Review of Income and Wealth
Series 41, Number 1, March 1995

PUSHING THE SISYPHEAN BOULDER? MACROECONOMETRIC TESTING IN LATIN AMERICAN COUNTRIES

BY HUGO MENA

Instituto Tecnologico Autonomo de Mexico (ITAM)

What are the implications of the historically observed economic policy instability in Latin American countries (LACs) for macroeconometric testing? Two pressing restrictions on the econometrician using time-series of LACs arise: time-varying parameters and time-varying specifications. Such an instability also has profound impacts on time-series measurements of national accounts at constant prices. This, together with the "second best methodology" used in LACs for computing real GNP, implies that LACs figures on GNP growth reflect growth in gross production rather than in value added. LACs time-series for private consumption are unreliable. Crucial data set constraints in LACs further complicate the task for the econometrician.

INTRODUCTION

Without attempting explanation, this paper exploits the historically observed nexus in LACs between political instability, economic policy instability, and structural instability in the economic system. It asks: what are the implications of the observed nexus for the specific procedures used in macroeconometric testing in these countries? This issue represents the core of the first section of the paper. Section II further exploits the nexus between political instability, economic policy instability, and structural instability in the economic system, by considering its implications for time series *measurements* of aggregate economic variables in LACs. Specifically, it attempts to answer the following two questions: (1) How can we visualize the extent of structural instability in the economic system using available empirical information for LACs? (2) How does it compare with what is observed in a developed country, e.g. the U.S.? The answers to these questions are obtained by contrasting annual rates of change in national accounts time series under different base periods. Official available statistics for output, private consumption and investment are examined for three LACs (Chile, Argentina, Uruguay) and the U.S.

Note: This paper is in some sense built on my previous professional experience of several years at the Central Bank of Chile, where I acquired a string of debts to various colleagues. Julio Acevedo an Antonio Escandon—Chilean experts on National Accounts—deserve explicit acknowledgement. Marcelo Ortuzar (from United Nations—ECLA) was particularly helpful in providing me with information concerning national accounts from several Latin American countries, an in sharing some of his close to 15 years of expertise on the subject. I acknowledge the sponsorship of Tulane University's Center for Latin American Studies, which funded a two-month stay in Chile under a Mellon Foundation Summer Research Grant. I also acknowledge useful comments from two anonymous referees. Of course, the content of this paper is solely my own responsibility.

Section III describes some crucial aggregate data set constraints (length of time series, frequency of surveys, required scope of economic indicators) encountered in LACs. The implied limitations on macroeconometric testing in LACs are stressed. Section IV presents some concluding remarks.

This essay should be of special interest to development economists and econometricians engaged in research on the aggregate behavior of less developed countries, "small-open-economies" and, particularly, Latin American countries.

I. Recurrent Policy Regime Switches and Structural Instability

This first section exploits the tight relationship between *political changes* and *economic policy changes* historically observed in Latin American countries. The nature of such alterations in economic policy has important implications for econometric testing of macroeconomic models or aggregate behavioral functions using time series data from these countries.

A. *Political Instability and Economic Policy Instability*

The following observation, while referring specifically to the 1930s and 1940s, is adequately representative of the political environment in most of Latin America up to the 1980s:

> ... "Latin American had become increasingly a conflict society in which the old norms and institutions were being questioned while the various newer groups were badly divided as to what future directions their country should take. A democratic government might come to power briefly, only to be followed by a new military regime, or else populist politicians would instigate a needed reform program only to be replaced by a conservative-oligarchic government".
>
> ... The conflicts were often so deep, the gaps among the contending groups and classes so vast, the bitterness so intense that no government—left, right, or center—could come to power, govern effectively, and hope to survive for long."
>
> *The Acceleration of Modernization, 1930 to the Present*,
> in Wiarda and Kline (1985), pages 40–41.

The historical alternation of power between specific political groups (governments) in these countries has translated into a sequence of drastic and profound changes in economic policy. In turn, these changes have constantly modified the structure of the economic system, the specific opportunities and constraints faced by different economic agents. To provide a better understanding of the nature of these recurrent changes in economic policy, it may prove useful to illustrate them with some examples. Although each example may not be applicable at all times for all LACs, it is true that many of these changes do take place in most LACs as power alternates between political groups, whether by election or by coup.

Several policy issues (some interrelated) are typically decided every time these countries switch political regimes. Among them are:

(a) government policy on the expropriation of private sector property;
(b) income (wealth) redistribution policies;

(c) degree of direct government involvement in productive and financial activities, and its potential as a competitor to private business;
(d) market vs. government determination (or regulation) of prices for various classes of commodities;
(e) economic activities, if any, which are going to be subsidized by the government;
(f) market vs. government determination (or regulation) of private sector wages, and the public sector wage indexation pattern;
(g) types and rates of direct and indirect taxes imposed on the private sector;
(h) the rates and uniformity of tariffs on imports and other commercial policy considerations;
(i) market vs. government determination (or regulation) of interest rates;
(j) whether private financial intermediaries will be free to allocate their loans, or be restricted by the government in order to "prioritize" some specific economic activities decided by policy-makers;
(k) the policy goals of monetary and fiscal authorities, the policy instruments used to achieve them, and the specific exchange rate policy to be followed;
(l) the extent and types of government restriction on private foreign borrowing;
(m) government regulation of international trade in real assets (foreign investment).

From an econometric standpoint this scenario implies that the behavior of time-series in these countries can be characterized as incorporating *recurrent policy regime switches*.[1] Typically, many of these policy changes in LACs take place by a sequence of decisions following no pre-announced pattern. Hence, they become known to economic agents only gradually, and then perhaps largely as higher variance of "noise." Furthermore, in such a "noisy policy environment," it becomes highly unlikely that private agents within LACs regard every single policy shift as a permanent, "once-and-for-all" change.

Why is this important for econometric testing? My argument rests heavily on Robert E. Lucas' article on "econometric policy evaluation" (1981). Quoting from Lucas' "concluding remarks:"

> . . . "given that the structure of an econometric model consists of optimal decision rules of economic agents, and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision maker, it follows that any change in policy will systematically alter the structure of econometric models. For the question of the short-term forecasting, or tracking ability of econometric models, we have seen that this conclusion is of only occasional significance. For issues involving policy evaluation, in contrast, it is fundamental; for it implies that comparisons of the effects of alternative policy rules using current macro-econometric models are invalid regardless of the performance of these models over the sample period or in *ex ante* short-term forecasting."

