Are There Restrictions to Consumption Smoothing in Latin American Countries? Differences between OLS and GLS Estimation

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Abstract

We study empirically how close consumption-smoothing models employing present-value relationships fit data for Latin-American countries, either in an open-economy or closed-economy environment. Bivariate VARS are estimated using either individual-system or a joint-system techniques (OLS or GLS - SURE). The latter are more efficient, as is widely known. Interestingly, Wald-Test results for OLS estimates are consistent with consumption smoothing, while GLS are not. However, this last result contradicts previous literature on this issue, which have found that Latin-American countries conform to consumption-smoothing models, with free-capital mobility and no liquidity constraints, which seems odd, given these countries' recent history.

1 Introduction

The notion of consumption smoothing is widely used in explaining aggregate consumer behavior, where individuals take into account not only current but also lifetime income when allocating their resources between consumption and saving. In many cases, optimal consumption behavior may be assessed using present-value tests, such as in Campbell (1987), Campbell (1987) and Shiller (1987), Campbell and Deaton (1989), *inter-alia*.

Models that incorporate (the Life-Cycle (LC) and/or) the Permanent-Income (PI) Hypothesis (PIH) in a closed-economy framework assume that consumption is proportional to permanent income. One implication of this is that consumption should be higher than current income when the latter is relatively low and is expected to rise and below it when individuals expect a fall in earnings, allowing them to smooth consumption intertemporally. Hence, dissaving should precede a rise in income while saving should anticipate reductions in income levels, i.e, "people save for a rainy day".

In an open economy, under perfect capital mobility, agents can smooth consumption in a similar fashion in the presence of shocks to the national cash flow (output net of investment and government spending). In this case, the country's current account is used as a buffer, adjusting capital flows to fulfill optimal consumption decisions. The country finds it optimal to borrow resources from abroad, running a current account deficit, when national cash flow is expected to rise over time, and run a current account surplus when national cash flow is expected to fall.

Either in a closed- or in an open-economy framework there are present-value restrictions that must be obeyed if agents behave as in the optimal consumption model; see, for example, Campbell and Deaton and Ghosh (1995). These restrictions are easilly tested in a vector-autoregressive framework using Wald tests, where data for one specific country is confronted with theory.

Present-value test results rarely reject optimal consumption behavior for Latin American countries when tests are conducted for each country in isolation. This is confirmed by our own results below, in a closed-economy framework, as well as by Ghosh and Ostry (1995), in an open-economy framework. Because Latin American countries have a long history of constraints to borrowing, which happens at the individual and at the country level, finding unconstrained consumption behavior seems odd. Indeed, we would expect to find the opposite.

The objective of this paper is to perform a wide study of consumption smoothing behavior for Latin-American countries, testing the validity of optimal consumption behavior in a closed- and in an open-economy framework. We employ two alternative econometric techniques: individual-country system estimation (OLS, equation-by-equation), where country data is examined in isolation, and multiple-country system estimation (GLS or SURE approach), where data for several countries is examined simultaneously.

The results of Present-Value tests differ dramatically depending on the estimation method employed. When individual-country system estimation is used, results suggest that the vast majority of Latin-American countries follow optimal consumption behavior, which seems odd given the overall perception that liquidity constraints is a potential problem for these countries. Despite this perception, for none of them Present-Value restrictions are rejected at the 5% level when considering closed-economy tests. Results for open-economy tests are similar, suggesting that most of these countries have perfect capital mobility. When multiple-country system estimation is used, results suggest that most Latin-American countries do not follow optimal consumption behavior, conforming to *a priori* expectations.

A possible explanation for the difference in test results is the fact that several common international shocks affect these countries simultaneously. For example, the Mexican crisis of 1982 affected the current-account behavior of the whole region, not just that of Mexico. Common international shocks increase the variance of country-specific errors, leading to a loss of power when tests are applied to individual countries alone. However, the impact of these common shocks can be taken into account when multiple-country estimation techniques are employed. This is exactly the advantage of using the SURE method for system estimation vis-a-vis using OLS equation-by-equation.

This paper is structured as follows. Section 2 provides an overview of the theory and main implications of Present Value Models in the context of consumption smoothing. The methodology adopted in the analysis is also presented in this section. Section 3 describes the data used. Section 4 presents the empirical results and section 5 concludes.

