New Directions in Latin American Macroeconometrics

Thomas M. Fullerton, Jr.*
Eiichi Araki**

Summary

This paper provides a brief overview of modeling and forecasting methodologies for price trends and other macroeconomic variables in developing countries. Five different approaches are reviewed within the time series and econometric traditions from which they have been selected. Each methodology offers a means for understanding different aspects of inflationary and other macroeconomic variable movements in Latin American economies. A brief list of publications that illustrate examples of how to implement each modeling strategy is included in the bibliography. There may be situations in which one approach is more useful than alternative techniques, but no methodology should be regarded as uniquely superior to the others.

Introduction

Econometric forecasting analysis began developing as a field of research with the initial endeavors of Jan Tinbergen and others in the 1930s (Dhane and Barten, 1989). These relatively small macro-econometric models of the Dutch economy were developed using

---

* Department of Economics and Finance, College of Business Administration, and Texas Center for Border Economic Development, University of Texas at El Paso
** Faculty of Economics, St. Andrew's University
annual data. Research on business cycles in the United States began replicating and extending the Dutch modeling examples in the 1940s. Increasing interest in short-term economic fluctuations eventually led to the development of quarterly forecasting models (Barger and Klein, 1954). Although directed toward better understanding of national economic behavior over time, these early efforts influenced nearly all areas of international macroeconomic analysis which developed subsequently.

Along with the expansion of structural econometric modeling and research with respect to forecasting and policy analysis, time series statistics also grew increasingly sophisticated in the realm of predictive modeling. Most of these efforts occurred with respect to high frequency monthly data, especially univariate autoregressive moving average ARIMA models (Box and Jenkins, 1976). While often regarded as competitors, time series models are frequently utilized as complements to econometric equation sets and can also be imbedded within a variety of forecasting systems (Clemen, 1989; Fullerton, 1989; Zellner, 1994).

Latin American macroeconomic forecasting models began to appear in the 1960s (Beltrán del Río, 1991). Similar to the first models for the Netherlands and the United States, the early Latin American models utilized systems of simultaneous equations designed around national income and product account (NIPA) data. Unlike most industrialized economies, however, NIPA data in Latin America during this period tended to be published only at an annual frequency. This constraint precluded the development of Latin American quarterly forecasting models in a manner analogous to what occurred in many industrialized economies, a problem that
long frustrated policy modeling efforts with respect to "southern-hemisphere" countries (Sawyer and Sprinkle, 1987).

Although quarterly forecasting models have not been widely disseminated in Latin America, large-scale forecasting models built using annual NIPA data abound. Representative examples include the CIEMEX-WEFA model for Mexico (Beltrán del Río, 1991), the CIEPLAN model for Chile (Vial, 1988), the Metroeconómica model for Venezuela (Palma and Fontiveros, 1988), and the WEFA models for Colombia and Ecuador (Fullerton, 1993a, 1993b). Among the most salient characteristics shared by these models are continuous maintenance and enhancement over sustained periods of time. All of the aforementioned studies provide detailed references to the history of macroeconometric modeling in the region. Econometric forecasting analysis using annual data in Latin America has a distinguished history and track record that is well-documented.

Given the volatile behaviors of the majority of the economies in Latin America in the 1980s, the absence of quarterly forecasting tools hampered business planning efforts. Forecasting conferences sponsored by commercial entities such as Wharton Econometrics during the late 1980s utilized simulation output from annual structural models for Latin American countries of interest. Client questions at these meetings were generally directed toward the first year of the forecast period, largely ignoring outer period extrapolation results (for example, see Fullerton, 1993a).

This is not to imply that the traditional macroeconometric Latin American models are regarded as useless. Most analyses of international indebtedness typically rely on annual data in order to examine the consequences of changes in regional balance of
payment factors. Not surprisingly, significant effort was put forth in recent years to enhance the current account–capital account linkages and simulation performances in Latin American macroeconomic models (Fullerton, 1993a). The relative lack of forecasting models estimated with higher frequency data, nevertheless, continues to pose an obstacle to corporate, public sector, and multilateral agency planners and economists.