[1]It should become clear from such a list that the economic implications of a political regime switch within a LAC, are of an entirely different nature than, for example, the ones associated with a change of administration in the U.S. government, between Republicans and Democrats.

B. *Implications for Macroeconometric Testing in LACs*

Recurrent policy regime switches in LACs will typically impose two different problems on the econometrician. First, the typical "structural change" situation in econometrics, which involves nonconstancy of the *parameters* in regression and time series models. This calls for varying-parameter econometric models. However, that is not enough for LACs. These policy regime switches will in general modify the specifications of econometric models. Thus, second, in these countries "structural change" also involves nonconstancy of the *explanatory variables* in the econometric models. This calls for what I henceforth refer to as "time-varying econometric models."

The meaning of "structural instability" in this context is, therefore, twofold. Specifically, consider an econometrician representing a given behavioral relationship for private individuals in a LAC, by the following classical linear regression model:

$Y = X\beta + \mu$; where Y is a $(n \times 1)$ vector of dependent variables, X is a $(n \times k)$ matrix of explanatory variables, β is a $(k \times 1)$ vector of coefficients, and μ is a vector of random disturbances of dimension $(n \times 1)$. From an econometric standpoint, "structural instability" appears whenever *any* of the following two conditions hold:

(i) the vector of coefficients, β, is not time-invariant ("parameter instability");

(ii) the matrix of explanatory variables, X, is not time-invariant ("specification instability").

Changes in economic policy of the types stressed in the well-known Lucas' article (1981) relate to the first condition. Thus, as $\beta = F(\theta)$, "the behavioral parameters β vary systematically with the parameters θ governing economic policy."[2] As a corollary, whenever the economic system is subject to changes in economic policy, the econometrician must use varying-parameter econometric models for estimation and macroeconometric testing purposes. However, changes in economic policy may be so drastic that they also alter the relevant *specification* of behavioral functions.[3] This relates to the second condition for structural instability stated above. In this latter case, $X = G(\theta^*)$, where θ^* is a vector of policy regimes.[4] This implies that, whereas for some specific time interval, the behavior of Y can be represented by $Y = Z\alpha + \varepsilon$, for some other time interval—during which a different policy regime is in place—the relevant specification is, say, $Y = W\gamma + v$, where W includes a set of explanatory variables which differs from the one contemplated in matrix Z. In fact, each policy regime θ^* involves a different matrix of explanatory variables. This phenomenon is frequently the case in LACs, and call for using what I referred to as "time-varying econometric models" for estimation and macroeconometric testing purposes. I next further illustrate these issues, with the aid of some examples.

[2]Adapted from Lucas, R., *op. cit.*, page 125.

[3]These are the types of economic policy changes which I refer to as "policy regime switches." Further explanations and examples are provided next.

[4]Of course, within a *given* policy regime $\theta^* = \theta_0^*$, Lucas' argument still applies: $\beta = F(\theta)$.

(i) Time-varying econometric models

The econometrician will need to specify (estimate) *different* models every time an economic policy regime switch occurs. This will happen every time a new political group gains power, and/or each time a new economic policy (such as a development program or stabilization program) is instituted by the government.[5] The need to specify different models will spring from two sources. The first is when an aggregate variable in one policy regime is a market-determined economic variable, whereas in a subsequent regime it is either a constant fixed by the government, or a variable that evolves according to a predetermined rule enforced by the government. Examples of these variables in LACs are interest rates, wages, commodity prices, and the exchange rate.[6] A second source arises when an explanatory variable in an econometric model is no longer relevant to a given private decision because the economic policy regime switch implies different opportunity sets for private agents. For example, interest rates and "permanent income" may become irrelevant for private consumption (saving) decisions, if some newly-installed government passes laws forbidding consumer loans and discretionally decides the allocation of bank credit. Similarly, world prices of importables may become irrelevant for private consumption/production decisions if import quotas or prohibitively high tariffs are imposed by a new government. Alterations in foreign interest rates may become irrelevant to some private decisions if international private capital mobility is heavily restricted or simply forbidden by policy-makers. Of course, the opposite will be true when these private opportunities are later changed by other policy-makers.

The econometrician using LAC time series must therefore divide the sample into different sub-samples or partitions, one for each policy regime. He must then specify and estimate *different* econometric models for each partition of the sample. This procedure may yield few observations for each econometric model, thereby so reducing the degrees of freedom as to risk the viability of obtaining reliable parameter estimates.

Economic policy instability produces instability in the set of relevant explanatory variables for aggregate private behavior in these countries. Partitioning the data is necessary to formulate a "time-invariant specification" of any given macro-econometric model in a LAC. By a "time-invariant specification," we mean one in which the relevant explanatory variables of the model are *the same* throughout the sample period. However this, although necessary, is not sufficient.

[5]There can also be economic policy regime switches *within* the time interval of a given government. This complicates the definition of a policy regime in LACs. Examples are the military dictatorships that emerged in the 1970s in the Southern Cone of Latin America. For a description of the different economic policies involved, see Ramos (1986). Another exception is Mexico. In this country economic policy regime switches occur *in spite* of maintaining the same political group (PRI) in power.

[6]Allow me to illustrate this with an anecdote, which only serves as an example. Once I had to referee a paper in which the author attempted to determine (using sophisticated time-series econometrics techniques) whether the observed behavior of the exchange rate in a LAC had conformed to "purchasing power parity" (PPP). The PPP hypothesis was accepted. However, the author was apparently unaware that, precisely in the period analyzed, policy-makers constantly adjusted the exchange rate in response to discrepancies between domestic and foreign inflation rates. Hence, the author was indeed testing a tautology!