2 Theory and Testable Implications

2.1 Theory

2.1.1 Household Behavior Present Value Model

For a representative household, Campbell (1987) derives the following expression describing the behavior of saving:

$$\begin{aligned} s_t &= -\left(\frac{r}{1+r}\right)\sum_{i=0}^{\infty}\left(\frac{1}{1+r}\right)^i [E_t y_{l,t+i} - y_{lt}] \\ &= -\sum_{i=1}^{\infty}(\frac{1}{1+r})^i E_t \Delta y_{l,t+i}. \end{aligned} \tag{1}$$

where s_t is saving, defined as $s_t = y_t - c_t/\gamma$, where y_t represents total disposable income, c_t is real consumption, y_{lt} is real labor income, and y_{kt} real capital income, where $y_t = y_{kt} + y_{lt}$ holds. All variables are expressed in per capita terms. It is worth mentioning that s_t is the conventional measure of saving when γ, the proportionality factor between consumption and Hicksian income, is set equal to one. From equation (1) it can be seen that saving may be interpreted as the expected present value of future declines in labor income. According to this model, saving will be positive only in the case that income exceeds its permanent level and is consequently expected to decline. If the PIH holds, saving is the optimal forecast of future declines in labor income. As a result, the forecast of this present value based on an unrestricted VAR should equal saving.

A logarithmic approximation to (1), which is sometimes more convenient to work with, was derived by Campbell and Deaton (1989):

$$\frac{s_t}{y_t} \approx -\sum_{i=1}^{\infty} \rho^i E_t \Delta \log y_{t+i} - \kappa \tag{2}$$

where κ is a constant, and ρ is a discount factor.

2.1.2 Open Economy Present Value Model

For an open economy, consumption smoothing can be analyzed based on the intertemporal approach of the current account; see Sachs (1982). It assumes perfect capital mobility in deriving consumption behavior for the representative agent. The country bases its saving decisions on future changes of national cash flows, where the current account acts as a buffer to obtain consumption smoothing in the presence of shocks. The present-value relationship between the current account and changes in national cash flow is:

$$CA_t = -\sum_{j=1}^{\infty} \left(\frac{1}{1+r}\right)^j E_t \left[\Delta Z_{t+j}\right], \tag{3}$$

where the national cash flow Z_t is, $Z_t = Y_t - G_t - I_t$, where C_t is aggregate consumption, G_t is government spending, and I_t is investment. The current account is:

$$CA_t = B_{t+1} - B_t = Y_t + rB_t - G_t - I_t - C_t, \tag{4}$$

where B_t represents the country's net foreign assets, and r the interest rate.

The national cash flow equation (3) indicates that the optimal current account is equal to minus the present value of expected changes in national cash flow, and is completely analogous to (1): agents save by accumulating foreign assets when they expect a reduction in national cash flow, and vice-versa.

2.2 Present Value Models: An Overview

A general present value model is presented in Campbell and Shiller (1987) for two variables, w_t and W_t. There, W_t is a linear function of the present discounted values of w_t:

$$W_t = \theta(1-\delta)\sum_{i=0}^{\infty}\delta^i E_t w_{t+i} + c \tag{5}$$

where c is a constant, θ the coefficient of proportionality and δ the discount factor.

A common problem in testing (5) directly is that the variables w_t and W_t usually require some sort of transformation before the theory of stationary stochastic processes can be applied. This happens because w_t and W_t are usually stationary in first differences, i.e., have a unit root. The usual approach entails linearly combining w_t and W_t to be able to apply standard econometric techniques as follows:

$$S_t \equiv W_t - \theta w_t = \theta E_t\left[\sum_{i=0}^{\infty}\delta^i \Delta w_{t+1+i}\right]. \tag{6}$$

It is straightforward to show that (6) impose a set of linear restrictions on the coefficients of a Vector Autoregression (VAR) on S_t and Δw_t, which is used as a reasonable representation to compute the optimal forecast implicit in (6). These restrictions are then tested using a Wald test.