Although quarterly national income and product account data are still not widely available to researchers in Latin America, monthly time series for many economic variables do exist. Examples of the latter include inflation indices, money supply measures, currency exchange rates, commodity export prices, and international reserves. Those data, plus the development of low cost microcomputing hardware and econometric software, have encouraged macroeconometric analysis throughout the region to become more time series oriented in recent years (Fullerton, 1992). Accompanying this trend has been the application of increasingly sophisticated econometric methodologies that yield new insights with respect to economic performance in Latin America. Given the adoption of market-oriented adjustment packages that erase many of the short-run relative price rigidities (see Ize and Salas, 1985), the latter class of information analysis is of central importance to policy advisors throughout the region.

This article provides an overview of new directions in Latin American macroeconometric research. Because there is a huge volume of work occurring in this regard, the research contained herein serves as a suggestive survey designed to familiarize readers with some of the promising developments that have
emerged in recent years. As an organizational strategy, inflationary modeling research is utilized as the common unifying theme about which each topic is referenced. Additional topics are included where appropriate or of interest, but inflation provides a convenient vantage point from which to develop the framework in an organized manner. Subsequent sections of the paper include discussions of univariate ARIMA time series analysis, multi-input ARIMA transfer function modeling, single-equation econometric modeling, structural model systems of equations econometric analysis, and vector autoregressive multi-series endogeneity approaches.

**Univariate ARIMA Time Series Analysis**

Univariate ARIMA modeling has been increasingly applied to a wide variety of economic applications in Latin America and other regions of the world. This form of time series analysis attempts to characterize the behavior of an individual variable by utilizing the information contained in its own historical movements. These movements are broken down into stationary components involving autoregressive and moving average sub-components, where the latter are comprised by estimated residuals. Differencing and transformation of the data series are frequently required to induce stationarity in the various moments, generally the mean and variance, associated with the series of interest (Pankratz, 1983).

The basic form of an ARIMA (p, d, q) equation may be expressed as follows:

\[ P_t = a_0 + a_1 P_{t-1} + \cdots + a_p P_{t-p} + b_1 U_{t-1} + \cdots + b_q U_{t-q} + U_t, \]

where \( t = 1, 2, \ldots, T \), \( P \) is the stationary working series for a dependent variable such as a price index, and \( U \) is a random error
term. The above representation is for a time series process of autoregressive order $p$ and moving average order $q$, reflecting the respective number of lags for each type of parameter. The degree of differencing necessary to induce trend stationarity is indicated by the value taken on by the $d$ term in the parentheses. A differenced series is referred to as integrated of order $d$.

Four basic steps are taken with respect to this type of statistical analysis: identification, estimation, diagnostic checking, and forecasting. Identification is usually accomplished via graphical analysis of autocorrelation and partial autocorrelation functions. When moving average parameters appear in an ARIMA equation, estimation must be accomplished using iterative procedures because the resulting equation is nonlinear. Standard coefficient t-tests, residual chi-square statistics, and goodness-of-fit log-likelihood ratios are used for diagnostic checking. Extrapolation exercises, over history and out-of-sample, provide an idea of the simulation capabilities with any estimated equation. Good diagnostics do not always guarantee forecast accuracy. Still growing in popularity with respect to Latin American macroeconomics, an interesting range of applications has emerged over the course of the past two decades. Two examples are discussed below.

In one of the earliest time series studies developed for an economy in Latin America, Cabrera and Montes (1978) utilize univariate ARIMA techniques to model the consumer price index (CPI) in Colombia. Logarithmic transformation, plus regular and seasonal differencing of the monthly CPI series are used to induce stationarity. An equation containing an autoregressive term at lag 1 and a seasonal moving average term at lag 12 yields statistically significant
parameter estimates. While simple in structure, the model exhibits good statistical traits and is found to simulate historical movements of the CPI successfully. Empirical evidence is provided that Colombian inflation, although high relative to that observed in many industrial economies such as Japan and the United States, is stable enough to be modeled and predicted with a fair degree of accuracy. Interestingly, this early model specification withstood the test of time in an impressive manner in later research on price trends in Colombia (Fullerton, 1993c).

