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Do Capital Flows Reflect Economic Fundamentals in Developing Countries?

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Abstract

This paper proposes a methodology for testing whether capital flows to developing countries are determined by economic fundamentals or by purely speculative forces. We use the intertemporal optimizing approach to current account determination as our benchmark for judging the behavior of capital flows. According to this approach, capital flows should act as a buffer to smooth consumption in the face of temporary shocks to national cash flow, defined as output less investment less government expenditures. The results are encouraging. For a large sample of developing countries, economic fundamentals are indeed found to be the most important determinant of capital flows.

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1/ Princeton University and International Monetary Fund, respectively.
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Contents

I. Introduction

A number of recent studies have suggested that the effective degree of capital mobility in developing countries has been increasing in recent years. 1/ While the vast majority of developing countries continue to maintain some form of restriction on capital movements--including exchange controls and quantitative restrictions on capital movements, these restrictions were not very successful in stemming the large capital outflows ("capital flight") that took place in the 1970s and 1980s. A number of developing countries, moreover, have resorted to capital controls in order to stem occasional surges of inward capital flows, yet experience suggests that despite these controls, evasion is widespread and inflows persist. Finally, recent evidence suggests that, even in developing countries with extensive capital controls, domestic interest rates have tended to move quite closely with international interest rates adjusted for expected exchange rate changes. Again, this suggests that the effective degree of capital mobility in these countries may be quite high. 2/

While recent empirical evidence is suggestive of a higher degree of capital mobility in developing countries than was previously believed, there is a separate--and perhaps equally important--question of what factors actually drive capital movements in developing countries. Recently, for example, the increasing volatility of capital movements in a number of developing countries has led to concern that such movements require policy corrections, particularly when large inflows put upward pressures on the real exchange rate, and lead to difficulties in controlling domestic inflation, interest rates, and the fiscal deficit. This has been the case for example in some Latin American countries--particularly Mexico, and to a lesser extent Argentina, Brazil, Chile, Colombia, and Venezuela--that have received very large inflows of capital during the 1990-1991 period. 3/ The phenomenon is not confined to the Latin American region, however, as similar developments have occurred in Asia and some Middle Eastern countries.

In order to distinguish between capital movements which reflect economic fundamentals and those which do not, some model of how capital flows might optimally respond to exogenous and policy-induced disturbances is required. 4/ An approach which is both theoretically and empirically appealing is that capital flows should act as a buffer to smooth consumption in the face of shocks to income, investment, and government expenditure.

1/ See for example, Mathieson and Rojas-Suarez (1992), Montiel (1992), and Haque and Montiel (1990).

2/ Faruqee (1991) suggests that the effectiveness of capital controls in breaking the linkage between domestic and international interest rates has been declining over time.

3/ Calvo, Leiderman and Reinhart (1992).

4/ On the view that recent capital flows into Latin America may have reflected speculative forces rather than economic fundamentals, see for example Rodriguez (1992).

in the face of shocks to income, investment, and government expenditure. This is the view of capital flows familiar from the modern intertemporal approach to current account determination (Sachs (1982) and Frenkel and Razin (1987)) which has recently received renewed attention in the empirical applications of Ghosh (1990), Sheffrin and Woo (1990), and Otto (1992). 1/ This approach combines the assumptions of high capital mobility and of consumption-smoothing behavior to predict what capital flows should be if agents behave in accordance with permanent income theory. According to the model, a country's current account will be in deficit (surplus) whenever national cash flow, defined as output (GDP) less investment less government spending, is expected to rise (fall) over time. Intuitively, if cash flow is expected on average to grow over time, the country finds it optimal to borrow against future resources (i.e., to accumulate indebtedness) by running a current account deficit. If on the other hand national cash flow is expected to fall over time, as might be the case if government spending were expected to increase in the future, the country would run a current account surplus (increase its savings) today in order to be able to maintain consumption in the future at a level consistent with permanent income.

The intertemporal model of the current account therefore provides a benchmark for judging what capital flows (including changes in official reserves) ought to be, given the specific shocks affecting an economy. Optimal capital flows, according to this model, are those that allow agents to smooth their consumption fully in the face of shocks to national cash flow. Once this benchmark for the optimal level of capital flows has been obtained, it is possible to compare the benchmark series with actual data for the current account. 2/ Furthermore, deviations from this benchmark have an economic interpretation: if actual capital flows are less volatile than optimal flows, effective capital mobility may be less than perfect. Conversely, if actual flows are more volatile than optimal flows, speculative factors may be important in driving capital movements.

To compare the actual and benchmark time series for the current account (our proxy for capital flows), a number of measures may be used, some formal, others less so. First, a Wald test may be employed to gauge whether the data are consistent with the stringent time series implications of the theoretical model. A slightly less stringent test uses an important implication of the model that the current account should help to forecast

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1/ For a somewhat different application of the consumption-smoothing approach in a developing-country context, see for example Paxson (1993).

2/ The current account deficit is identically equal to the change in a country's net international indebtedness, and thus is identically equal to the sum of all capital inflows, including changes in official reserves.

(Granger-cause) subsequent movements in national cash flow. 1/ At a more intuitive level, the benchmark and actual current account series should be highly correlated, and their variances should be equal. That this indeed is the case for a large number of developing countries is apparent from the simple time series plots of actual and predicted current account balances which are presented below.

The paper is organized as follows. Section II presents the intertemporal optimizing current account model for a small open economy and derives a closed-form solution for the current account as a function of expected changes in output, investment, and government expenditures. In order to obtain the benchmark current account series, Section III estimates the expected changes in national cash flow by means of a vector autoregression and presents the various tests of the model. Concluding remarks are provided in Section IV.

II. The Analytical Framework

In line with much of the recent literature on current account determination, the model used here emphasizes the intertemporal trade implied by the divergence of savings and investment. As argued by Sachs (1982), Svensson and Razin (1983), and Frenkel and Razin (1987) among others, the current account in such a model will depend mainly on agents' expectations of the path of national cash flow--defined as output (GDP) less investment less government expenditure--over time. Because of *consumption-smoothing*, a given fluctuation in national cash flow will only affect consumption by the present value of that fluctuation. The remainder of the shock will be reflected in the current account. A temporary unanticipated increase in government spending, for example, would be associated with a current account deficit as the country tried to smooth consumption by borrowing in international capital markets. Likewise, an investment boom would result in a current account deficit as the investment was financed by the world capital market, rather than by squeezing domestic consumption. Indeed, assuming capital is mobile, consumption would rise with an investment boom, as the higher investment portends greater national wealth. This is in sharp contrast to the fall in consumption that would be observed were the economy closed to capital flows.

1/ The idea that the current account should Granger-cause subsequent movements in national cash flow is reminiscent of Campbell's (1987) hypothesis that saving should Granger-cause subsequent movements (declines) in labor income. This is the familiar "saving for a rainy day" hypothesis which states that, according to permanent income theory, people save when they expect their income to decline. The analogy for a small open economy is that national saving (net of investment) should help to predict subsequent declines in national cash flow.

1. A two-period example

The main elements of consumption-smoothing behavior can be illustrated by means of a simple two-period optimizing model of a small open economy in which agents have perfect foresight. Of course, for the empirical implementation of the model, the fact that agents are uncertain *ex ante* about the future path of national cash flow, and the fact that real-world economies last for more than two periods, will need to be taken into account. Nevertheless, even the simple two-period example presented below is sufficient to illustrate the role of the time-profile of national cash flow in determining current account behavior.

Accordingly, consider an economy in which there is a single homogeneous commodity which can be used for consumption (either by the government or the private sector) or investment. There is perfect capital mobility in the sense that the country can borrow and lend in unlimited amounts at a given world interest rate subject only to its lifetime budget constraint. The representative agent is assumed to maximize:

$$u(c_1) + \frac{1}{(1+\rho)} u(c_2)$$

subject to the intertemporal budget constraint:

$$c_1 + \frac{c_2}{(1+r)} = z_1 + \frac{z_2}{(1+r)}$$

where z is national cash flow, $z \equiv q - i - g$, q is output (GDP), i denotes investment, g is government expenditure, r is the exogenous world interest rate, and ρ is the exogenous rate of time preference. 1/ Under the simplifying assumption that $r = \rho$ (so that there are no incentives to *tilt* the profile of consumption), the first order necessary condition for an optimum is:

$$u_c(c_1) = u_c(c_2)$$

where $u_c(.)$ denotes marginal utility. Clearly, with u(.) concave, the same level of consumption is chosen in each period. From the intertemporal budget constraint, it follows immediately that:

$$\text{sign } (z_1 - c_1) = \text{sign } (z_1 - z_2)$$

1/ The level of investment, i, is chosen so as to equate its marginal product with the exogenous world interest rate, r, independent of the path of consumption, i.e., Fisherian separability holds in this economy. It follows that the levels of investment and output may be treated as exogenous to the consumption decision under the assumption that r is exogenous.