2.3 Testable Implications

Let the variables S_t^i and Δy_t^i, both assumed stationary, be described by the following present value relationship

$$S_t^i = \lambda E_t \sum_{j=0}^{\infty}\beta^j\left(\Delta y_{t+j}^i\right). \tag{7}$$

Here, countries are indexed by i, $i = 1, 2, \cdots, N$, S_t^i represents either saving – in a closed-economy framework – or the current account value – in an open-economy framework, and Δy_t^i represents either change in labor income – in a closed-economy framework – or the changes in national cash flow – in an open-economy framework.

Consider the following representation for a VAR containing S_t^i and Δy_t^i:

$$\begin{bmatrix} \Delta y_t^i \\ S_t^i \end{bmatrix} = \begin{bmatrix} a^i(L) & b^i(L) \\ c^i(L) & d^i(L) \end{bmatrix} \begin{bmatrix} \Delta y_{t-1}^i \\ S_{t-1}^i \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t}^i \\ \varepsilon_{2t}^i \end{bmatrix} \tag{8}$$

and $a^i(L), b^i(L), c^i(L)$ and $d^i(L)$ are polynomials of lag order p in the lag operator for $i = 1, ..., N$. This VAR(p) can be written as a VAR(1) for forecasting purposes as follows:

$$\begin{bmatrix} \Delta y_t^i \\ \vdots \\ \\ \Delta y_{t-p+1}^i \\ S_t^i \\ \vdots \\ \\ S_{t-p+1}^i \end{bmatrix} = \begin{bmatrix} a_1^i & \cdots & a_p^i & b_1^i & \cdots & b_p^i \\ 1 & & & & & \\ & \ddots & & & 0 & \\ & & 1 & & & \\ c_1^i & \cdots & c_p^i & d_1^i & \cdots & d_p^i \\ & & & 1 & & \\ & 0 & & & \ddots & \\ & & & & & 1 \end{bmatrix} \begin{bmatrix} \Delta y_{t-1}^i \\ \vdots \\ \\ \Delta y_{t-p}^i \\ S_{t-1}^i \\ \vdots \\ \\ S_{t-p}^i \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t}^i \\ 0 \\ \vdots \\ 0 \\ \varepsilon_{2t}^i \\ 0 \\ \vdots \\ 0 \end{bmatrix} \tag{9}$$

or more compactly as

$$z_t^i = A_i z_{t-1}^i + u_t^i \tag{10}$$

where A_i is the companion matrix of the VAR and u_t^i is a vector of shocks. A forecast of z_t^i, j periods ahead is:

$$E(z_{t+j}^i / H_t) = A^j z_t^i \tag{11}$$

where H_t is the information set containing current and past values of z_t.

A weak implication of the model is that S_t^i Granger-causes Δy_t^i since the former is the optimal forecast of a weighted sum of future values of Δy_t^i conditional on agents' information set. In this context, if individuals are able to forecast Δy_t^i taking into account information beyond that contained in its past values, S_t^i will have additional explanatory power for future Δy_t^i. A second implication of the model is a set of restrictions imposed on (9). In order to derive such restrictions, take the expectation of (7) conditional on information set $H_{t.}$ The left hand side of (7) remains the same since S_t is contained in H_t and the following expression can be obtained

$$g' z_t^i = \lambda \sum_{j=1}^{\infty} \beta^j h' z_t^i, \tag{12}$$

where g' and h' are vectors of dimension $2p \times 1$ in which all elements are zeros except for the first element of h' and the $p+1st$ element of g', both of which are unity. For this expression to hold it should be the case that

$$g' = \lambda \sum_{j=1}^{\infty} \beta^j h' A_i^j = \lambda h' \beta A_i \left(I - \delta A_i\right)^{-1} \tag{13}$$

Given the assumed stationarity of variables S_t^i and Δy_t^i, the infinite sum in (13) converges. Post-multiplying both sides of (13) by $(I - \delta A)$ we obtain:

$$g'(I - \beta A_i) = h' \beta A_i. \tag{14}$$

In terms of the individual coefficients of matrix A_i, restrictions (14) can be written as

$$\begin{aligned} c_j^i &= -\lambda a_j^i, \quad j = 1, ..., p \\ d_1^i &= \beta^{-1} - \lambda b_1^i \\ d_j^i &= -\lambda b_j^i, \;\; j = 1, ..., p, \end{aligned} \tag{15}$$

which can be tested by means of a Wald test. We can summarize the implications of the PVM in the following manner:

1. The variable S_t^i is a cointegrating relationship between W_t and w_t. In our study, this means the saving ratio, in the household setting, or the current account, in the open economy setting, are cointegrating relationships. This can be verified by means of a cointegration test.