Of course, univariate ARIMA modeling can be applied to many other areas of macroeconomic analysis. A recent example is provided with respect to the behavior of money multipliers in South America (Fullerton and Kapur, 1991). While monetary aggregates in developing economies are generally subject to high degrees of volatility, evidence is provided that the relationships between monetary bases and money supply measures are systematic enough to be modeled and forecast. The analysis indicates that results are comparable to those obtained for industrial economies such as the United States and the Netherlands. As such, the article partially refutes the old adage that standard economic hypothesis testing is not applicable to developing economies because they are somehow “different.”

Univariate ARIMA analyses helped illustrate the existence of stable economic structures in developing economies, but it should be noted that univariate ARIMA models cannot represent the structure itself which generates such stable behavior of the variable in question. Such a structure can partially be handled by time series techniques, such as Transfer Function ARIMA Analysis and Vector
Autoregressive Models. Underlying economic structures can also be
directly analyzed more generally by traditional Systems of Structural Equations as described below.

**Transfer Function ARIMA Analysis**

As shown by Box and Jenkins (1976), it is a relatively straightforward and natural progression to move beyond the narrow, but valuable, focus associated with univariate ARIMA modeling. Transfer functions incorporate new information via input series to augment what is already provided in a single variable time series equation. Further utilizing the consumer price index example provided above, the basic form of an ARIMA transfer function can be expressed as follows:

$$P_t = a_0 + a_1 P_{t-1} + \cdots + a_p P_{t-p} + b_1 U_{t-1} + \cdots + b_q U_{t-q} + c_i M_{t-i} + d_j X_{t-j} + c_{i+1} M_{t-i-1} + d_{j+1} X_{t-j-1} + \cdots + U_t,$$

where $i = 1, \ldots, h$, $j = 1, \ldots, k$. $M$ is the stationary component of a money supply measure such as MI, and X is the stationary component of an exchange rate series (generally expressed in local currency units per dollar) or an import cost index. Obviously, different input variables will be selected as the nature of the process under consideration determines. The parameters $\{c_i, d_j, c_{i+1}, d_{j+1}, \ldots\}$ show how movements in the exogenous variables, $M$ or $X$, are transferred to the endogenous variable $\{P_t\}$. Note that if $i > 0$ (or $j > 0$), the contemporaneous value of $M_t$ (or $X_t$) does not affect $P_t$ and $M$ (or $X$) is called a leading indicator.

The procedure followed when estimating a transfer ARIMA model is similar to that utilized for univariate time series analysis. In the two-input series case like that depicted in Equation 2,
individual univariate ARIMA equations are developed for the dependent variable P and the independent regressors, M and X, under the four basic steps discussed above. Cross-correlation functions (CCFs) are then estimated using the individual residual series calculated for each of the three univariate models. The CCFs indicate which, if any, lagged observations of M and X are of use in predicting current values of P.

Estimation of the transfer equation for P is then conducted by proceeding as follows. All of the univariate autoregressive and moving average parameters appearing in Equation 1 are incorporated into the initial model. Lags of the input series are included based on the results obtained from the CCFs. Once model parameters have been calculated, diagnostic testing and equation simulation exercises are conducted to test the overall reliability of the equation. Again, the latter steps are very similar to those conducted for univariate ARIMA specifications (Enders, 1995).

Fullerton (1993c) utilizes a transfer function autoregressive integrated moving average (transfer ARIMA) modeling framework to analyze movements in consumer prices in Colombia. Forecasting experiments are conducted with the resulting model to shed light on potential impacts associated with an anti-inflationary program enacted by the central bank. Results indicate that this class of time series modeling can provide useful insights with respect to macro-economic trends and potential policy results in Latin American countries.

This class of time series model has also proven helpful in gauging the impact of currency movements on commuter flows between Mexico and the United States (Fullerton, 1997). Macro-
economic policy changes and business cycle developments of this nature have substantial impacts on regional economic performance and commercial activity. Transfer function analysis conducted for the El Paso, Texas – Ciudad Juarez, Chihuahua international metropolitan area indicates that northbound bridge traffic is impacted in a manner analogous to the well-known J-curve effects observed for merchandise trade (for example, see Tegene, 1989). For the 1979–1988 sample period, commuter flows between Mexico and the United States are found to respond to real changes in the peso/dollar exchange rate within an eight-month time frame.