(ii) Varying-parameter econometric models

If there is (unknown) policy instability there must be policy uncertainty and agents optimizing inter-temporally must know this. Hence, one cannot merely partition the data, specify a different model for each policy regime, and assume that agents in each sub-period act as if the model was going to remain constant. Following Lucas (1981), within each partition of the sample the econometrician will need to explicitly consider policy variables as explanatory variables for the parameters of econometric models. Thus, one necessarily ends up with varying-parameter models, and any meaningful econometric estimation in LACs would have to be done within such a framework.[7]

However, two implementation problems occur when adopting this strategy. First, a significant share of policy-variable changes in LACs usually take the form of a sequence of policy decisions conforming to no pre-announced pattern, thereby making the identification of policy *rules* a rather difficult if not completely intractable task. This complicates the specification of a relationship between the behavioral parameters of the econometric models and those governing economic policy. Second, it is typical in macroeconomics that the estimation of behavioral functions and general equilibrium models requires a simultaneous equations framework. Estimating time-varying parameters within a simultaneous equations framework is particularly difficult.[8]

One crucial element emerges clearly from this discussion: the econometrian considering a LAC necessarily faces an additional hurdle over and above those typically encountered. He must become fully acquainted with the policy-regime switches and with the different economic policies implemented in the country (countries) considered during the entire period investigated. Such an historical investigation of economic policy represents a fundamental prerequisite for any meaningful specification and estimation of econometric models of the aggregate behavior of a LAC economy. In this sense, an important outcome of this discussion is that the specification of econometric models and the estimation procedures are not only problem-specific (as usually regarded) but also country-specific.[9] Without a country-specific, detailed knowledge of the economic policy evolution throughout the period investigated, and without incorporating such information into both the *specification and estimation procedures* of the econometric model, testing a given theoretical macro-model or proposition for a LAC is not meaningful.

II. Structural Instability and Data Interpretation

The interaction between political instability, economic policy instability and structural instability in the economic systems of LACs imposes some pressing

[7]For an exposition of these models, see, for example, Maddala (1977), Judge, Griffiths, *et al.* (1985), and Broemeling and Tsurumi (1987). For a thorough (and recent) bibliography on the econometrics of structural change, see Hackl and Westlund (1989).

[8]A good discussion of this latter issue appears in Kelejian (1974).

[9]As will be shown in the next section, a similar conclusion holds for interpreting some crucial aggregate economic data.

restrictions on the econometrician in terms of model-specification and estimation procedures. This section shows that such an interaction also has a profound impact on time series *measurements* of aggregate economic variables in LACs.

For a better interpretation of the empirical evidence to be presented in this section, however, it will prove useful to provide a specific explanation concerning the meaning of *base year* under the "extrapolation method." This is the basic method used by LACs national accounts for computing *real* output (GNP).[10]

A. *The Meaning of Base Year Under the Extrapolation Method*

Consider the following simple example. Suppose we focus on a given sector of the economy, the Industrial Sector (I). Suppose further that the sector is composed of only the following two activities:

(i) Food Industry (F),

(ii) Clothing Industry (C).

Suppose we have the figure for the production growth rate in F for a given year. This number represents the percentage change in *gross* output which—under the extrapolation method—is assumed to be *equal* to the growth rate in *real value added.* To obtain the overall growth rate of the Industrial Sector, the production growth rate in food is weighted by the share of food industry's value added in the industrial sector, VA_F/VA_I. This share can be decomposed as follows:

$$\text{(1)} \qquad \frac{VA_F}{VA_I} \equiv \left(\frac{VA_F}{GPV_F}\right)\left(\frac{GPV_F}{GPV_I}\right)\left(\frac{GPV_I}{VA_I}\right),$$

where VA stands for value added and GPV is gross production value.

The weights VA_F/VA_I are required for each year of each given time series. However, except for the base year—chosen as equal to the year for which an input–output table for the economy exists—no statistical information in LACs is available concerning the decomposition of each industry's gross production value into intermediate consumption and value added. Only information about *gross* production is available. Hence, the following assumptions for the food and clothing industries (in this case) are used:

$$\text{(2)} \qquad \left(\frac{VA_F}{GPV_F}\right)_{t_0} = k_F^0 = \left(\frac{VA_F}{GPV_F}\right)_{t_0+j} \qquad \forall j$$

$$\text{(3)} \qquad \left(\frac{VA_C}{GPV_C}\right)_{t_0} = k_C^0 = \left(\frac{VA_C}{GPV_C}\right)_{t_0+j} \qquad \forall j,$$

where t_0 stands for the national accounts "base year."

These "constants" for the food and clothing industries, k_F^0 and k_C^0, are computed using the information contained in the economy's input-output table.

[10]By contrast, the U.S. National Accounts use the "Double Deflation Method," which is—conceptually—the appropriate one. LACs cannot use such a methodology due to lack of adequate time-series on sectoral price indexes.

Given these assumptions, and since $VA_I \equiv VA_F + VA_C$, it follows that (1) can be expressed, for any year t_0+j, as:

$$(4) \qquad \frac{VA_F}{VA_I} = k_F^0 \left(\frac{GPV_F}{GPV_I}\right)\left(\frac{GPV_I}{k_F^0 GPV_F + k_C^0 GPV_C}\right).$$

Analogously, the contribution of the clothing industry to the industrial sector's growth rate is computed as:

$$(5) \qquad \frac{VA_C}{VA_I} = k_C^0 \left(\frac{GPV_C}{GPV_I}\right)\left(\frac{GPV_I}{k_F^0 GPV_F + k_C^0 GPV_C}\right).$$

Thus, the measured weights VA_i/VA_I capture two different structural elements of the economy:

(i) the cost structure of each individual activity (as summarized by the k_i ratios); and

(ii) the structure of gross production within the (industrial) sector.

For a *given* base year, the weights VA_i/VA_I can change through time *only* because of changes in the relative growth rates in gross outputs across individual activities: k_F and k_C are *constants* throughout.

For *different* base years, different aggregate growth rates for the same given period can be obtained. These will reflect the effect of *changes* in the k_F, k_C types of ratios, on the sectoral (industrial) growth rates and, consequently, on the overall growth rates measured for the aggregate economy.