2. S_t^i Granger-causes Δy_t^i. This implies the presence of Granger causality from the current account to changes in national cash flow and from the the saving ratio to the real growth rate of labor income.

3. The restrictions imposed by (15) should be statistically valid and can be tested by means of a Wald test.

4. The actual series S_t should coincide with the series implied by the estimated VAR and the present value relationship. In our study, this implies that the actual saving ratio

and actual current account series should be close to the optimal forecast obtained with the estimated VAR.

2.4 Estimation Method

The Vector Autoregressions (8) can be estimated using two methods: Ordinary Least Squares (OLS) equation-by-equation and Seemingly Unrelated Regression Equations (SURE), which is Generalized Least Squares (GLS) in the system as a whole. The first disregards the covariance between errors in different countries, while GLS does not. As is widely known, GLS provides a gain in efficiency when compared to OLS.

The joint system is constructed by stacking the group of equations that compose the VAR characteristic of each country expressed in (8) on top of each other in the following manner:

$$\begin{bmatrix} \Delta y_t^i \\ S_t^i \end{bmatrix} = \begin{bmatrix} a^i(L) & b^i(L) \\ c^i(L) & d^i(L) \end{bmatrix} \begin{bmatrix} \Delta y_{t-1}^i \\ S_{t-1}^i \end{bmatrix} + \begin{bmatrix} \epsilon_{1t}^i \\ \epsilon_{2t}^i \end{bmatrix}, \; i = 1, ..., N \tag{16}$$

Define $Z_t^i = \begin{pmatrix} \Delta y_t^i \\ S_t^i \end{pmatrix}_{(2\times1)}$, $X_t^i = \begin{pmatrix} \Delta y_{t-1}^i \\ \vdots \\ \Delta y_{t-k_i}^i \\ S_{t-1}^i \\ \vdots \\ S_{t-k_i}^i \end{pmatrix}_{(2k_i\times1)}$, $\beta_i = \begin{pmatrix} a_1^i \\ \vdots \\ a_{k_i}^i \\ b_1^i \\ \vdots \\ b_{k_i}^i \\ c_1^i \\ \vdots \\ c_{k_i}^i \\ d_1^i \\ \vdots \\ d_{k_i}^i \end{pmatrix}_{(4k_i\times1)}$, $\epsilon_t^i = \begin{pmatrix} \epsilon_{1t}^i \\ \epsilon_{2t}^i \end{pmatrix}_{(2\times1)}$

Then the system of equations in (16) can be represented as

$$Y_t = X_t\beta + \epsilon_t \tag{17}$$

where $X_t = \begin{pmatrix} X_t^{1\prime} & 0 & \cdots & & & & 0 \\ 0 & X_t^{1\prime} & 0 & \cdots & & & 0 \\ & 0 & X_t^{2\prime} & 0 & \cdots & & 0 \\ \vdots & & 0 & X_t^{2\prime} & 0 & \cdots & 0 \\ & & & & \ddots & & \vdots \\ 0 & \cdots & & & 0 & X_t^{N\prime} & 0 \\ 0 & 0 & \cdots & 0 & & & X_t^{N\prime} \end{pmatrix}_{(2N\times 4K)}$, $\beta = \begin{pmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_N \end{pmatrix}_{(4K\times 1)}$ and $\epsilon_t = \begin{pmatrix} \epsilon_t^1 \\ \epsilon_t^2 \\ \vdots \\ \epsilon_t^N \end{pmatrix}_{(2N\times 1)}$

It should be noted that $\sum_{i=1}^{N} k_i = K$. The ϵ_t's have mean zero and are serially uncorrelated with covariance matrix given by $E(\epsilon_t \epsilon_t') = \Omega$. Stacking the T equations given by (20) in the usual way, it can be shown that the covariance matrix of the disturbances $u^* = (\epsilon_1', ..., \epsilon_T')$ is

$$E(u^* u^{*'}) = \begin{bmatrix} \Omega & 0 & \cdots & & 0 \\ 0 & \Omega & 0 & \cdots & 0 \\ \vdots & 0 & \ddots & & \vdots \\ & \vdots & & \Omega & 0 \\ 0 & 0 & \cdots & 0 & \Omega \end{bmatrix}$$