The current account is equal to GNP minus absorption, and since the country is assumed to have no initial assets, GNP is equal to GDP (q) in period 1. Therefore, we have:

$$\text{sign}\ (ca_1) = \text{sign}\ (z_1 - c_1) = \text{sign}\ (z_1 - z_2)$$

This result is illustrated in Figure 1 where point A denotes the consumption point, which is located at the intersection of a 45 degree line through the origin and the intertemporal budget line with slope minus (1+r). If $z_1 < z_2$ ($z_1 > z_2$), the cash flow point will be located to the north-west (south-east) of A on the budget line--at a point such as U (W), and the economy will run a current account deficit (surplus) in period 1. In the special case in which $z_1 = z_2 = \bar{z}$, the cash flow point is located at A, and the economy has a zero current account balance. Thus, according to this simple model, the current account is fully determined by the expected (and in this case of perfect foresight actual) evolution of national cash flow through time. In order to implement the model empirically, however, it is necessary to relax the assumptions of two periods and perfect foresight.

2. <u>An infinite-horizon model</u>

Accordingly, consider a small open economy that is represented by a single, infinitely-lived, agent whose preferences are given by:

$$(1) \qquad \sum_{t=0}^{\infty} \beta^t \, E\{u(c_t)\}$$

where β is the subjective discount rate, u(.) is the instantaneous utility function, c_t denotes consumption of the single good. With a view to empirical implementation, a quadratic form for the instantaneous utility function is imposed. The social planner maximizes (1) subject to the economy's dynamic budget constraint: 1/

$$(2) \qquad b_{t+1} = (1+r)b_t + q_t - c_t - i_t - g_t$$

where b is the level of foreign bonds held by the economy, r is the fixed world interest rate, q is the level of output (GDP), i is the level of investment, and g is the level of government expenditure. Combining the first order necessary conditions for an optimum with the budget constraint, and the standard no-Ponzi game constraint yields the following consumption function:

$$(3) \qquad c_t^* = \frac{r}{\theta} \{b_t + \frac{1}{(1+r)} E_t[\sum_{j=0}^{\infty} \frac{1}{(1+r)^j} (q_{t+j} - i_{t+j} - g_{t+j})]\}$$

where θ is a constant of proportionality which reflects the consumption-tilting dynamics of consumption, and c_t^* denotes the optimal path of consumption. The term in curly brackets is the country's net productive

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1/ It is simplest to work in terms of the social planner's problem, although the competitive equilibrium yields equivalent results.

wealth, as of time t. Permanent income is simply r times wealth since the interest rate is assumed to be constant. As one would expect, consumption is proportional to permanent national cash flow. For $\Theta < 1$, the country is consuming more than its permanent cash flow, i.e., it is tilting consumption towards the present; while, for $\Theta > 1$, the country is tilting consumption towards the future. Finally, in the case $\Theta = 1$, the consumption-tilting component is identically zero, and consumption is equal to the country's permanent cash flow. 1/

The primary focus of our analysis is on the consumption-smoothing component of the current account: the consumption-tilting component is removed and disregarded. This is done mainly because the component of the current account that reflects consumption-tilting will be non-stationary so standard statistical inferences will not be valid. In contrast, the consumption-smoothing component of the current account is stationary by construction and is therefore more amenable to econometric analysis. The consumption-smoothing component of the current account is given by: 2/

$$ca_t^* = y_t - i_t - g_t - \Theta c_t^* \tag{4}$$

where y_t is GNP (GDP plus interest income on existing foreign assets, $q_t + rb_t$). Substituting (3) into (4) yields, after some manipulation:

$$ca_t^* = - \sum_{j=1}^{\infty} \frac{1}{(1+r)^j} \{E_t \Delta (q_{t+j} - i_{t+j} - g_{t+j})\} \tag{5}$$

where Δ is the (backward) difference operator, $\Delta x_t = x_t - x_{t-1}$. The expression in equation (5) shows that the consumption-smoothing current account is identically equal to minus the present discounted value of expected changes in national cash flow. Equation (5) thus embodies the intertemporal approach to the current account in a clear and simple way. Shocks to national cash flow (or to any of its components--output, investment, government spending) which are expected to be permanent have no effect on the current account since their expected change is zero. On the other hand, favorable transitory shocks lead to improvements in the current

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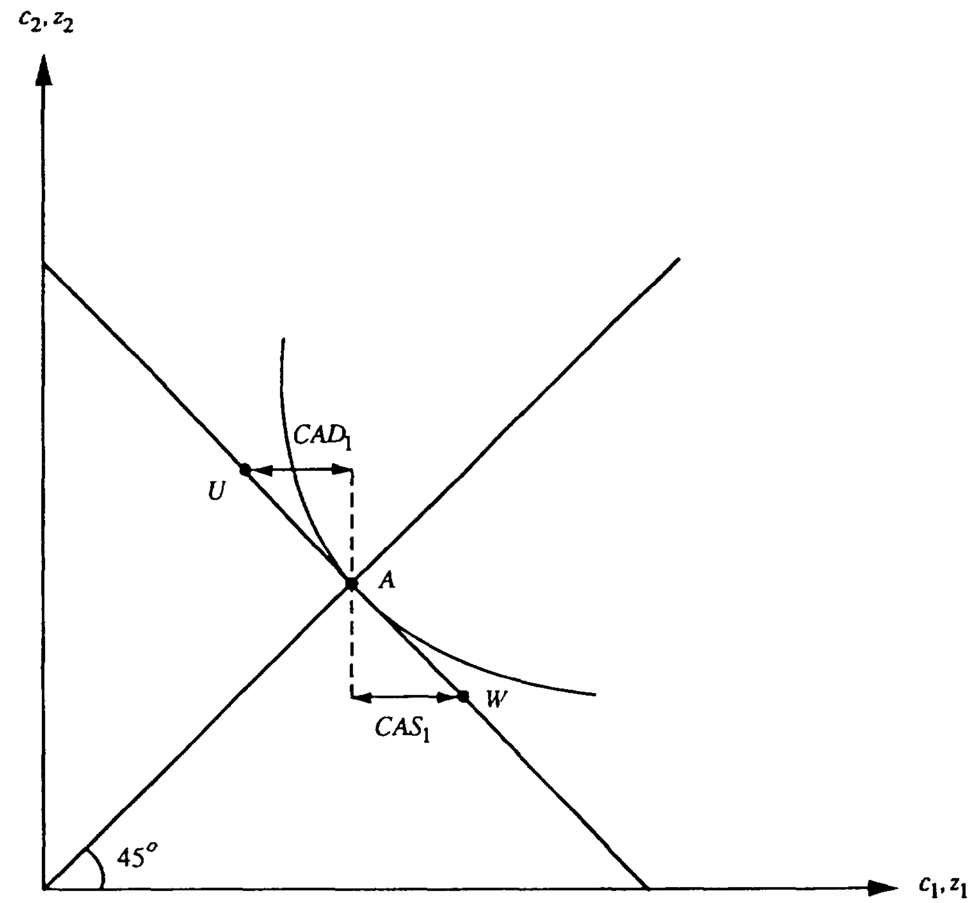
1/ We follow Ghosh (1990), Sheffrin and Woo (1990) and Otto (1992) in assuming that Fisherian separability holds in this economy, so that investment and output may be treated as exogenous when choosing the optimal path of consumption in (3). Although, as shown in Mendoza (1992) for example, the Fisherian separation theorem holds *strictly* only in a world in which there are no stochastic shocks to the marginal productivity of capital, it continues to hold as a first approximation even in the presence of random investment shocks. Thus, the simple intuitions provided by the theorem, for example that consumption need not fall in order to finance an investment boom induced by a positive productivity shock, continue to hold even with random disturbances to the marginal product of capital.