Thus, the structural elements that are not held constant whenever the base year of national accounts is altered are the economy's *structural parameters*, k_i. In this sense, one can interpret the sensitivity of the measured overall growth rates to changes in the base year employed by national accounts as an indicator of the extent to which structural instability in LACs affects the *measurement* of growth in economic activity.[11]

We next provide a set of overlapping time series for growth in economic activity under different base years. These can be compared and their observed differences can be interpreted along the lines previously suggested. Some other information concerning aggregate economic variables will also be provided, as specified next.

B. *Structural Instability and Measurement of Aggregate Variables: Evidence*

The tables presented in this section display time series data from national accounts for three Latin American countries (Chile, Argentina, Uruguay) and for the U.S. In all of these tables, the annual percentage changes in aggregate output, private consumption, and investment are computed. These rates of change are

[11]Changes in base years of national accounts also involve changes in some non-structural elements, such as data sources, specific definitions of economic activities and sectoral classifications. In the specific case of the information for the three LACs considered here, however, these other elements are unimportant for this analysis, as they mostly affect the *composition* of GNP by sectors of economic activity, rather than the *level* of GNP.

based on the corresponding *official* annual figures (in real terms), and are computed for two different base years employed by each country's national accounts. The purpose of this presentation is to compare, for all of these macroeconomic aggregates, the corresponding annual rates of change across different base periods. Within each table, the observed "remarkable differences" across bases are emphasized with an asterisk (*) by the corresponding figures. These "remarkable differences" were defined by a quite conservative criterion: an annual rate of change for one base period that is *at least* twice as large as when computed for some other base period.[12]

Several elements about this type of statistical information merit comment. First, it must be said at the outset that it is very difficult to obtain overlapping time series of national accounts under different base periods for LACs. Thus, it is typical that, once the base period is changed, the "old" time series (based on the previous base period) are discontinued and the "new" time series are not extended backwards for a significant number of years. The three countries selected here (Chile, Argentina, and Uruguay) were chosen, to a great extent, because they are the only LACs that do not present these difficulties in obtaining such national accounts statistics. Moreover, the base years included in Tables I, II, and III for Chile, Argentina, and Uruguay represent either the *only* base periods that currently exist, or the only ones for which overlapping time series of national accounts are available. Furthermore, the length of the corresponding time series shown is the *maximum* that is obtainable.

This is not the case for the U.S., with corresponding data displayed in Table IV. In fact, currently there are *three* different base periods available for the U.S. national accounts (1958, 1972, and 1982). The base periods cited in this study (1958 vs. 1972) are chosen because the distance between these two base years is similar to that between the available base periods for the three LACs. The statistical information available for the U.S. also allows extension—backward and forward—of the different time series presented in Table IV. The main patterns displayed, however, are unaffected by considering extra years in the series included in Table IV.[13]

Additional limitations are encountered which further restrict the possibility of obtaining this type of information for other LACs. For example, in some LACs (Brazil, Colombia, Venezuela) not every national accounts' base period is built upon the structural parameters embedded in an actual input–output table of the economy. Rather, the procedure is to update some previously computed ("old") input–output table, using some *ad hoc* statistical method and based on incomplete information. This makes unclear whether the observed differences in output growth rates across base periods effectively reflect changes in the structure of the economy (input–output matrix) or merely the peculiarities of the specific statistical procedures used to estimate the true input–output matrix of the economy. In

[12]Such a "gentle" criterion is enough for current purposes. In fact—as Tables I, II and III will indicate—for all three LACs the majority of these observed remarkable differences across national accounts' base periods far exceeded such a lower bound.

[13]In terms of the observed asymmetries in annual rates of change across the two base years for the different aggregate variables shown.

some other countries, the available *overlapping* time series for different base periods are too short (Mexico, for example: only 4 observations can be obtained). Last but not least, one can find LACs whose basic system of national accounts is extremely frail. This is either because they lack adequate primary information for measuring a significant share of real sectoral GDPs (for example, Brazil: figures on production of *services* are based on very rough estimates); or because data on real GDP expenditures is either nonexistent/discontinued (Venezuela, Haiti, Barbados, Jamaica, Guyana) or incomplete (Brazil computes the *sum* of private consumption, government expenditure plus changes in business inventories, as a residual item). There are also cases in which even annual information on *nominal* sectoral GDPs is not available (Haiti, Guatemala).

TABLE I

CHILE (Annual Percentage Changes)

	GDP		Private Final Consumption Expenditure		Gross Domestic Investment	
	Base 1965	Base 1977	Base 1965	Base 1977	Base 1965	Base 1977
1961	6.0	4.8	6.7	5.7	14.7	13.4
1962	5.3	4.7	3.4	4.1	−2.7*	−7.6*
1963	4.4	6.3	4.4	4.2	13.0	19.8
1964**	4.9*	2.2*	5.6*	−0.6*	−4.7*	20.4*
1965	6.5*	0.8*	2.3*	−0.1*	12.8*	−2.3*
1966	9.9	11.2	10.6	11.3	5.8*	43.2*
1967	1.3*	3.2*	3.5	3.4	−9.0	−9.3
1968	3.5	3.6	3.2	3.8	7.6	8.7
1969	5.5	3.7	2.7*	5.3*	10.7	7.2
1970**	3.5	2.1	4.0*	−0.5*	3.9*	8.3*
1971	5.2*	9.0*	10.0	13.2	−3.3	−3.2
1972	−0.6	−1.2	5.9	7.7	−19.8	−27.7
1973**	−1.1*	−5.6*	−4.5	−6.6	−0.2*	−10.9*
1974	4.2*	1.0*	−1.2*	−18.3*	13.5*	81.5*
1975	−16.6	−12.9	−9.7	−11.4	−46.0	−52.6
1976	5.0	3.5	−2.7*	0.3*	−8.2*	0.2*
1977	11.8	9.9	15.8	16.3	18.2	15.4
1978	6.0	8.2	6.3	8.9	23.6	17.4

Source: Based on official data appearing in:
(1) National Accounts of Chile, ODEPLAN (several issues)
(2) National Accounts of Chile, Central Bank of Chile (several issues).
*Remarkable differences across bases.
**Years in which a change in government (political regime) took place.