The GLS estimator of β is then given by

$$\tilde{\beta} = \left(\sum_{t=1}^{T} X_t' \Omega^{-1} X_t \right)^{-1} \sum_{t=1}^{T} X_t' \Omega^{-1} y_t \tag{18}$$

The variance of this estimator in the case where $E(\epsilon) = 0$ and $E(\epsilon\epsilon')$=$\sigma^2\Omega$ is

$$VAR(\tilde{\beta}) = \sigma^2 \left(\sum_{t=1}^{T} X_t' \Omega X_t \right)^{-1} \tag{19}$$

When Ω is unknown, as is usually the case, this expression cannot be applied directly. The estimator can be obtained, however, by applying OLS to each equation separately. If e_i is a

$T \times 1$ vector containing the residuals of the ith equation estimated by OLS, an estimate of the ijth element of Ω is given by

$$\hat{\omega}_{ij} = \frac{e_i' e_j}{T}, \quad i, j = 1, ..., N. \tag{20}$$

In this case, a feasible SURE estimator of β is obtained

$$\tilde{\beta}^* = \left(\sum_{t=1}^{T} X_t' \hat{\Omega}^{-1} X_t \right)^{-1} \sum_{t=1}^{T} X_t' \hat{\Omega}^{-1} y_t \tag{21}$$

with variance given by

$$Var(\tilde{\beta}^*) = \sigma^2 \left(\sum_{t=1}^{T} X_t' \hat{\Omega}^{-1} X_t \right)^{-1} \tag{22}$$

The OLS estimator, on the other hand, is given by

$$\hat{\beta} = \left(\sum_{t=1}^{T} X_t' X_t \right)^{-1} \sum_{t=1}^{T} X_t' y_t \tag{23}$$

and variance

$$Var(\hat{\beta}) = \sigma^2 \left(\sum_{t=1}^{T} X_t' X_t \right)^{-1} \sum_{t=1}^{T} X_t' \Omega X_t \left(\sum_{t=1}^{T} X_t' X_t \right)^{-1} \tag{24}$$

The difference between their respective covariance matrices is a positive semidefinite matrix and can be expressed as

$$Var\left(\hat{\beta}\right) - Var(\tilde{\beta}) = \sigma^2 \eta \Omega \eta',$$

where $\eta = \left(\sum_{t=1}^{T} X_t' X_t \right)^{-1} \sum_{t=1}^{T} X_t' - \left(\sum_{t=1}^{T} X_t' \Omega^{-1} X_t \right)^{-1} \sum_{t=1}^{T} X_t' \Omega^{-1}$ indicating the gain in efficiency of SURE estimators relative to their OLS counterpart.

3 Data

The data used in the empirical analysis of the household behavior PVM were obtained from the World Bank - World Development Indicators. The series represent eleven countries (listed in Table 6) and are composed of annual data from 1960 to 1999.

The two basic series used for the saving ratio s_t^i/y_t^i and the real growth rate of income $\Delta \log y_t^i$ and were constructed as follows. Following Campell and Deaton (1989), the numerator is $s_t^i = z_t^i - c_t^i$, where z_t^i is total real income per capita and c_t^i is real per capita consumption, obtained directly from the database as gross national savings (including net current transfers) in constant local currency units. The measure of income used y_t^i reflects national disposable income per capita[1]. It was constructed as Gross National Savings plus Final Consumption Expenditure, both in constant local currency units. Income is measured in per-capita terms.

For the open-economy PVM data were obtained from the World Bank as well, ranging from 1975 to 1996. Current account data were extracted directly from the database and net national cash flow was contructed from its basic elements: $Z_t = Y_t - G_t - I_t$, where C_t is aggregate consumption, G_t is government spending, and I_t is investment. All were set in per-capita terms.