A closely related class of ARIMA models that has yet to be widely applied in the context of Latin American macroeconometric analysis is known as intervention analysis (Box and Tiao, 1975). Because of its ability to clarify the effects of major policy changes, this methodology is particularly well-suited to analyze developments that have taken place over the last 15 years of widespread structural adjustment efforts throughout the region. A typical intervention model is as follows;

\[ P_t = a_0 + a_1 P_{t-1} + \cdots + a_p P_{t-p} + b_1 U_{t-1} + \cdots + b_q U_{t-q} + c_1 D_{1, t} + c_2 D_{2, t} + \cdots + U_t \]

where \( D_i \) is the \( i \)-th intervention (dummy) variable that takes on the value of unity prior to a policy change and zero after that. Prime examples of the latter include the elimination of retail price controls, multi-tiered exchange rate systems, and nontariff import barriers in several important economies such as Venezuela and Ecuador. Intervention modeling techniques may also prove useful in examining the financial consequences of natural disasters such as earthquakes and hurricanes that periodically affect Latin
America and the Caribbean (see Lenze, 1997). As with the other examples of ARIMA models, policy analysis in the region will benefit from the dynamic aspects of the intervention framework for quantitative estimation and simulation.

**Single Equation Econometric Models**

As discussed in the previous section, time series analysis can directly incorporate variables suggested by standard economic hypotheses. Economic theory can also be used to suggest the functional forms of equations to be estimated. Under this more traditional approach, the equation reflects a theoretically specified relationship between movements in the regressor variables and changes in the dependent variable. A wide variety of both static and simple dynamic examples of this type of model can be found in econometric textbooks (for example, see Pindyck and Rubinfeld, 1991). Straightforward model specifications provide valuable starting points and have been found to withstand the test of time in a robust manner for a wide variety of applications (Christ, 1993; Fullerton, 1993a). A common area of endeavor utilizing this approach for Latin America has been in the realm of macroeconomic growth performance (Edwards, 1993).

Recent work utilizing a single equation econometric approach has been completed with respect to short-term policy impacts and forecasting issues regarding consumer price movements (Fullerton, 1995). Consumer prices in Ecuador are modeled using an econometric framework that incorporates domestic monetary factors and international input costs. Because serial correlation is present in the model residuals, parameter estimation is accomplished with a
nonlinear procedure that provides sufficient flexibility to handle even mixed error structures. Simulation exercises are also utilized to examine possible consequences associated with a price stabilization program implemented by the central bank. A simplified version of the reduced from model for Ecuadorian consumer prices is summarized in Equation 3:

\[ P_t = e_0 + e_1 M_{t-1} + e_2 V_{t-j} + e_3 X_{t-k} + U_t, \]

where \( V \) represents the velocity of circulation.

As alluded to above, the hypothesized equations will frequently not account for all variation in the dependent variable. Nonrandom movements still present in the residuals may be modeled as an exogenous time series process. A nonlinear methodology suggested by Pagan (1974) has proven helpful in several Latin American modeling applications in recent years. This option is especially helpful when data constraints preclude further expansion of the initial specification. Equation 4 illustrates a general ARMAX specification for the previous equation:

\[ P_t = e_0 + e_1 M_{t-1} + e_2 V_{t-j} + e_3 X_{t-k} + f_t U_{t-1} + g_j W_{t-m} + W_t, \]

where \( f_t \) are autoregressive parameters, \( g_j \) are moving average coefficients, and \( W_t \) is a white noise component for \( U_t \), where the latter represents the disturbance term appearing in Equation 3. Methodologically, Equation 4 belongs to the category known as Generalized Least Squares Models. By properly specifying and taking into account the nonrandom movements of residuals, one can get statistically more efficient estimators. Besides ARMA specification, Autoregressive Conditional Heteroskedasticity (ARCH) specifications have often been employed in recent years, especially in financial market analyses of industrialized economies (Engle, 1982).
One question which naturally arises with respect to single equation models is how to account for movements in variables other than those appearing on the left-hand side. Feedback from the dependent variable to the "exogenous" variables on the righthand side may also be considered. The latter is feasible via systems of equations modeling and, as discussed in the introductory remarks, represents one of the most valuable areas in Latin American macroeconometric research during the late 1980s and early 1990s.