Tables I–IV present these time series data from national accounts for Chile, Argentina, Uruguay, and the U.S. The first two columns of these four tables show the annual growth rates of the economy, computed under two different base years. The observed differences in annual growth rates can be interpreted along the lines previously suggested. Thus, for LACs, these differences basically reflect the impact of changes in the economy's input-output matrix (sectoral VA/GPV ratios) on the measurement of economic growth. For the U.S. economy, the observed differences in growth rates for any given year reflect the impact of the changes in the corresponding price indexes (basket of goods and services and specific weights attached to them) on the measurement of economic growth. In both cases—LACs

TABLE II

ARGENTINA (Annual Percentage Changes)

	GDP		Private Final Consumption Expenditure		Gross Domestic Investment	
	Base 1950	Base 1960	Base 1950	Base 1960	Base 1950	Base 1960
1951	3.1	3.9	3.2	2.1	17.8*	47.5*
1952	−6.6	−5.0	−7.2*	−4.1*	−9.3	−15.1
1953	5.5	5.3	8.3*	−1.5*	−19.8*	7.2*
1954	3.3	4.1	−0.1*	9.1*	19.9*	−5.2*
1955**	5.3	7.1	9.2	10.0	6.5*	12.2*
1956	−0.2*	2.8*	−0.7	0.7	−6.5	−5.8
1957	4.7	5.2	2.0*	5.6*	21.9	12.5
1958**	2.7*	6.1*	4.3	6.2	−0.6*	9.6*
1959	−5.2	−6.5	−5.5	−8.5	−15.1	−11.3
1960	4.2*	7.9*	1.2	2.0	25.8*	47.3*
1961	5.7	7.1	9.8	11.1	3.8*	9.6*
1962**	−4.0*	−1.6*	−10.9*	−4.4*	−3.8*	−8.0*

Source: Based on official data appearing in:
(1) National Accounts of Argentina, Central Bank of Argentina (several issues)
(2) National Accounts of Argentina, Statistics and Projections Division, Economic Commission for Latin America, UN, Santiago, Chile.
*Remarkable differences across bases.
**Years in which a change in government (political regime) took place.

TABLE III

URUGUAY (Annual Percentage Changes)

	GDP		Private Final Consumption Expenditure		Gross Domestic Investment	
	Base 1961	Base 1978	Base 1961	Base 1978	Base 1961	Base 1978
1971	−1.0*	0.2*	1.1	0.7	11.5*	6.1*
1972**	−3.6*	−1.5*	−0.4	0.7	−16.3	−16.1
1973	0.8	0.4	0.2	0.5	−3.6	−5.0
1974	3.1	3.0	−1.8	−1.8	−5.0*	3.9*
1975	4.4	5.9	−0.8*	3.5*	28.2	26.9
1976	2.6*	4.0*	−8.4*	−2.3*	20.8	21.0
1977	3.4*	1.1*	3.4*	−0.4*	13.5	17.2
1978	3.9	5.3	3.6	3.4	−0.2*	14.2*
1979	8.4	6.2	n.a.	5.4	31.6	23.9

Source: Based on official data appearing in:
(1) National Accounts of Uruguay, Central Bank of Uruguay (several issues)
(2) National Accounts of Uruguay, Statistics and Projections Division, Economic Commission for Latin America, UN, Santiago, Chile.
*Remarkable differences across bases.
**Years in which a change in government (political regime) took place.
n.a. = not available (national accounts computed the *sum* of private and government consumption as a residual item for this year).

and the U.S.—the observed differences across base years in measured growth rates can be thought of as a manifestation of changes in structural parameters of the economy. The specific structural parameters are distinct of course, given the different underlying methods used to compute output in real terms.

TABLE IV

UNITED STATES (Annual Percentage Changes)

	GNP		Private Final Consumption Expenditure		Gross Private Domestic Investment	
	Base 1958	Base 1972	Base 1958	Base 1972	Base 1958	Base 1972
1950	9.6	8.7	6.5	5.7	44.4	42.8
1951	7.9	8.1	1.0	1.2	1.0	0.4
1952	3.1	3.8	2.8	2.5	−13.6	−11.6
1953	4.5	3.9	4.8	3.8	1.2*	2.9*
1954	−1.4	−1.3	2.0	1.8	−2.9	−2.6
1955	7.6	6.7	7.2	6.5	26.9	24.8
1956	1.8	2.1	2.6	2.8	−1.5	−1.2
1957	1.4	1.8	2.4	2.1	−7.4	−5.5
1958	−1.1*	−0.2*	0.7	1.0	−11.5	−9.8
1959	6.4	6.0	5.9	5.4	20.9	22.5
1960	2.5	2.3	2.9	2.6	−1.6	−1.9
1961	1.9	2.5	2.0	2.0	−4.7*	−1.7*
1962	6.6	5.8	4.9	4.5	15.1	13.3
1963	4.0	4.0	4.4	3.8	3.9*	6.0*
1964	5.5	5.3	5.8	5.4	6.4	6.1
1965	6.3	5.9	6.4	5.6	13.0	13.6
1966	6.5	6.0	5.1	5.0	10.2	7.5
1967	2.6	2.7	2.9	2.9	−7.4	−5.3
1968	4.7	4.4	5.3	5.0	4.0	4.5
1969	2.7	2.6	3.6	3.5	5.0	5.3
1970	−0.4	−0.3	1.8	2.1	−6.4	−7.9
1971	3.2	3.0	3.9	3.4	6.7	7.8
1972	6.1	5.7	6.1	5.9	11.4	12.9

Source: Based on official data appearing in *Economic Report of the President*, United States Government Printing Office, Washington D.C.
(1) February 1974 Issue, Tables C-2 and C-5 (for base year = 1958).
(2) January 1980 Issue, Tables B-2 and B-5 (for base year = 1972).
*Remarkable differences across bases.

The other columns of these tables also present empirical evidence that sheds light on the issue of "structural instability" and its impact on the measurement of aggregate variables in LACs. The third and fourth columns of these tables present the annual rates of change for real private consumption, computed for these same two base periods. Given that consumption is computed residually in LACs, it is difficult to provide a precise interpretation (in terms of specific structural parameters) for the observed differences in annual rates of change in private consumption across base years. A mixture of elements (measurement errors, structural instability) will typically be involved. For the U.S. economy, figures on real private consumption are calculated by deflating current values (directly computed) by adequate price indexes.[15] Hence, changes in the base year basically reflect changes in the base of the price indexes.