Nine Latin American countries were used in open-economy tests of the PV model: Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, and Venezuela. For the closed-economy tests we add Argentina and Bolivia to this list, comprising of eleven countries. All countries included in the present analysis were also object of investigation in Ghosh and Ostry (1995), permitting a comparison of the results obtained in both studies. The two samples of countries are listed in Table 6.

4 Empirical Results

4.1 Household Behavior Present Value Model

An important step in the empirical analysis consisted in determining the number of lags to be incorporated in each Vector Autoregression estimated. A set of Information Criteria and Diagnostic Tests were carried out in the selection process. In determining the lag length of the VAR, the following criteria were used: the Sequential Modified Likelihood Ratio Test, Akaike Information Criteria, Schwarz Criteria, and Hannan and Quinn Criteria. In most cases, the criteria were unanimous in indicating the number of lags to be used in each VAR. The lag choice was also supplemented by Diagnostic Tests to discard the presence of autocorrelation

[1] Although the literature uses labor income, such a measure is not available in the database. As a result, the measure of income adopted throughout the empirical work is national disposable income.

and heteroskedasticity in the residuals and attest that the model was correctly specified. The results of these tests are presented in Tables 1 and 2[2].

Once the number of lags to be included in each VAR was determined, estimations of the coefficients were carried out. Two forms of estimation were conducted: Ordinary Least Squares (OLS) and Seemingly Unrelated Regressions (SURE) in order to verify if the VAR coefficient estimates are in conformity with those predicted by the theory.

4.1.1 Wald Restriction Test

As mentioned previously, the Wald Test consists in assessing if the coefficients estimated for the following system of equations, representing the VAR characteristic for each country

$$\begin{aligned} \Delta \log y_t^i &= \sum_{j=1}^{p} \left(a_j^i \Delta \log y_{t-j}^i + b_j^i \frac{s_{t-j}^i}{y_{t-j}^i} \right) \\ \frac{s_t^i}{y_t^i} &= \sum_{j=1}^{p} \left(c_j^i \Delta \log y_{t-j}^i + d_j^i \frac{s_{t-j}^i}{y_{t-j}^i} \right) \end{aligned} \tag{25}$$

satisfies the set of restrictions obtained when substituting the values of $\beta = \rho$ and $\lambda = -1$ implied by (2) into (15)

$$\begin{aligned} a_j^i &= c_j^i \text{ for } j = 1..., p \\ b_j^i &= d_j^i \text{ for } j = 2, ..., p \\ d_1^i - b_1^i &= \rho^{-1} \end{aligned}$$

The results depend on the method of estimation (OLS or SURE), the discount factor (ρ) and the level of statistical significance used in testing. Four different values of ρ were considered, ranging from 0,9 to 1. Although the empirical literature tends to adopt a discount factor bearing one, the wider range of values assumed in this study represents a form of assessing the robustness of the empirical results.

In the case of OLS estimation, the results indicate wide non-rejection of optimal Household Behavior, in accordance with the PVM (Table 3 - Appendix). In nine of the eleven countries considered, the restrictions imposed by the PIH cannot be rejected. For only two countries - Chile and Paraguay, is the empirical respective restrictions can be put on check. For Paraguay, the restrictions are rejected only at the 10% level for ρ=0,9. Chile, on the

[2]White Heteroskedasticity Tests were conducted and ruled out the presence of heteroskedasticity. The results are not reported and are available upon request.

other hand, while rejecting the theory for three of the four values of ρ used, in only one instance we reject PVM restrictions at the 5% level.

As a result, OLS estimation yields a promising prognosis for the permanent income hypothesis. This result is also confirmed when considering the group as a whole by estimating the system of equations representing all the countries at once and testing the restrictions imposed by each together. In this case, all values indicate that the restrictions set by the theory are satisfied i.e. cannot be rejected based on the Wald Test (line labeled *ALL* in Table 3).

Results in Table 4 – using SURE estimation – show a very different picture, casting doubts as to the empirical adherence of the Permanent Income Hypothesis. When adopting this efficient method of estimation, the restrictions on the coefficients imposed by the theory are overwhelmingly rejected for six out of the eleven countries considered: Bolivia, Chile, Colombia, Peru, Uruguay, and Venezuela. Three are borderline cases – Brazil, Mexico and Paraguay – and only two cases is the theory in undeniably not rejected: Argentina and Ecuador.