There is another class of single-equation econometric models that have become widespread in the analysis of advanced industrial macroeconomies. The latter are generally referred to as error-correction models and were introduced by Davidson, Hendry, Srba, and Yeo (1978). A principal feature of this category of econometric models is the simultaneous incorporation of long-term structural trends and short-term dynamic movements in the variables being modeled (Hamilton, 1994). Simulation properties associated with error-correction models resemble those of partial adjustment equations (Wallis and Whitley, 1991). It is likely that a large volume of Latin American research will be conducted in the coming years using this technique. With regard to other recent modeling advances, macroeconomic and financial studies in the region have already begun to utilize unit root-cointegration methodologies (Arellano, 1993). It should be noted that error-correction models and cointegration techniques can fall within the category of single-equation specifications. They can also be utilized in conjunction with the next topic of this paper, systems of simultaneous equations.
Structural Model Systems of Equations Models

Of course, independent variables such as the money supply and the exchange rate regressors that appear in Equations 2, 3 and 4 are also functions of economic processes and can be modeled as such. Inflation models can be, and frequently are, readily expanded into systems of simultaneous equations, with individual component specifications determined by theories of how the economy works. Different sectors of each model can affect the simulation behavior of other variables depending on model structure and forecast assumptions regarding exogenous variables such as international consumer price movements. This general modeling approach has proven its worth in numerous research, policy simulation, and business condition forecasting exercises for Latin America during the better part of the past three decades.

Building upon the basic inflationary macroeconometric framework outlined thus far, the general model form for a small structural system of equations is presented immediately below:

5. \( P_t = f_0 + f_1 * M_t + f_2 * X_t + U_t \)
6. \( M_t = g_0 + g_1 * MB_t + W_t \)
7. \( X_t = h_0 + h_1 * P_t / PF_t + h_2 * BOP_t + Z_t \)

where MB is the monetary base (implying that the \( g_1 \) regression coefficient is an MI or M2 money multiplier), PF is an international price index, and BOP is a balance of payments international reserves variable. From these well-known and relatively intuitive specifications, it is easy to see that such a structural model can handle multiple factors that may potentially alter the inflationary outlook for an economy (for actual forecasting results associated with
this approach, see Fullerton, 1993a, 1993b).

In such simultaneous equation systems, error terms inevitably correlate to some regressors. In the above example, $P_t$ is affected by $U_t$ in equation 5, and $X_t$ is affected by $P_t$ in equation 7, so $U_t$ and $X_t$ are correlated in equation 5. In such case OLS (Ordinary Least Squares) estimator is neither unbiased nor consistent. Thus other methods are sometimes employed to estimate parameters. TSLS (two stage least squares), LIML (limited information maximum likelihood), 3SLS (three stage least squares) and FIML (full information maximum likelihood) are representative. In TSLS and LIML, each equation is estimated separately. In 3SLS and FIML, all equations in the system are estimated simultaneously (Hamilton, 1994).

In addition to the research listed in the first section of the paper, several other examples within this model category are mentioning. Montes and Candelo (1983) utilize a monetary theory framework to analyze balance of payments performance in Colombia. Given the many different components, categories, and global influences affecting international trade and financial flows, the systems of equations model and estimator utilized in that paper yields interesting insights to changes that periodically surface in international reserves positions. Vaez-Zadeh (1989) uncovers similar results for Venezuela and relates them to fixed investment behavior. In more recent work, Torres (1991) models the supply side value-added categories for Colombian gross domestic product in a simultaneous equations framework. That study represents one of the early efforts to forecast Latin American output in a disaggregated format, something Vial (1988) and Haque, Lahiri and Montiel
had indicated as a necessary step in order to bring macroeconometric analysis in the region up to par with research developments in industrialized economies.