Finally, the last two columns of these four tables show the annual rates of change in investment (gross fixed capital formation plus changes in business

[15]Components of the consumer price and wholesale price indexes and indexes of prices paid by farmers are used in the U.S. national accounts.

inventories).[16] For the three LACs, figures include both private and public investment, whereas for the U.S. economy private investment is recorded.[17] In all four countries considered, figures on current investment are directly obtained from primary statistical sources. Figures at constant prices are computed in the U.S. through price deflation, both for the different components of gross fixed capital formation and for changes in business inventories.[18] In the LACs considered here, a share of real investment is obtained through deflation of nominal figures and the other share through extrapolation via quantum indexes applied to the corresponding base-year figures.[19]

Several empirical findings from this section deserve emphasis. The empirical evidence indicates that the magnitude of this problem for LACs—namely, share of observations within these time series that present remarkable differences across

TABLE V

SUMMARIZED PICTURE OF TABLES I–IV

	Chile	Argentina	Uruguay	U.S.
Total Cases of Remarkable Differences Across Bases	20	17	10	4
Total number of Observations [# of years × # of variables (3)]	54	36	27	69
Total Cases of Rem. Diff. / Total Number of Observations	37%	47%	37%	6%
Remarkable Cases Involving Different Signs in Rates of Change	7	6	5	None

bases—is far more serious than for the U.S. economy. Table V briefly summarizes the main results in Tables I–IV and aids comparison of the situation observed in any of these LACs with the corresponding one for the U.S.

For the three LACs considered—and for all three macro variables examined—it is evident that changing the base year of national accounts makes a huge difference. In many cases, entirely different stories about the aggregate behavior of these economies could be told, depending on the national accounts base year that is considered!

An econometrician will typically be forced to choose one of the (two) base-periods available in LACs' national accounts. This will happen either if "some relatively longer" time series are required, or if information related to some other periods (different than the ones displayed in these tables) is needed. How can we know whether the base period thus "chosen" by the econometrician is the one

[16]Due to lack of data for the corresponding time series in Table I under base year 1965, investment figures for 1977 and 1978 *exclude* changes in business inventories. For those years Chilean national accounts computed *both* private consumption and changes in stocks as a residual item. For current comparison purposes, the same procedure was followed here for the corresponding figures under base year 1977.

[17]Typically, *private* investment is the most frequently used investment variable in macro-models whenever physical capital accumulation is considered. Unfortunately, the decomposition of these investment time series, between its private and public components, is not available for these LACs.

[18]Except for some farm-stocks, in which extrapolation through relevant quantum indexes is made. For more details about the U.S. National Accounts, see "National Accounting Practices in Seventy Countries" (1979), UN, pp. 159–171.

[19]For further details, see "The Current State of the National Accounts in Latin America and the Caribbean," UN-ECLA (1989).

relevant to the particular purpose at hand? If some other (currently nonexistent) base periods for national accounts were available, what would these same time series look like? How much would they differ from the available ones? Which one would better represent the "true" aggregate behavior of the economy over time? Given the recurrent policy regime switches in LACs, is there any stable "base" (i.e. period over a significant time span) at all in these countries?

Finally, and most importantly, the evidence presented by Tables I–III indicates that profound and recurrent structural changes occur in LACs, and that such structural instability severely distorts the measurement of the rates of change in output, consumption, and investment.[20] As the reader can verify in Tables I through III, the majority (though not all) of the most remarkable breakdowns in these time series occur in years in which there is a change in government (political regime).

III. Nature of Aggregate Data Set Constraints

This last section briefly identifies other data set constraints relevant to macroeconometric testing in LACs, over and above those suggested in the previous section. While the data in this section is mostly drawn from Chile, these constraints may be encountered in other LACs, as well. In fact, since the Chilean economy's statistical system appears to be among the best developed among LACs, the types and extent of the data limitations present for the Chilean economy can be regarded as representing downward biased estimates of the "average" data sets' constraints usually encountered within LACs. In this sense, our example will be a quite "conservative" one.

We will focus on statistics related to aggregate variables from the economy's *real* sector. The measurement of financial or monetary variables generally presents fewer statistical problems within LACs. For the purposes of macroeconometric testing, however, it is quite rare to estimate models containing only monetary variables. Rather, the more common situation is one in which monetary behavioral equations contain both monetary and real variables. We will concentrate here on two types of statistical information regarding aggregate economic variables: (1) national accounts' statistics; and (2) data on aggregate employment. Clearly, the scope of variables included among those is quite significant for most imaginable macroeconomic models, aggregate economic relationships, or structural equations.

A. *National Accounts Statistics*

Let us first focus on the available annual statistics on the Chilean economy's gross domestic product (GDP).

[20]It is important to emphasize that the essential element that triggers these time series breakdowns is not the measurement methodology *per se*, but the presence of a huge structural instability in the economic system. The same breakdowns could show up if LACs were to use the double-deflation (rather than the extrapolation) method to compute GNP at constant prices.

Historical Length of the Time Series

The first National Accounts statistics in Chile appear in 1940. Unfortunately, there is a time-series statistical (measurement) break at 1960, which makes the 1940–59 GDP series non-comparable with the one beginning in 1960. This break in the time series is due to the following.

a.1. The bulk of the primary statistical surveys employed for the preparation of national accounts statistics during the 1940–59 period covers only Santiago, the capital city. Such primary statistical information was simply extrapolated to the whole country with minor adjustments.[21] The currently available national accounts' series beginning from 1960 are not constructed in this way.

a.2. Today's national accounts are based on the latest standards provided by the United Nations' national accounting office, but the pre-1960 series is not.

a.3. Today's national accounts make use of the information contained in input–output matrixes to check for some basic aggregate consistency of individual sectoral data. This procedure leads to (sometimes significant) revisions of preliminary calculations in the national accounts. The series for the 1940–59 period do not aggregate consistency of sectoral data, since no input–output matrix was computed before the 1960s.

These three elements thus imply that the longest *annual* time series that satisfies minimum standards regarding homogeneous statistical coverage and measurement methodologies is the one beginning from 1960.