4.2 Open Economy Present Value Model

In the case of the open economy PVM, joint system estimation of Vector Autoregressions were conducted for the Latin American countries. The order of the VAR characteristic of each country was specified in accordance with Ghosh and Ostry (1995), who adopted a 1-lag VAR specification for all countries. In the present analysis, VARs of lag length 2 were also considered. The values of θ, used to isolate the consumption smoothing aspect of the current account, were either set equal to one or set to the values obtained in Ghosh and Ostry. However, the lack of data available to calculate the optimal current account CA_t for each country led us to the adoption of a slightly different procedure than that described previously. Instead of CA_t, VARs were estimated using the observed current account CA_t and the corresponding set of restrictions was calculated. The new set of PV restrictions derive from:

$$CA_t = -\sum_{j=1}^{\infty} \left(\frac{\theta - 1}{\theta} + \frac{1}{\theta \left(1 + r\right)^j} \right) E_t \left[\Delta Z_{t+j} \right] + r \left(\frac{\theta - 1}{\theta} \right) B_t, \tag{26}$$

and can be shown to be a function of θ as follows:

$$
\begin{aligned}
c^i_j &= [\theta + r(\theta - 1)]\, a^i_j, \;\; j = 1, ...p \qquad (27)\\
1 - \frac{d^i_1}{\theta(1+r)} &= -\frac{\theta + r(\theta - 1)}{\theta(1+r)} b^i_1 \\
d^i_j &= [\theta + r(\theta - 1)]\, b^i_j, \;\; j = 2, ...p
\end{aligned}
$$

The method of estimation adopted was SURE. Table 5 summarizes the results obtained. In all cases analyzed, the restrictions imposed by the theory are rejected at any usual significance levels, indicating that the permanent income model and consumption smoothing view are not supported by the data.

The results obtained here are different from those obtained by Ghosh and Ostry, who do not reject theory for eleven of the sixteen Latin American and Caribbean countries analyzed, when OLS estimates are used. Using GLS estimates, we find evidence that PV restrictions do not hold for Latin American countries when joint tests are performed. These results hold even if we consider only countries for which individual test results do not reject PV restrictions in the study conducted by Ghosh and Ostry. However, due to time constraints, individual country tests were not implemented here, but will be implemented soon.

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To be Completed

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A possible explanation for this difference in behavior of test results lies on the econometric technique employed, when several common shocks affect these countries simultaneously. These shocks increase the variance of country-specific errors, leading to a loss of power when tests are applied to individual countries alone. However, the impact of these common shocks can be taken into account when multiple-country estimation techniques are employed. This is exactly the advantage of using GLS for system estimation.

5 Conclusions

We analyze consumption-smoothing behavior for Latin American countries by testing the empirical fit of Present Value Models in an open- and closed-economy framework. For household behavior, bivariate VARs containing the saving ratio s_t/y_t and the real growth rate of income $\Delta \log y_t$ are estimated for each country separately (OLS) and for the group as a whole (GLS). For the group as a whole, bivariate VARs incorporating the current account CA_t and changes in national cash flow ΔZ_t are estimated using these two techniques.

Wald Tests are then conducted to examine the restrictions imposed by the PV restrictions on the VAR coefficients. The empirical results obtained are highly sensitive to the estimation method adopted. Wald-test results under OLS estimation produced favorable results for optimal consumption behavior for households. For only two countries - Chile and Paraguay, are the empirical restrictions undeniably put to check. System estimates by OLS also provided evidence in favor of consumption smoothing. When considering SURE estimation, on the other hand, the household PV restrictions do not hold. In this case, the theory is rejected for seven out of eleven countries.

For open-economy PV restrictions, a similar pattern was obtained. They hold when using OLS estimates but not when GLS is employed. While Gosh and Ostry (1995) find evidence that roughly 2/3 of the countries in Latin America have been able to fully smooth consumption by means of current account movements, our results point in the opposite direction.

A possible explanation for this difference in behavior of test results lies on the econometric technique employed, when several common shocks affect these countries simultaneously. These shocks increase the variance of country-specific errors, leading to a loss of power when tests are applied to individual countries alone. However, the impcat of these common shocks can be taken into account when multiple-country estimation techniques are employed. This is exactly the advantage of using GLS for system estimation.

