open," a number of domestic exogenous variables must be projected by the forecaster. Econometric models in the region cannot be run as simple satellite models to larger international forecasting systems. Determining the future paths of many exogenous variables such as commodity export volumes often becomes an exercise in applied game theory because the analyst must try to understand the likely decisions of state enterprises. These domestic monopolies face internal policy concerns, are generally not independent of central government executive

branches, and frequently belong to international cartel groups such as OPEC or the International Coffee Organization. Here again, personal contacts within the international community can be of enormous help in assessing potential outlook scenarios.

Two other differences exist between forecasting Latin American and OECD countries. Seasonal adjustment is not used very much in the southern hemisphere. As a result, many of the technical criticisms regarding seasonal adjustment error in OECD government statistics and forecasts are not cause for concern in Latin America. In annual data, seasonal patterns almost never cause forecasting problems. In monthly outlooks, this problem is overcome by examining variables of interest to year-ago levels and computing 12-month moving averages.

A final difference arises from the treatment of statistical discrepancies and measurement error in economic series. In national income and product accounts, these discrepancies are generally subsumed by incorporating them in another series such as inventory investment. In South America, this practice makes them difficult to identify and monitor. In balance of payment statistics, errors and omissions are published by multilateral organizations such as the International Monetary Fund. However, "omissions" frequently is a byword for flight capital. Statistical aberrations may also be encountered in unclassified long-term capital flow series as well. Careful forecasters and business economists must recognize these differences in economic accounting systems and adjust their interpretations of trends (or the absence thereof) accordingly. Failure to do can result in embarrassing questions at quarterly outlook seminars in front of an audience of peers.

NORTH-SOUTH: THE PC CONNECTION

Microcomputers have revolutionized econometric forecasting in Latin America. Hardware and software configurations are now accessible to economists facing stringent operating budgets throughout the world. Elaborate (mainframe) econometric models, once the exclusive realm of central bank research departments and large foreign universities, are now maintained by a multitude of corporations and consulting services. Data transfers, both international and domestic, can today be efficiently accomplished using diskettes. For a region where telecommunications systems lag those of most other market economies, data transmittal via diskettes is one of the most useful developments associated with PCs.

Examples of data interchange abound. From a forecasting perspective, new outlooks for Latin American economies are regularly sent to clients on diskettes. Local economists can then incorporate these tools directly into their own planning activities. Local installation of a new forecast permits the users to examine more closely the assumptions used to generate projections. This process frequently gives rise to valuable critiques of how different issues are treated or how a particular sector of a model behaves when shocked.

Modern software permits forecasters to install their models on client machines. Consultants can send model updates to their subscribers through international mail or courier services, saving time and expense. An open interchange of information of this nature creates a variety of business and occasional publication opportunities. As I recently discovered, even journal article submissions in South America must be accompanied by electronic versions of the manuscripts and data sets.

Of course, econometric forecasts are only the tip of iceberg in terms of PC information transfer and management in the region. Financial spreadsheets are used to analyze corporate cash flows and government financing requirements. Manufacturers use quality control programs to monitor production performance. PC bar code software has been instrumental in keeping retail prices abreast of inflation in countries where merchants face the serious menu costs associated with hyperinflation. Accounting systems are often maintained on microcomputers. The increasing spread of PC technology is serving to automate and categorize business information statistics, leading to improved data sets for nearly all sectors in any Latin American economy.

Improved statistical coverage is permitting researchers to study Latin American economies with techniques previously applied only in OECD nations. Journals throughout the region are increasingly referenced by authors in Europe and the United States. Areas in which new econometric techniques and recent theoretical advances are regularly tested include real business cycles, consumption and investment behavior, exchange rate movements, and international capital flows. Capital markets growth will undoubtedly lead to new studies of trading day cycles, financial variable reactions to news, and the evolution of equity prices and stock returns. The widespread analysis of bond and capital markets information, currently gaining momentum, could not take place without improved data bases or low cost PC technologies.

Many econometric computing facilities in Latin America lag behind the latest hardware and soft-

ware releases, but this is not universal. State-of-the-art technologies are commonplace in major manufacturing and financial companies throughout the Americas. In 1990, I directed a team of fourteen in the development of a macroeconomic forecasting system for a South American client of The WEFA Group. Because the client wanted the new system to be available for immediate use, his corporate planning department provided a Toshiba lap top computer on which the new system was to be installed. Not only was the Toshiba superior to any lap top at WEFA, it also surpassed all of the desk tops at WEFA in every computational phase other than color graphics and screen resolution. The latest consulting project I conducted at the University of Florida was prepared for a Latin American customer whose Compaq notebook PC capabilities exceeded those of either of the microcomputers assigned to me by the university.

Naturally, not all research institutes or government agencies in the region enjoy access to the most advanced PC configurations. This does not pose the difficulties that it may have in the early years of the microcomputer revolution. In fact, the situation is similar to that in many organizations worldwide where some departments use 386 machines but whose output is used by others that rely on 286 units, and vice versa. Computational facilities in Latin America are continuously being upgraded and improved. That some systems lag those of their counterparts abroad does not cause insurmountable problems.

Opportunities are what should be emphasized with respect to this new linkage between researchers, analysts, planners, and forecasters in the North and South. Consulting contracts I obtained have been alluded to above. Where data permit, business economists in the United States and elsewhere can now provide research services on a cost-effective basis to a wide variety of new potential clients.. Because the final products can be delivered electronically and installed on similar operating systems, implementation becomes easier. As they are more likely to avoid collecting dust on a shelf, the potential for subsequent orders is improved. The spread of PCs and efficient data transfer also allow international researchers to compete with local consultants for projects in individual countries (the converse also applies). The latter helps the profession as a whole, as client organizations are provided with a greater selection of consulting and forecasting services.

CONCLUSION

All phases of macroeconomic research in Latin

America, modeling, forecasting, and policy analysis, have benefited from advances in microcomputing hardware and software. In addition to extending the realm of study in this area, the introduction of PC technology has opened new lines of communication between international planners. This has proved beneficial for academic research as well as for commercial endeavors available to professional economists. Flexibility and ease of implementation insure that new discoveries are tested and improved with user friendly PCs.

In a region well known for "special twists," microcomputers are being used very much as they are in the United States and Europe. Maintaining internal consistency within Latin American forecasts

is as difficult as anywhere in the world. However, the widespread variability in growth and inflation rates, plus other uncertainties such as political instability, require forecasters to be imaginative when analyzing these issues. During one consulting trip to South America, I inadvertently wandered into a cloud of tear gas used to disperse student protesters in front of the central bank. When I arrived at the monetary board conference room with tears streaming down my face, the director of open market operations leaned over and patted me on the back, saying "Don't worry Tom. One day we'll figure out how to fix this economy." When that day arrives, personal computers will undoubtedly be used to find the solution.