2/ Our model identifies the stationary component of the current account with consumption-smoothing behavior; more generally, it could include other transitory factors.

Figure 1

The Current account and the Profile of National Cash Flow



account, with the extent of the movement in the latter being a decreasing function of the persistence of the shock.

To create the consumption-smoothing current account series, equation (5) shows that one must estimate the present value of expected changes in national cash flow, where the expectation is conditional on the information set used by economic agents. This is a daunting task because, in general, the information set used by agents to forecast future values of these variables is unknown to the researcher. It turns out, however, that one does not need to know precisely what information is employed by the agent. This is because, as shown by Campbell and Shiller (1987) in a somewhat different context, the current account itself reflects *all* the information available to agents for the purpose of forecasting these variables. Therefore, by including the current account in the conditioning information set, we can fully capture agents' expectations of shocks to output, investment, and government expenditure.

Following Campbell and Shiller (1987), we estimate an unrestricted vector autoregression (VAR) in $[\Delta(q_t - i_t - g_t), ca_t]$, where ca_t is the actual (detrended) current account, defined (in analogy to (4)) as $ca_t = y_t - i_t - g_t - \theta c_t$. Obviously, some estimate of θ is required for the VAR estimation. We explain below how an estimate of this parameter may be obtained. The VAR may then be written as:

(6) $$\begin{bmatrix} \Delta(q_t - i_t - g_t) \\ ca_t \end{bmatrix} = \begin{bmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{bmatrix} \begin{bmatrix} \Delta(q_{t-1} - i_{t-1} - g_{t-1}) \\ ca_{t-1} \end{bmatrix} + \varepsilon_t$$

or more compactly as

(7) $$\mathbf{x}_t = \Psi \mathbf{x}_{t-1} + \varepsilon_t$$

From (7), the *k*-step ahead expectation is simply

(8) $$E_t\{\mathbf{x}_{t+k}\} = \Psi^k \mathbf{x}_t$$

and the expression for ca^* (in (5)) is given by

(9) $$ca_t^* = -[1\ 0][\Psi/(1+r)][I - \Psi/(1+r)]^{-1}\mathbf{x}_t \equiv \Gamma \mathbf{x}_t$$

This expression is valid as long as the infinite sum in (5) converges, which it will if the variables in the VAR are stationary. Assuming that $(q_t - i_t - g_t)$ is I(1), its first difference will be stationary; since, under the null, the current account is a discounted sum of $\Delta(q_t - i_t - g_t)$, it too will be stationary.

An important implication of the intertemporal smoothing model is that the current account should, in general, Granger-cause changes in national cash flow. 1/ From (5), ca^* is equal to (minus) the expected present discounted value of $\Delta(q-i-g)$, where the expectation is conditional on agents' *entire* information set. If agents have more information about the evolution of national cash flow than is contained in its own past values, then the current account ought to Granger-cause changes in cash flow. If, for example, a change in administrations portends higher future government spending, then the country should run a current account surplus. The latter would then Granger-cause the subsequent decline in national cash flow. 2/

It remains only to describe how to calculate the consumption-tilting parameter, Θ, so that the actual data on the current account can be purged of its consumption-tilting component. As argued previously, the optimal current account series ca^* will be an I(0) process. Under the null hypothesis that the actual consumption-smoothing component of the current account is equal to ca^*, the actual (detrended) current account is also I(0). This means that the lefthand side of (4) is I(0) and therefore that Θ may be obtained as the cointegrating parameter between consumption c_t and national cash flow inclusive of interest payments $y_t-i_t-g_t$. 3/

Once the optimal current account series ca^* has been calculated, a number of tests may be performed. First, an implication of the intertemporal model is that the current account should Granger-cause subsequent movements in national cash flow. This is easy to test using the results of the VAR estimation. Second, again using the VAR estimates, the model implies two restrictions on the parameter values. Specifically, defining the parameter vector Γ in equation (9) by

$$\Gamma \equiv [\Gamma_y, \; \Gamma_{ca}]$$

1/ That is, in a regression of the change in national cash flow on the lagged current account and the lagged change in cash flow, the coefficient on the lagged current account should be statistically significant (Sargent (1979), page 278).

2/ This is completely analogous to the notion, presented in Campbell (1987) in his study of the permanent income hypothesis, of "saving for a rainy day."

3/ If one took the theoretical model--with its infinitely-lived representative agent who has a constant subjective discount rate--literally, then Θ should be constant over the entire sample. Moreover, values of Θ which differed from unity--though not at all inconsistent with the theoretical model--would have the troubling implication that the most patient country would eventually own the entire world. We do not believe that such an extreme conclusion is necessarily warranted. Instead, we view the use of the infinite-horizon, constant discount rate model as a simple abstraction. The model provides a practical means of removing the trend in the current account which results from, *inter alia*, shifts in demographic and other factors not captured here, and allows one to focus on the consumption-smoothing aspect of the current account, which is our primary interest.

the model requires that $\Gamma_y = 0$, and $\Gamma_{ca} = 1$. The requirement that the coefficient on national cash flow, Γ_y, be close to zero and that on the current account, Γ_{ca}, be close to unity can easily be tested. Third, under the null, the variances of the actual consumption-smoothing current account and the optimal consumption-smoothing current account should be equal. This equality of variances restriction can also be tested. Fourth and finally, the sample correlation between ca and ca^* may be examined to determine whether current account movements have at least been broadly consistent with the twin assumptions of capital mobility and the intertemporal consumption-smoothing model of the current account.

III. Data and Estimation

A large cross-sectional sample of developing countries for which the necessary national accounts data were available over a sufficiently long time period were chosen for the analysis. The main source for all data was the International Monetary Fund's International Financial Statistics (IFS). In the case of a few countries, for which the IFS data either contained errors or was unavailable over a sufficiently long time period, the World Bank's World Tables were used instead. Fourteen African countries were employed for the analysis: Botswana, Ethiopia, Ghana, Kenya, Liberia, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, Tunisia, and Zambia. Eleven Asian countries were used: Hong Kong, India, Indonesia, Korea, Malaysia, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, and Thailand. Five Middle Eastern countries were included: Egypt, Israel, Islamic Republic of Iran, Jordan, and Saudi Arabia. Finally, sixteen countries from the Western Hemisphere were also used: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Uruguay, and Venezuela. 1/ All data are at an annual frequency and cover in most cases about 30 observations ending in 1990.

1. Granger-causality tests

As described in the previous section, the empirical analysis proceeds by first ensuring that the variables entering the VAR are rendered stationary. This is done by working with the national cash flow in first differences and the current account series with the stochastic trend removed, as described above. The first implication of the intertemporal model is that the current account should Granger-cause subsequent movements in national cash flow. A standard t-test can then be used to gauge whether the data satisfies this implication or not. These results are reported in Tables 1-4 for the different regions.

1/ The countries for which the World Bank's World Tables were used were as follows. Africa: Botswana, Nigeria, Senegal; Asia: India and Indonesia; Middle East: Egypt and Israel; and Western Hemisphere: Argentina, Brazil, Colombia, and Peru.

Table 1. Granger-Causality Tests: Africa 1/

Country	t-statistics
Botswana	0.66
Ethiopia	-0.98
Ghana	-0.85
Kenya	-1.98 *
Liberia	-0.51
Malawi	-2.55 *
Mauritius	-3.61 *
Morocco	-0.74
Nigeria	-1.48
Senegal	-3.72 *
South Africa	0.60
Tanzania	-1.82
Tunisia	-2.57 *
Zambia	-4.57 *

1/ t-statistic on the lagged (detrended) current account in a regression of national cash flow (in first differences) on lagged national cash flow (in first differences) and lagged current account. An asterisk indicates significance at the 95 percent level.

Table 2. Granger-Causality Tests: Asia 1/

Country	t-statistic
Hong Kong	-2.29 *
India	-2.89 *
Indonesia	-1.55
Korea	-2.67 *
Malaysia	-1.67
Pakistan	0.58
Papua New Guinea	-2.89 *
Philippines	-3.63 *
Singapore	-1.41
Sri Lanka	-0.66
Thailand	-1.48

1/ t-statistic on the lagged (detrended) current account in a regression of national cash flow (in first differences) on lagged national cash flow (in first differences) and lagged current account. An asterisk indicates significance at the 95 percent level.