6 Appendix

Hosehold Behavior Present-Value Tests

Table 1

Optimal Lags of VAR

Countries	Number of Lags
Argentina	4
Bolivia	5
Brazil	4
Chile	1
Colombia	2
Ecuador	1
Mexico	5
Paraguay	1
Peru	5
Uruguay	1
Venezuela	1

Hosehold Behavior Present-Value Tests

Table 2

Serial Autocorrelation LM Test

H_0: No Serial Autocorrelation

Countries	P-Value (lags 1 to 5)
Argentina	90,75%; 79,96%; 29,36%; 95,74%; 34,64%
Bolivia	49,76%; 58,86%; 64,39%; 18,80%; 87,26%
Brazil	41,27%; 97,90%; 11,69%; 68,54%; 51,75%
Chile	54,23%; 96,94%; 68,35%; 74,82%; 20,69%
Colombia	38,94%; 91,75%; 41,02%; 69,94%; 73,21%
Ecuador	91,94%; 63,79%; 11,29%; 31,01%; 82,28%
Mexico	17,62%; 38,34%; 52,92%; 96,02%; 52,00%
Paraguay	68,50%; 43,70%; 54,80%; 25,08%; 48,38%
Peru	68,78%; 35,28%; 96,22%; 3,41%; 60,72%
Uruguay	73,52%; 49,98%; 33,19%; 20,96%; 29,10%
Venezuela	63,81%; 56,79%; 89,79%; 12,35%; 24,31%

Hosehold Behavior Present-Value Tests

Table 3

Test of Restrictions on Coefficients - WALD (OLS)

	Values of ρ			
	0,90	0,93	0,96	0,99
Countries	**P-value(%)**			
Argentina	83,48	82,42	81,38	80,31
Bolivia	24,00	28,28	32,31	36,22
Brazil	88,63	88,77	88,78	88,66
Chile	3,93	5,83	8,16	11,04
Colombia	36,22	40,57	44,54	48,30
Ecuador	49,49	56,43	62,81	68,87
Mexico	94,35	94,61	94,82	95,02
Paraguay	8,52	12,25	16,65	21,91
Peru	99,32	99,35	99,38	99,40
Uruguay	10,29	10,25	10,19	10,12
Venezuela	21,02	27,97	35,38	43,36
ALL	76,44	85,66	91,37	94,91

Hosehold Behavior Present-Value Tests

Table 4

Test of Restrictions on Coefficients - WALD (SURE)

Countries	**Values of ρ**			
	0,90	0,93	0,96	0,99
	P-value(%)			
Argentina	34,52	32,58	30,79	29,07
Bolivia	0	0	0	0
Brazil	14,09	14,34	14,35	14,15
Chile	0,42	0,81	1,44	2,40
Colombia	0,01	0,02	0,04	0,08
Ecuador	16,36	22,93	30,21	38,29
México	14,68	15,48	16,21	16,90
Paraguay	5,44	8,35	12,01	16,61
Peru	4,37	4,71	4,99	5,22
Uruguay	3,65	3,63	3,60	3,56
Venezuela	0,82	1,97	4,07	7,62
ALL	0	0	0	0

Country Behavior Present-Value Tests

Table 5

Test of Restrictions on Coefficients - WALD (SURE)

Countries	*VAR Order*	❑	*P-Value*
South America & Mexico 1	1	1	0
South America & Mexico 1	1	G-O	0
South America & Mexico 1	2	G-O	0
South America & Mexico 2	1	1	0
South America & Mexico 2	1	G-O	0
South America & Mexico 2	2	G-O	0

G-O: Ghosh and Ostry (1995)

Country Behavior Present-Value Tests

Table 6

Countries Included in the Sample

Household Behavior PVM	Open Economy PVM	
	South America & Mexico 1	South America & Mexico 2
Argentina	Brazil	Brazil
Bolivia	Chile	Chile
Brazil	Colombia	Colombia
Chile	Ecuador	Ecuador
Colombia	Mexico	Mexico
Ecuador	Paraguay	Paraguay
Mexico	Peru	Peru
Paraguay	Uruguay	
Peru	Venezuela	
Uruguay		
Venezuela		

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