Frequency of Surveys: Quarterly National Accounts Series

Quarterly figures for both total GDP and its distribution among different sectors of economic activity have been computed in Chile only since 1980. Prior to that year, *official* quarterly figures on national accounts simply do not exist.[22]

The quarterly figures published since 1980 do not cover information for GDP expenditure items, except for the period 1980–83. However, even within this subperiod, only a few components of aggregate demand are measured quarterly. Specifically, quarterly GDP expenditure figures on private consumption, government consumption, investment and inventory changes simply do not exist.

Finally, the overall accuracy of the official *quarterly* GDP figures is not comparable to the accuracy of the *annual* national accounts. This is because the amount of relevant primary statistical information available on a quarterly basis is significantly less than that available on a yearly basis. Consequently, the types of aggregate consistency checks used for annual GDP calculations are not done for the quarterly estimates of GDP.

B. *Aggregate Employment Data*

The other time series we will consider is employment. The longest time series available for the Chilean economy's *aggregate* employment data starts in 1966.

[21]For further details, see Mamalakis (1978).

[22]Of course, there is always the possibility of estimating quarterly figures using *ad hoc* statistical procedures. These quarterly "estimates," however, may clearly represent a quite imperfect substitute for actual quarterly figures.

The following chart summarizes some basic general features of these employment statistics. Clearly, the time series on aggregate employment data is rather short; moreover, it suffers from a two-year hiatus and lack of homogeneity with respect to (a) the frequency of surveys, (b) the specific months from which sample observations are taken, and (c) the sample sizes themselves.

GENERAL FEATURES OF CHILEAN AGGREGATE EMPLOYMENT STATISTICS

Periods	Number of Observations Per Year	Specific Months to Which Observations are Referred	Sample Size (number of families surveyed)
1966	1	July–December	10,000
1967	1	March–June	10,000
1968	1	March–June	10,000
1969	1	July–December	10,000
1970	1	September–December	10,000
1971	1	July–December	10,000
1972	1	January–June	10,000
1973		No Available Data	–
1974		No Available Data	–
1975	1	July–December	28,000
1976–80	1	October–December	28,000
1981	2	April–Jun; Oct–Dec	28,000
1982	1	October–November	28,000
		Moving Averages	
1983	8	May-July through December-February	28,000
		Moving Averages	
1984	12	Jan–March through December–February	28,000
1985	12	ibid	28,000*
1986–89	12	ibid	36,000*

Source: *National Employment Statistics* (various issues), Instituto Nacional de Estadisticas (National Bureau of Statistics), Santiago, Chile.
*Beginning November 1985 the sample size is 36,000.

C. *Data Set Constraints and Structural Instability*

LACs political and economic policy instability and their profound effects on the structure of these economies, have two other important implications for macroeconometric research. First, there is a presumption of significant biases in some widely used national accounts time series, and the direction of these biases seems very difficult to determine. Second, there is the need for a specific disaggregation of some widely used macroeconomic time series, which is generally not available in LACs. I briefly address these two issues.

The sectoral *VA/GPV* ratios are vital inputs in the implementation of the "extrapolation method" used in LACs to compute real GDP. These ratios are computed from the economy's input–output matrix. Since input–output tables are calculated infrequently, these sectoral *VA/GPV* ratios are used for a significant period of time.[23] This methodology implicitly assumes time-invariancy in the structure of production costs and in the coefficients of joint production, within each economic activity identified in the country's input–output table. As shown in our

[23]Input–output tables are very costly to build. In LACs, these matrixes are computed every ten to fifteen years (approximately). For the different input–output tables available within LACs, see UN, ECLA (1983).

discussion of "recurrent policy regime switches and structural instability" (see section I), it is highly unlikely that such implicit assumptions are justifiable for LACs. Changes in economic policies involving price controls and wage controls, alterations in taxation, subsidies, tariffs, and so forth, are expected to change relative prices of commodities, inputs, and hence the allocation of resources within the economy.[24] Moreover, the empirical evidence presented in the previous section—Tables I–III—clearly shows that in LACs significant changes in the structure of the economic system do take place, and that these changes have profound effects on time series measurements. Therefore, the measurement methodology employed in LACs to compute real GDP presumably biases to a significant degree the GDP time series for periods distant from the national accounts base year. Due to the procedure used to compute private consumption in LACs, the same holds for this variable.

Finally, according to our discussion treating policy regime switches in LACs (section I of this paper), the degree of the government's direct involvement in productive activities, together with the government's own labor demand and wage indexation policies, is essentially a time-varying issue within LACs.[25] Moreover, the criteria on which production, investment and labor demand decisions are based in state-owned companies in LACs is definitely not always compatible with profit maximization, as one would expect from private enterprises. Under such a scenario, an asymmetry in the economic behavior of the private sector vis-à-vis the government should clearly be expected to show up on the data. Hence, it is extremely important for macroeconometric testing in LACs to have aggregate economic statistics (time series for GDP, Investment, Imports, Employment, etc.) in which the private and the public sectors are explicitly distinguished.[26] However, in national accounts' statistics—except the (traditional) decomposition of consumption expenditure between private and government expenditures—there is no separation whatsoever of aggregate figures between these behaviorally distinct economic agents.[27] The same lack of information is exhibited by the data on the economy's aggregate employment. These data limitations restrict the feasibility of obtaining meaningful time-series for the purposes of macroeconometric testing in LACs.

IV. Concluding Remarks

Structural instability in the economic system of LACs is likely to be a manifestation of economic policy instability. In turn, the last has been historically linked

[24]For example, the Chilean (indirect) tax system prevailing before 1975 was heavily based on the existence of a sales tax. Beginning in 1975, the commodity tax was eliminated and a value added tax substituted it. Clearly, such a policy change should be expected to alter VA/GPV ratios throughout the economy.

[25]Preliminary estimates indicate that Chilean government production of goods and services increased from (roughly) 14 percent of GDP in 1965 to 40 percent in 1973. Starting in 1974, this pattern was reversed by a new administration (see work by Larrain, F. and Meller, P., in book edited by Dornbusch, R. and Edwards, S., 1991.)

[26]In the "public sector" I include both the central government *and* government-owned enterprises.