Table 3. Granger-Causality Tests: Middle East 1/

Country	t-statistic
Egypt	-1.24
Israel	-1.08
Iran, I. R.	-2.59 *
Jordan	-2.99 *
Saudi Arabia	-3.50 *

1/ t-statistic on the lagged (detrended) current account in a regression of national cash flow (in first differences) on lagged national cash flow (in first differences) and lagged current account. An asterisk indicates significance at the 95 percent level.

Table 4. Granger-Causality Tests: Western Hemisphere 1/

Country	t-statistic
Argentina	-2.01 *
Bolivia	-3.07 *
Brazil	-2.74 *
Chile	-2.41 *
Colombia	-1.85
Ecuador	-3.09 *
El Salvador	-4.07 *
Guatemala	-5.15 *
Honduras	-3.40 *
Jamaica	-1.78
Mexico	-3.78 *
Panama	-2.94 *
Paraguay	-2.89 *
Peru	-1.62
Uruguay	0.64
Venezuela	-4.73 *

1/ t-statistic on the lagged (detrended) current account in a regression of national cash flow (in first differences) on lagged national cash flow (in first differences) and lagged current account. An asterisk indicates significance at the 95 percent level.

Beginning with Africa (Table 1), we see that the current account Granger-causes national cash flow in about half the countries: Kenya, Malawi, Mauritius, Senegal, Tanzania, Tunisia, and Zambia. Interestingly, in virtually all the countries, the *sign* of the coefficient estimate is negative, implying that the country increases its current account surplus (reduces its deficit) when national cash flow is expected to decline in the future, as theory requires.

Turning to Asia (Table 2), the results suggest Granger-causality in five cases (Hong Kong, India, Korea, Papua New Guinea, and the Philippines), with a further four cases (Indonesia, Malaysia, Singapore, and Thailand) being quite close to passing the test at standard significance levels, and with the coefficient estimates being negative (as required by theory) in all but one of the eleven cases. Only for Pakistan and Sri Lanka is the Granger-causality restriction clearly not satisfied. Apart from the case of India, where previous research has found evidence of relatively effective capital controls over much of this period (Montiel (1992)), the results reported in Table 2 are broadly consistent with those found elsewhere in the literature using different analytical approaches.

The results for the Middle East are also encouraging, with three of the five countries passing the test at standard significance levels, and all the point estimates being negative as predicted by theory. Finally, the Western Hemisphere region, which contains some of the relatively more developed countries of our sample, performs best among the regions, with twelve of the sixteen countries exhibiting Granger-causality from the current account to national cash flow, and a further three being borderline. Again, in virtually all cases, the point estimates are negative as required. On the whole, therefore, this first implication of the consumption-smoothing approach is satisfied for about 60 percent of the countries in the sample, a result that compares favorably with estimates of the model for the large industrial countries (see Ghosh (1990)).

2. Formal tests of the model

Tables 5-8 present some formal statistical tests of the model. As mentioned previously, if the consumption-smoothing model is valid, then in equation (9) the coefficient on $\Delta(q-i-g)$, Γ_y, should be zero, while the coefficient on ca, Γ_{ca}, should be equal to unity. 1/ In other words, the actual (detrended) current account should be precisely equal to the optimal consumption-smoothing current account defined by equations (4) or (5) or (9), which is the case if the parameter restrictions $\Gamma_y = 0$ and $\Gamma_{ca} = 1$ are

1/ From (9), the coefficients Γ_y and Γ_{ca} are nonlinear functions of the coefficients estimated in the VAR.

Table 5. Wald Tests of the Model: Africa

Country	Γ_y	t-statistic 1/ $\Gamma_y=0$	Γ_{ca}	t-statistic 1/ $\Gamma_{ca}=1$	χ^2 2/
Botswana	0.33	0.42	-0.73	-2.51 *	61.90 *
Ethiopia	-0.05	-0.36	1.05	0.07	0.19
Ghana	-0.04	-0.80	0.43	-3.56 *	16.16 *
Kenya	0.20	2.22 *	0.58	-1.62	5.72
Liberia	0.08	1.60	0.23	-7.00 *	45.70 *
Malawi	0.12	1.09	0.74	-0.93	1.39
Mauritius	-0.03	-0.17	0.99	-0.02	0.26
Morocco	-0.04	-0.80	1.60	0.97	1.28
Nigeria	-0.10	-0.56	0.88	-0.24	0.45
Senegal	0.25	2.78	1.04	0.13	8.43 *
South Africa	0.25	12.50 *	-0.02	-102.00 *	.... *
Tanzania	0.21	1.24	0.80	-0.38	1.90
Tunisia	0.07	0.58	1.03	0.08	0.37
Zambia	0.15	1.50	0.57	-3.07 *	9.32 *

1/ t-statistics are based on White (heteroscedastic-consistent) standard errors. An asterisk indicates that the null hypothesis is rejected at the 5 percent level.
2/ χ^2 is the Wald test statistic for the overall fit of the model. An asterisk indicates rejection at the 5 percent level.

Table 6. Wald Tests of the Model: Asia

Country	Γ_y	t-statistic 1/ $\Gamma_y=0$	Γ_{ca}	t-statistic 1/ $\Gamma_{ca}=1$	χ^2 2/
Hong Kong	-0.60	-2.61 *	1.47	0.87	7.26 *
India	-0.18	-1.13	2.16	1.71	3.12
Indonesia	-0.12	-1.20	0.73	-1.08	3.48
Korea	-0.83	-2.44 *	1.50	1.39	9.42 *
Malaysia	-0.21	-1.40	0.64	-1.64	5.00
Pakistan	-1.13	-3.90 *	-0.36	-4.12 *	27.45 *
Papua New Guinea	-0.19	-0.76	1.12	0.26	0.89
Philippines	-0.32	-2.00 *	1.13	0.35	6.05
Singapore	-0.32	-2.91 *	0.77	-1.05	12.26 *
Sri Lanka	0.26	6.50 *	0.17	-6.92 *	81.43 *
Thailand	-2.89	-3.04 *	2.52	1.21	25.86 *

1/ t-statistics are based on White (heteroscedastic-consistent) standard errors. An asterisk indicates that the null hypothesis is rejected at the 5 percent level.
2/ χ^2 is the Wald test statistic for the overall fit of the model. An asterisk indicates rejection at the 5 percent level.

Table 7. Wald Tests of the Model: Middle East

Country	Γ_y	t-statistic 1/ Γ_y=0	Γ_{ca}	t-statistic 1/ Γ_{ca}=1	χ^2 2/
Egypt	0.17	2.13 *	0.43	-1.68	5.67
Israel	0.11	1.22	0.58	-1.14	1.54
Iran, I. R.	-0.10	-0.56	1.00	0.00	0.74
Jordan	-0.05	-0.25	0.92	-0.32	0.22
Saudi Arabia	0.17	0.71	1.00	0.00	0.50

1/ t-statistics are based on White (heteroscedastic-consistent) standard errors. An asterisk indicates that the null hypothesis is rejected at the 5 percent level.
2/ χ^2 is the Wald test statistic for the overall fit of the model. An asterisk indicates rejection at the 5 percent level.