Many of the controversial issues arising from the liquidity crisis and the balance of payment imbalances of the 1980s can also be analyzed within a structural equation context, even when they involve multiple countries. Secondary market trades involving sovereign debt certificates became widespread following the outbreak of the international debt crisis in 1982. Fullerton (1993d) employs a three-stage least squares modeling strategy to study the predictability of short-run movements in secondary market debt prices in Colombia, Ecuador, and Venezuela. Selection of the estimator was motivated by the opportunity to take advantage of the information content in cross-country contemporaneously correlated individual equation residual strings. Doing so, improved the parameter estimation results. The simulation tests also met with some success and additional experimentation with alternative estimators and larger sample sizes is recommended.

This simultaneous equation system approach has been the mainstream in econometric tradition and therefore has been criticized from various points of view. A widely-cited basic criticism is offered by Sims (1980) who pointed out that structural econometric models sometimes contain too many restrictions. In economics, it is usual that there exist some competing theories to explain a fact. Traditional econometric research has a tendency to regard an economic theory as the most important source for hypothetical model specifications and think little of the information that actual data contain. The distinction between exogenous
variables and endogenous ones, or the selection of the variables on
the right-hand side of equations is in harmony with a particular
economic theory. In simultaneous equation systems, such pre-
exclusion of some variables is inevitably necessary for the identi-
fication of the system. But it may seem "arbitrary" to those who
do not support that theory and there may be a risk of distorting
the information that actual data contain. These models may
sometimes include even ad hoc specified equations that seem
inconsistent with existing theory.

Critics propose another method to treat each variable symmetri-
cally as a natural extension of transfer function analysis. This is the
VAR approach described below.

**Vector Autoregression Equation Systems**

It is sometimes argued that structural systems of equations are
inadequate vehicles for modeling any given economy or market.
Economic theory, it is rightly claimed, will provide only a partial
explanation of what takes place at any point in time. It is
further stated that no economic variable can truly be regarded
as completely exogenous. Consequently, all variables in any model
should be regarded as functions of previous lags of themselves and
all other variables (see Hamilton, 1994). Implementation of this
severe interpretation of economic modeling gives rise to a series
of identically specified vector autoregressive (VAR) equations.

Further expansion of the theoretical inflation model that has
been developed in earlier sections of this article yields the basic form
of a VAR model:

\[ P_t = \alpha_0 + \alpha_t P_{t-1} + \alpha_j M_{t-1} + \alpha_k X_{t-k} + \epsilon_t \]
9. \( M_t = b_0 + b_i \* P_{t-i} + b_j \* M_{t-j} + b_k \* X_{t-k} + W_t \)

10. \( X_t = c_0 + c_i \* P_{t-i} + c_j \* M_{t-j} + c_k \* X_{t-k} + Z_t \)

wherein each of the dependent variables are specified as functions of their own lagged observations and those of each other.

Note that the right-hand sides of equation 8, 9 and 10 contain only predetermined variables and the error terms are assumed to be serially uncorrelated with constant variance. Therefore, each equation can be estimated using OLS. When the errors are correlated across equations, the well-known seemingly unrelated regressions (SUR) method is employed (Hamilton, 1994).

Following their adaptation from the impulse class of multi-equation ARMA models in the early 1980s, VAR models have become very popular for studying dynamic reactions to changes in regional economic and/or macroeconomic business conditions (Demirden and Pastine, 1995). They require, however, large numbers of sample observations because estimating so many regression parameters causes an inordinate number of degrees of freedom to be lost. In fact, the profligate loss of degrees of freedom imposed by this modeling approach has led to some to criticize it in a fairly strenuous manner (Lütkepohl, 1990). This aspect of the VAR technique, a sharp departure from the principle of parsimony that guides traditional time series statistics and econometrics, represents an especially heavy burden for Latin American data sets that generally contain relatively few observations. Because of this shortcoming, Latin American VARs, including the Bayesian variety wherein (0,1) priors are set in advance of coefficient estimation, are likely to contain only a handful of equations at most for the foreseeable future.
Moreover, the number of parameters increases with the square of the number of variables, therefore selection (pre–exclusion) of variables may be a serious problem in VAR models. Exclusion of the important variables may change estimation result. VAR models can thus be just as dependent on some economic theories as are traditional simultaneous equation systems.