[27]An exception is Venezuela. This country—with a significant public sector heavily based on the petroleum industry—does have separate GDP series (total and by sectors of economic activity) for the private and government sectors.

to political instability in LACs. The empirical evidence displayed in Tables I through III is quite convincing about the extent of such a structural instability in the economic system. Entirely different stories about the aggregate behavior of these LACs could be told, depending on which particular set of "structural parameters" of the economy is considered for computing national accounts in real terms. Thus, macroeconometric testing in LACs requires a country-specific, detailed knowledge of the economic policy evolution throughout the period investigated. Such information needs to be incorporated into *both* the *specification* and *estimation* procedures. This calls for the use of what I referred to as "time-varying econometric models," as well as of varying-parameter econometric models (the latter being a corollary of "Lucas' critique"). Otherwise, testing any given theoretical macro-model or proposition for a LAC is not meaningful. Unfortunately, such a route for econometric testing—as it is easy to verify—is far from being the common practice in the econometric research dealing with aggregate time series in LACs.[28] To some extent, this may be explained because such a strategy for econometric testing is quite difficult to implement. Among the reasons mentioned throughout the paper for the difficulty, the following ones are most important: (i) the technical problems involved in estimating time-varying parameters within a simultaneous equation framework (this framework being typically necessary in macroeconomics); (ii) the actual difficulty in identifying policy *rules* in LACs (as discussed in Section I.A. of this paper); and (iii) the obvious voluminous data which are especially required to estimate time-varying econometric models and varying-parameter econometric models (data which is unlikely to be found in LACs' databases).

However, these pressing restrictions on the econometrician are not the only ones encountered when dealing with LACs. The "second best methodologies" employed in the computation of national accounts at constant prices in LACs (which is mostly due to lack of statistical resources for building time series on sectoral price-indexes), together with the evidence about the extent of structural instability in LACs, implies that their economic growth figures (and hence their time series on real private consumption expenditure) are conceptually incorrect and misleading. In addition—given the different measurement methodologies involved—these LACs time series are non-comparable to those computed in developed nations (such as the U.S. or Japan). Other crucial aggregate data set constraints are encountered in LACs. As explained in this paper, these deal with the overall length of time series, frequency of statistical surveys, and required scope of economic indicators. Regarding the latter, particularly relevant is the lack of aggregate time series which decompose the data between the private and government sectors.

Certainly, all these elements make macroeconometric testing in LACs a task such as . . . pushing the Sisyphean boulder?

Overall, we can classify all these pressing constraints on the econometrician dealing with LACs, into two broad categories: (a) lack of adequate statistical information; and (b) structural instability in the economic system. In principle,

[28]The unacquainted reader is invited to randomly glance through the voluminous literature in this area.

the first element is relatively easier to address. It certainly requires an enormous policy effort for a much *better* and *greater* government investment in databases and statistical systems in LACs. The need for such a policy effort must be particularly stressed. The second type of element is relatively more complicated to "solve." To the extent that structural instability in the economic system is a manifestation of economic policy instability and, in turn, the latter is a consequence of political instability, it follows that a greater political consensus in LACs about economic policy is required.

REFERENCES

Amemiya, T., *Advanced Econometrics*, Harvard University Press, Cambridge, Massachusetts, 1985.

Ames, B., *Political Survival: Politicians and Public Policy in Latin America*, University of California Press, Berkeley, 1987.

Broemeling, L. D. and Tsurumi, H., *Econometrics and Structural Change*, Marcel Dekker, New York, 1987.

Diaz-Alejandro, C. F., *Essays on the Economic History of the Argentine Republic*, Yale University Press, New Haven, 1970.

Dornbusch, R. and Edwards, S. (eds.), *The Macroeconomics of Populism in Latin America*, The University of Chicago Press, Chicago, 1991.

Hackl, P. and Westlund, A. H., Statistical Analysis of Structural Change: An Annotated Bibliography, in *Empirical Economics*, pp. 167–192, Vol. 14(2), 1989.

Judge, G. G., Griffiths, W. E., Carter Hill, R., Lütkepohl, H., and Lee, T. C., Varying and Random Coefficient Models, in *Introduction to the Theory and Practice of Econometrics*, 2nd ed. Chapter 19, John Wiley, New York, 1985.

Kelejian, H. H., Random Parameters in a Simultaneous Equation Framework: Identification and Estimation, *Econometrica*, pp. 517–527, May, 1974.

Lucas, R. E., Econometric Policy Evaluation: A Critique, in *Studies in Business-Cycle Theory*, MIT Press, Cambridge, 1981.

Maddala, G. S., Varying-Parameter Models, in *Econometrics*, Chapter 17, McGraw-Hill Book Company, New York, 1977.

Mamalakis, M. J., *Historical Statistics of Chile: National Accounts*, Greenwood Press, Westport, Connecticut and London, England, 1978.

Mena, H., Some General Considerations Regarding the Measurement of Economic Growth in the Chilean National Accounts, *Cuadernos de Economia* No. 79, Universidad Catolica de Chile, December, 1989, (in Spanish).

Ramos, J., *Neoconservative Economics in the Southern Cone of Latin America, 1973–1983*, The Johns Hopkins University Press, Baltimore, 1986.

Ruggles, R., The United States National Income Accounts, 1947–1977: Their Conceptual Basis and Evolution, in Foss, M. F. (ed.), *The U.S. National Income and Product Accounts*, Chapter 1, The University of Chicago Press, Chicago, 1983.

Taylor, L., *Varieties of Stabilization Experience* (specially Chapter 4: Country Experiences), Clarendon Press, Oxford, 1988.

United Nations, Studies in Methods, Series F-No. 26, *National Accounting Practices in Seventy Countries*, Vol. No. 3, New York, 1979.

———, ECLA (Economic Commission for Latin America), Input–Output Tables in Latin America (in Spanish), *Cuadernos Estadisticos de la Cepal*, Santiago, Chile, 1983.

———, *The Current State of the National Accounts in Latin America and the Caribean* (in Spanish), October, 1989.

Wiarda, H. J. and Kline, H. F. (eds.), *Latin American Politics and Development*, Second Edition, Westview Press, Boulder and London, 1985.