Table 8. Wald Tests of the Model: Western Hemisphere

Country	Γ_y	t-statistic 1/ Γ_y=0	Γ_{ca}	t-statistic 1/ Γ_{ca}=1	χ^2 2/
Argentina	0.10	1.00	-0.47	-9.19 *	81.49 *
Bolivia	-0.34	-1.26	1.34	0.59	2.76
Brazil	0.14	0.45	2.63	0.84	0.73
Chile	-0.14	-1.00	0.89	-0.37	2.13
Colombia	-0.27	-1.69	1.04	0.18	4.43
Ecuador	0.05	0.50	0.93	-0.29	0.24
El Salvador	-0.08	-0.67	0.80	-1.25	2.97
Guatemala	-0.85	-3.27 *	1.69	1.73	13.88 *
Honduras	-0.00	-0.01	1.15	0.45	0.25
Jamaica	-0.13	-0.48	0.93	-0.12	1.95
Mexico	0.19	1.90	0.90	-0.36	4.29
Panama	-0.08	-0.42	0.91	-0.22	0.74
Paraguay	-0.44	-3.67 *	1.29	1.53	13.89 *
Peru	-0.21	-1.62	0.80	-0.80	3.35
Uruguay	-0.02	-0.40	0.35	-4.64 *	36.75 *
Venezuela	0.05	0.63	0.47	-6.63 *	50.97 *

1/ t-statistics are based on White (heteroscedastic-consistent) standard errors. An asterisk indicates that the null hypothesis is rejected at the 5 percent level.
2/ χ^2 is the Wald test statistic for the overall fit of the model. An asterisk indicates rejection at the 5 percent level.

satisfied. These two parameter restrictions can be tested individually by the use of a standard t-test 1/ and jointly via a chi-squared test. 2/

The results are once again quite encouraging. As far as the coefficient on cash flow (Γ_y) is concerned, the vast majority of the point estimates are extremely small (between minus one quarter and plus one quarter) as predicted by the theory. In less than one quarter of the cases, the estimates of Γ_y are statistically different from zero, but even within this group of countries the point estimates are frequently quite small.

Turning now to Γ_{ca}, again the vast majority of the estimates are not statistically different from unity, as the consumption-smoothing model requires. The point estimates are also close to unity in all but a few cases. As far as regional differences are concerned, this parameter differs most frequently from its theoretically-predicted value in the African countries, where the null hypothesis is rejected in five of the fourteen countries. The instances of rejection are quite small in the other regions, with two rejections among the eleven Asian countries, zero rejections among the Middle Eastern countries (the sample of which is admittedly quite small and where standard errors were quite large in two of the five cases), and three rejections among the sixteen Western Hemisphere countries.

As far as the joint test of the parameter restrictions implied by the model are concerned, two factors are obviously important. The first is how close the estimates are to their theoretical values under the null hypothesis, and the second is how precisely the coefficients are estimated. In the case of the African countries, the model is rejected in about half the cases; however, in the cases in which the data do not reject the model (eight of fourteen), parameters tend to be imprecisely estimated. For the Asian countries, where the incidence of rejection is slightly higher (six out of eleven), the parameters of the model are estimated much more precisely than in the African countries, making rejections that much more likely despite point estimates that are reasonably close to the values predicted by the model. Finally, as far as the remaining countries are concerned, the results are very favorable, with zero rejections out of five countries in the Middle Eastern region, and five rejections out of sixteen Western Hemisphere countries.

1/ The standard errors need to be computed numerically as $\nabla\Gamma'\Sigma\nabla\Gamma$ where Σ is the variance-covariance matrix of the parameters of the VAR, and $\nabla(\Gamma)$ is the gradient of $[\Gamma_y, \Gamma_{ca}]$ with respect to the VAR parameters. The standard errors used in Tables 5-8 are White heteroscedastic-consistent standard errors calculated as:

$$\Sigma_{ij} = (x'x)^{-1}(x'\epsilon_i\epsilon_j x)(x'x)^{-1}$$

where ϵ_i and ϵ_j are the residuals from the ith and jth equation of the VAR.

2/ The χ^2 statistics reported in Tables 5-8 follow the chi-squared distribution with degrees of freedom equal to the number of parameter restrictions, in this case two.

The results for the Western Hemisphere countries raise an issue as far as these countries' ability to smooth consumption in the face of shocks during the period of the debt crisis. One might think that the results for this region should have been much worse than they actually are, given that for part of the sample the debt-crisis countries were effectively cut off from the international capital market. However, it should be noted first that the model is in fact rejected for five countries among the sixteen in the sample, including the important cases of Argentina, Uruguay, and Venezuela, where capital inflows dried up for a part of the estimation period. In other cases, for example Brazil, which was also adversely affected by the debt crisis, the model is not rejected, but in this case, it is clearly because standard errors are extremely large, as evidenced by the fact that the point estimate on Γ_{ca} of 2.63 does not reject the null hypothesis that this parameter is equal to unity! Finally, it should be noted that we are using about thirty years of annual data in the estimation here, with the period of the debt crisis accounting for a relatively small fraction of the total sample. In order to gauge the *relative* performance of the model during debt-crisis versus no-debt-crisis periods, one really needs to employ data at a quarterly frequency. 1/

More generally, as in all statistical tests, our confidence in the model depends upon the *power* of the test--that is the probability of a correct rejection. In our context, the power of the test may be affected by the possibility of endogenous government behavior. To see this, consider a situation in which the government lowers its expenditure in the face of reduced access to capital inflows (or imminent capital outflows). If the private sector understands the government's reaction function, both the actual and the benchmark current account series will reflect the reduced access to capital flows. In this example, the economy would effectively be closed but our test would not detect any barrier to capital movements, since the actual current account would move by as much as (but not by more than) the benchmark current account, taking account of the endogenous government behavior and the availability of foreign capital. However, as we shall see below, for some countries the actual current account seems to be *more* volatile than the benchmark series, which suggests that endogenous government behavior is unlikely to provide a general explanation for the failure to reject the model in a majority of cases. Finally, quite apart from formal statistical power, the time series plots and statistics reported below suggest that the model indeed captures economically significant movements in the current account for most of the countries in the sample.

1/ Unfortunately, these data are not available for most of the countries in the sample, although in future work we intend to use what data are available in order to shed some light on this question. Some preliminary work in this regard does indeed suggest that the model performs much better when one excludes the period of the debt crisis.

3. Correlation between actual and predicted current account and variance of actual and predicted current account

As a further test of the consumption-smoothing model of current account determination, we look at the extent to which the current account predicted by the model is *correlated* with actual current account behavior observed in the data. Clearly, the results in this subsection will not be independent of those obtained in the previous subsection. Specifically, as long as Γ_{ca} is *positive* (even if it is significantly different from unity), the correlation here will also be positive. Nevertheless, the results obtained here may provide some further evidence that bears on the adequacy of the consumption-smoothing approach.

Tables 9-12 give the results as far as the correlation between actual and predicted current accounts is concerned (last column of these tables). In only four of the forty-six countries is the correlation negative, reflecting (as mentioned above) the fact that in these countries, the point estimate of Γ_{ca} is negative. In all but six of the remaining countries, the correlation is above 0.90, again lending strong support to the consumption-smoothing model.

Another interesting question relates to the *volatility* of capital flows in developing countries, an issue that was mentioned in the introduction as having received renewed attention recently. In the context of this paper, the relevant question is whether capital flows (inclusive of reserve changes) have been as volatile as one would expect, given the shocks experienced by these countries. The benchmark current account series calculated here directly addresses this issue since it tells us what capital flows ought to have been given the shocks hitting these economies. If the variance of the actual current account is not statistically different from the variance of the benchmark current account predicted by the consumption-smoothing model, then full consumption-smoothing has taken place but capital flows have not been excessive.

The first column in Tables 9-12 provides an estimate of the ratio of the variance of the predicted current account to the variance of the actual current account. 1/ The variance ratio has a standard error (not reported in the tables) but the χ^2 statistics reported in the second column test whether the variance ratio is significantly different from unity. 2/ As can be seen, the results do not immediately suggest that capital flows have been excessive in light of the shocks hitting these economies. For example, in only four of the fourteen African countries is the null hypothesis of equal variances rejected, while there are only two rejections among the eleven Asian countries. The results are as good or better for the remaining

1/ As elsewhere, both variables have been detrended in the manner described in Section II.

2/ The χ^2 statistics follow a chi-squared distribution with degrees of freedom equal to the number of restrictions, in this case one.

Table 9. Variance Ratio and Correlation: Africa

Country	Variance Ratio 1/	χ^2 2/	Correlation 3/
Botswana	0.40	0.89	-0.95
Ethiopia	1.07	0.00	0.99
Ghana	0.19	35.54 *	0.99
Kenya	0.49	2.84	0.94
Liberia	0.07	297.60 *	0.96
Malawi	0.63	0.65	0.99
Mauritius	0.93	0.02	0.99
Morocco	2.49	0.60	0.99
Nigeria	0.75	0.09	0.99
Senegal	1.51	0.54	0.94
South Africa	0.00	..... *	-0.11
Tanzania	0.66	0.15	0.99
Tunisia	1.10	0.02	0.99
Zambia	0.45	13.99 *	0.98

1/ Ratio of variance of optimal current account to variance of actual current account.
2/ χ^2 is the test statistic for the null hypothesis that the variance ratio is equal to unity. An asterisk denotes rejection of the null at the 5 percent level.
3/ Correlation between actual and optimal (predicted) current account.