Another criticism of VAR analysis is its complete lack of structure (Runkle, 1987). Given the perhaps excessive simplicity embodied in most mathematical economic models, VAR practitioners view its unstructured specification as a prime virtue of the approach. Others point out, however, that otherwise useful insights to the behavior of the variables in question are masked by the over-abundance of lagged coefficient estimates. In spite of these short-comings, small–scale VAR modeling and policy analysis have been applied on a variety of occasions to the arena of Latin American macroeconometrics.

Leiderman (1984) utilizes vector autoregressions to analyze inflation in Colombia and Mexico. In the case of Colombia, the results indicate that variations in the rate of change of M1 systematically affect the CPI, but not the converse. From a policy perspective, this implies that Colombian monetary authorities do not engage in “accommodative” measures in response to production and inflationary shocks, a result later confirmed by Fullerton (1993a). Not surprisingly, this observation regarding Colombian monetary policy actions was not found to hold for the higher inflationary economy that existed in Mexico during the waning days of its inward-looking development strategies.

Arellano and González (1993) examine inflationary dynamics
under the heterodox nominal anchor exchange rate policy during the initial phase of the export diversification, market-oriented reform period of the Salinas administration in Mexico. Separately, Kamas (1995) analyzes Colombian inflationary dynamics under the “crawling peg” exchange rate era in that economy. The latter paper uncovers empirical support for several, but not all, of the conclusions reached in Leiderman (1984) and Fullerton (1993a). It also provides evidence that Colombian inflation contains a substantial inertial component, and will be difficult to lower below its recent historical range of 20 to 23 percent per year.

**Conclusion**

There has been a rapid acceleration in macroeconometric research taking place in Latin America in recent years. Much of this applications-oriented investigation followed the aftermath of the international debt crisis and the ensuing market-oriented structural reform measures that governments throughout the region adopted. With the debt crisis, it became necessary to understand seemingly out-of-control inflationary processes as well as year-to-year balance of payment variations and external obligations performances. Market-oriented reforms reduced the role of government planning agencies in the economy, increasing the need for systematic analysis of general macroeconomic trends such as that which has occurred on a continual basis in industrial economies since the pioneering work of Tinbergen in the 1930s.

While a large volume of insightful research has already been completed, much work remains to be done. Two slightly separate strands of empirical analysis are likely to emerge in future years
as a reflection of the current state-of-the-art. It is still necessary in many Latin American economies to engage in basic hypothesis testing that examines the applicability of standard modeling techniques and macroeconomic constructs that have proven useful in advanced northern hemisphere countries. This class of investigation will prove especially helpful in the context of the steadily growing fields of fiscal, monetary, and financial market policy analysis.

The second category of empirical analysis will probably emerge just as quickly as the former. In large measure, Latin American researchers enjoy access to data sets of sufficient quality to permit the testing and potential adoption of nearly all newly developed econometric methodologies. Given this, it will not be uncommon to find theoretical advances being spurred onward by results associated with southern hemispheric modeling questions. Obviously, this symbiotic relationship between theory and application has been in existence in a limited form for many years. The rapid expansion of financial markets and data information systems will serve to expand the scale of this relationship in Latin America to one that resembles what already exists in Europe, Japan, and North America.

No matter what actually transpires in Latin American macroeconometric modeling and research in the future, it will probably take place within the context of serious policy and planning analytic questions. As such, research for this important area of the global economy will be scrutinized and supported to a much greater extent than was previously the case. Given this, it is undeniably an exciting and fulfilling time to be involved in this line of research and analysis. It is also very possible that what is currently
taking place in Latin American macroeconometrics is a precursor to what will also occur in Africa, the Middle East, and major parts of Southern Asia, where market-oriented economic reforms are only now beginning to be introduced.

References


New Directions in Latin American Macroeconometrics


**Acknowledgements**

Partial funding support for Fullerton was provided by the University Research Institute at the University of Texas at El Paso and by the Center for the Study of Western Hemispheric Trade at the University of Texas at El Paso.

(Received December 5, 1996)