Table 10. Variance Ratio and Correlation: Asia

Country	Variance Ratio 1/	χ^2 2/	Correlation 3/
Hong Kong	2.33	0.70	0.96
India	4.24	1.50	0.99
Indonesia	0.48	2.39	0.99
Korea	2.05	1.26	0.91
Malaysia	0.37	5.77 *	0.97
Pakistan	1.59	0.51	-0.30
Papua New Guinea	1.09	0.09	0.99
Philippines	1.27	0.11	0.98
Singapore	0.52	2.77	0.98
Sri Lanka	0.17	145.76 *	0.63
Thailand	8.65	1.47	0.20

1/ Ratio of variance of optimal current account to variance of actual current account.
2/ χ^2 is the test statistic for the null hypothesis that the variance ratio is equal to unity. An asterisk denotes rejection of the null at the 5 percent level.
3/ Correlation between actual and optimal (predicted) current account.

Table 11. Variance Ratio and Correlation: Middle East

Country	Variance Ratio 1/	χ^2 2/	Correlation 3/
Egypt	0.20	7.35 *	0.99
Israel	0.38	2.18	0.99
Iran, I. R.	0.93	0.01	0.99
Jordan	0.83	0.15	0.99
Saudi Arabia	1.01	0.00	0.99

1/ Ratio of variance of optimal current account to variance of actual current account.
2/ χ^2 is the test statistic for the null hypothesis that the variance ratio is equal to unity. An asterisk denotes rejection of the null at the 5 percent level.
3/ Correlation between actual and optimal (predicted) current account.

Table 12. Variance Ratio and Correlation: Western Hemisphere

Country	Variance Ratio 1/	χ^2 2/	Correlation 3/
Argentina	0.24	16.41 *	-0.98
Bolivia	1.78	0.25	0.99
Brazil	6.72	0.33	0.77
Chile	0.71	0.39	0.51
Colombia	0.92	0.03	0.98
Ecuador	0.94	0.02	0.99
El Salvador	0.60	2.82	0.99
Guatemala	2.72	1.73	0.78
Honduras	1.32	0.20	0.99
Jamaica	0.80	0.05	0.99
Mexico	0.78	0.18	0.99
Panama	0.84	1.04	0.99
Paraguay	1.39	0.98	0.78
Peru	0.73	0.40	0.96
Uruguay	0.12	88.51 *	0.99
Venezuela	0.24	117.22 *	0.99

1/ Ratio of variance of optimal current account to variance of actual current account.
2/ χ^2 is the test statistic for the null hypothesis that the variance ratio is equal to unity. An asterisk denotes rejection of the null at the 5 percent level.
3/ Correlation between actual and optimal (predicted) current account.

countries, with only one rejection among the five Middle Eastern countries, and three rejections among the sixteen Western Hemisphere countries. To conclude this section, capital flows in the majority of developing countries appear to have reflected mainly the desire to smooth consumption in the face of shocks to national cash flow, rather than other forces of a more speculative nature. 1/

Before summarizing the main conclusions of the analysis in the next section, Charts 1-8 plot actual and predicted current account balances for the forty-six countries in the sample. While the above statistical analysis is highly suggestive of the importance of consumption-smoothing considerations in determining capital flows in developing countries, the charts also provide a very convenient summary of our results. In the vast majority of the countries, actual and predicted current accounts move closely together (as reflected by the high degree of correlation between the two series reported previously). 2/ Incorporating agents' expectations of future movements of national cash flow appears, therefore, to be a promising avenue for predicting current account behavior in developing countries.

IV. Conclusion

This paper has sought to analyze some of the fundamental economic determinants of capital flows in developing countries under the assumption that agents in these countries attempt to smooth consumption in the face of shocks to output, investment, and government expenditure. The simple consumption-smoothing hypothesis turns out to have powerful implications for the prediction of current account movements in small open economies. Basically, whenever national cash flow is expected to rise, the current account surplus should decline; and conversely, expectations of decreases in national cash flow should cause the country to increase its saving (net of investment). This is the analogy to the permanent income hypothesis of consumption at the level of the individual household, according to which saving rises (falls) whenever household income is expected to fall (rise).

The consumption-smoothing approach yields a number of interesting hypotheses that can be tested empirically. Using data from a large cross-

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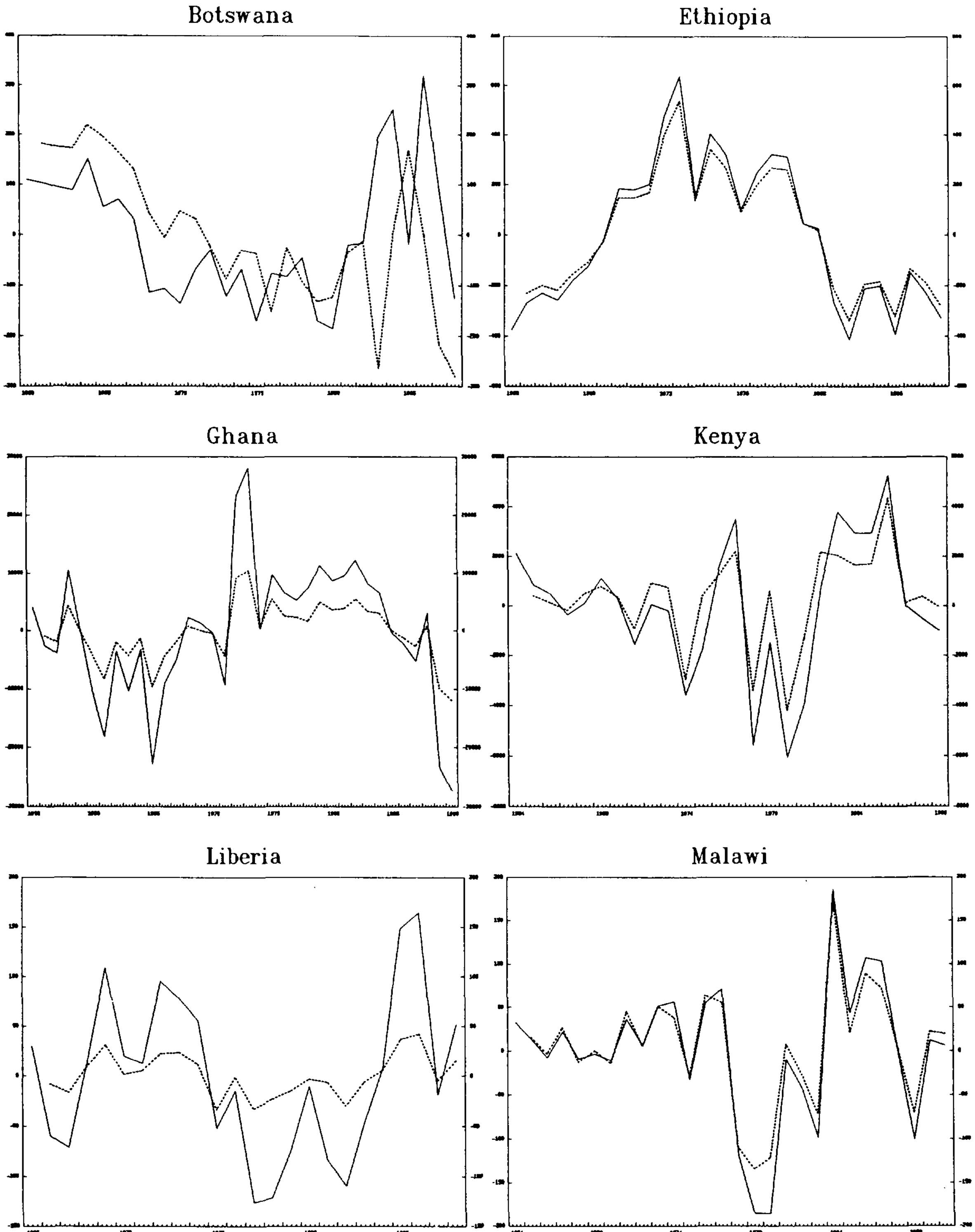
1/ It is also worth noting, as mentioned in the previous subsection, that for a number of countries, the point estimates of the variance ratio are *below* unity, which clearly is not consistent with a view that endogenous government behavior is driving our results.

2/ As mentioned previously, the model does not work that well for some of the countries that were affected by the debt crisis. Indeed, from the charts, it may be noted that for a number of countries--including to some degree Argentina, Chile, the Philippines, Uruguay, and Venezuela--actual current account balances (surpluses) *exceed* optimal (predicted) current account balances for most of the period since 1982, as one would expect if capital inflows had been less than desired.

Chart 1

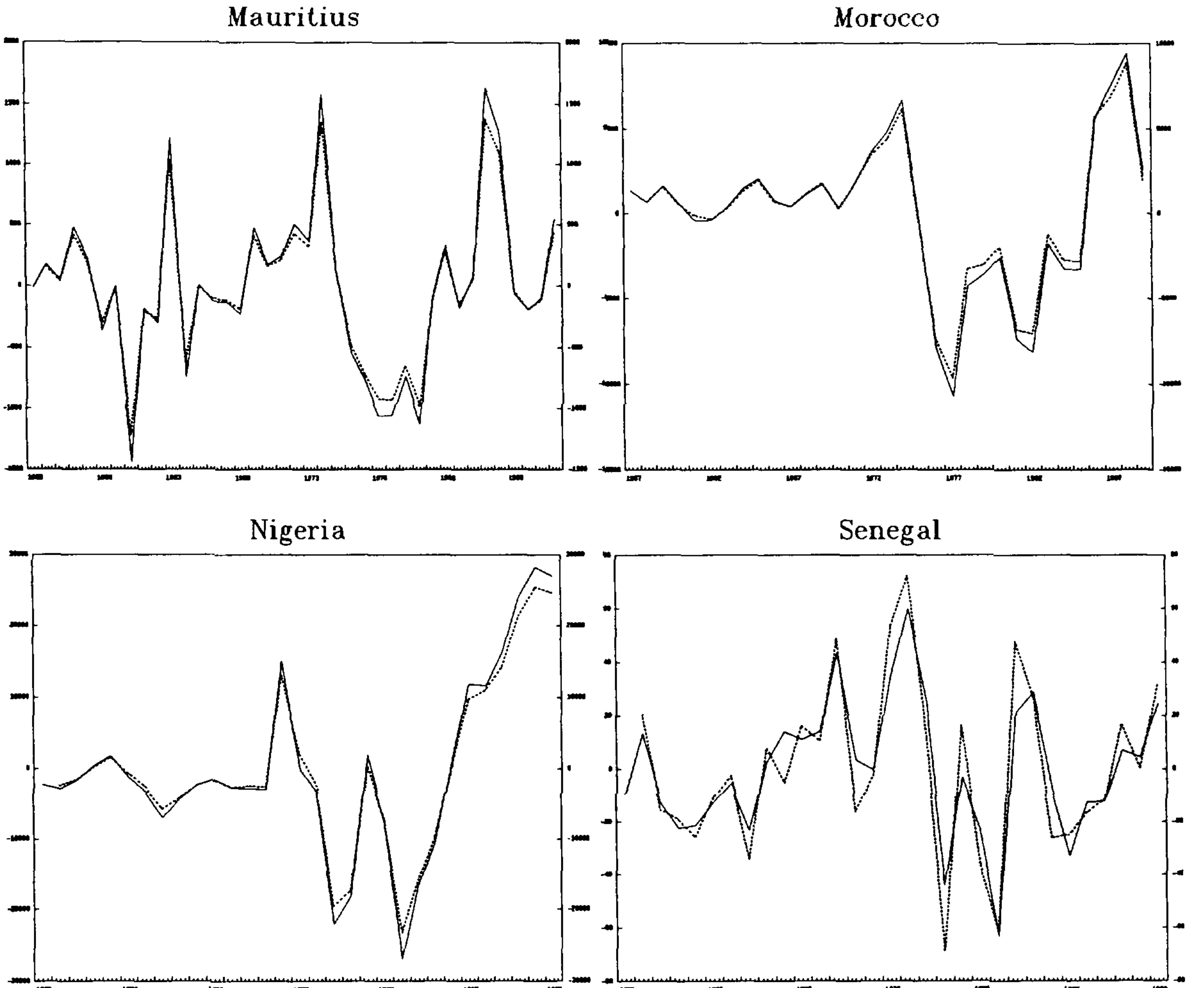
Predicted and Actual Current Account: Africa



— Actual - - Predicted

Chart 2

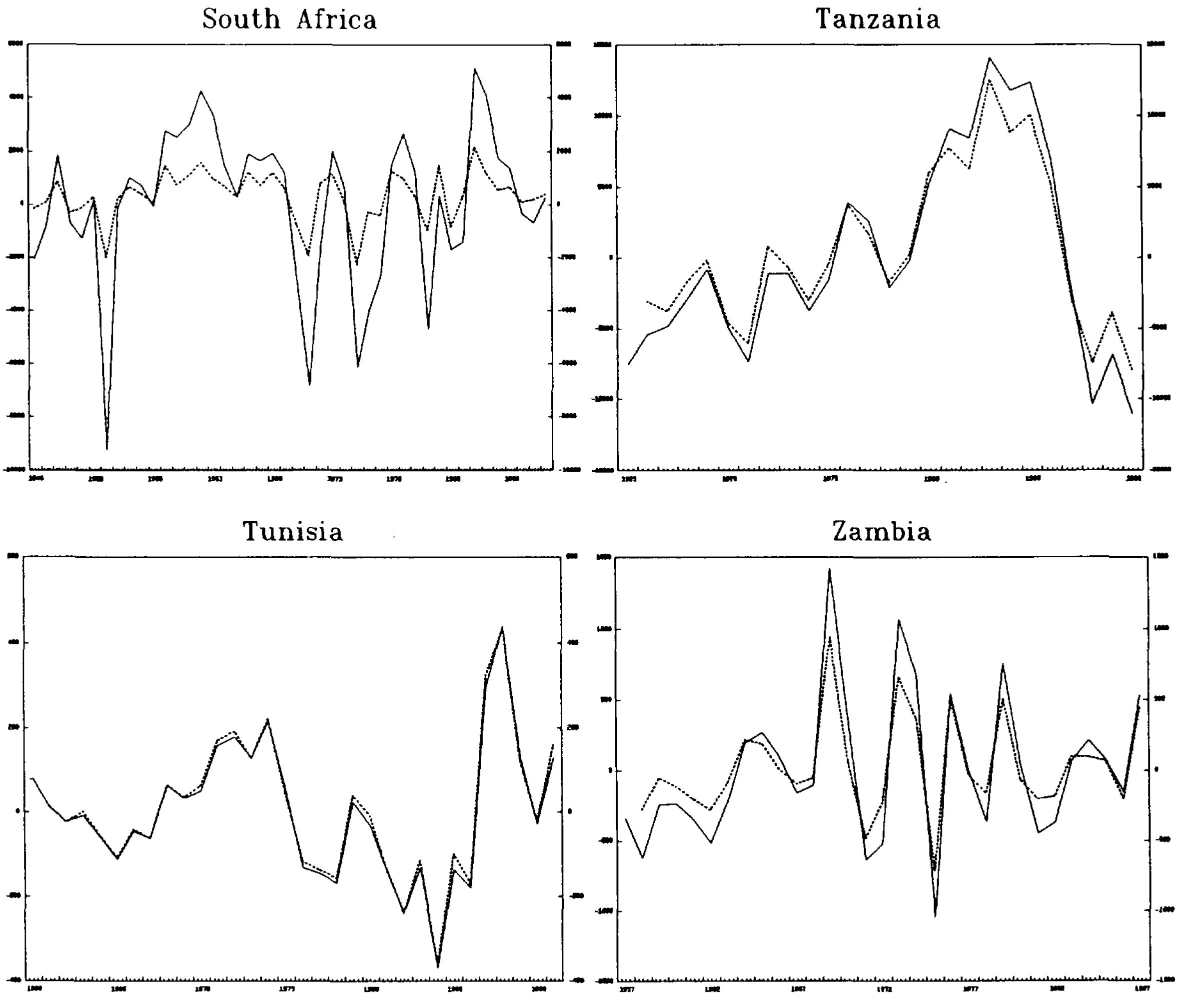
Predicted and Actual Current Account:
Africa (continued)



— Actual - - Predicted

Chart 3

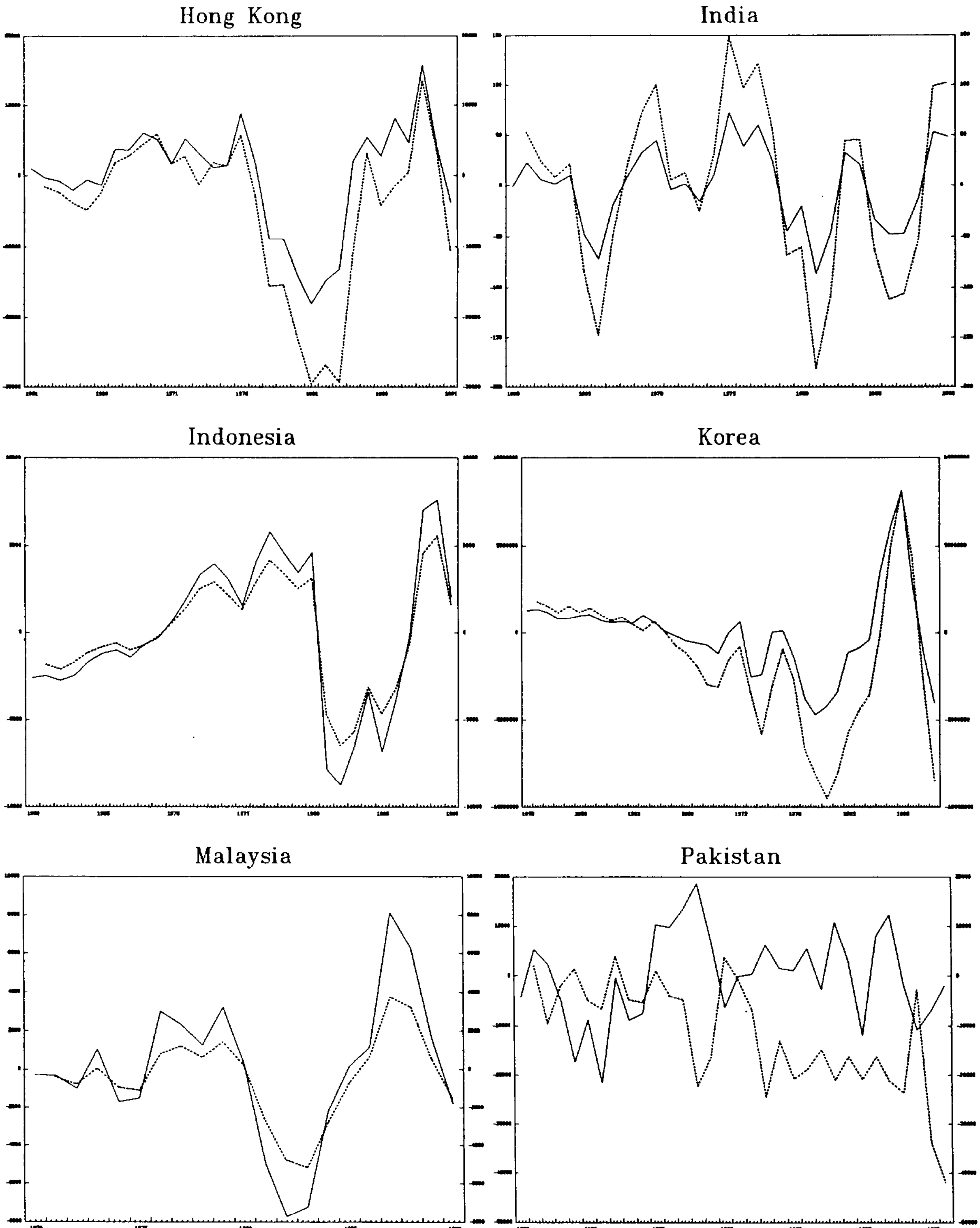
Predicted and Actual Current Account: Africa (concluded)



— Actual - - Predicted

Chart 4

Predicted and Actual Current Account: Asia

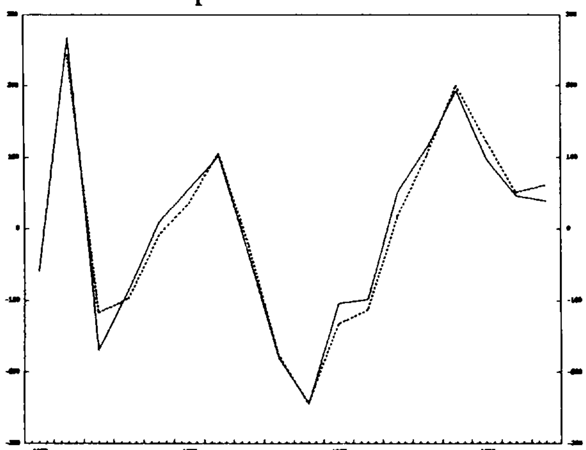


— Actual - - Predicted

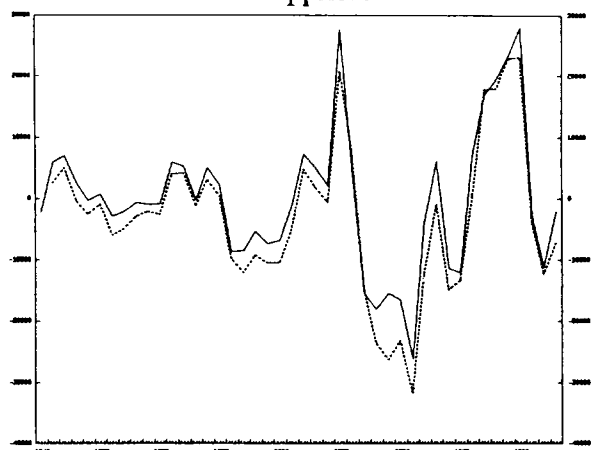
Chart 5

Predicted and Actual Current Account: Asia (continued)

Papua New Guinea

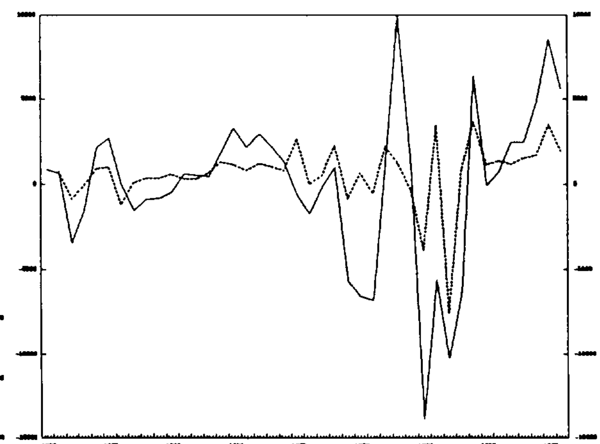


Philippines

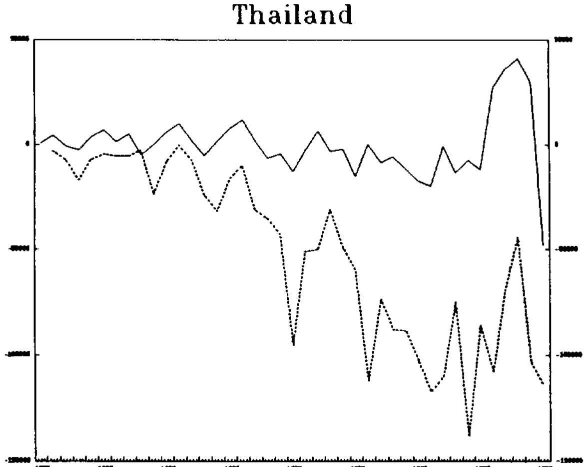


Singapore

Sri Lanka



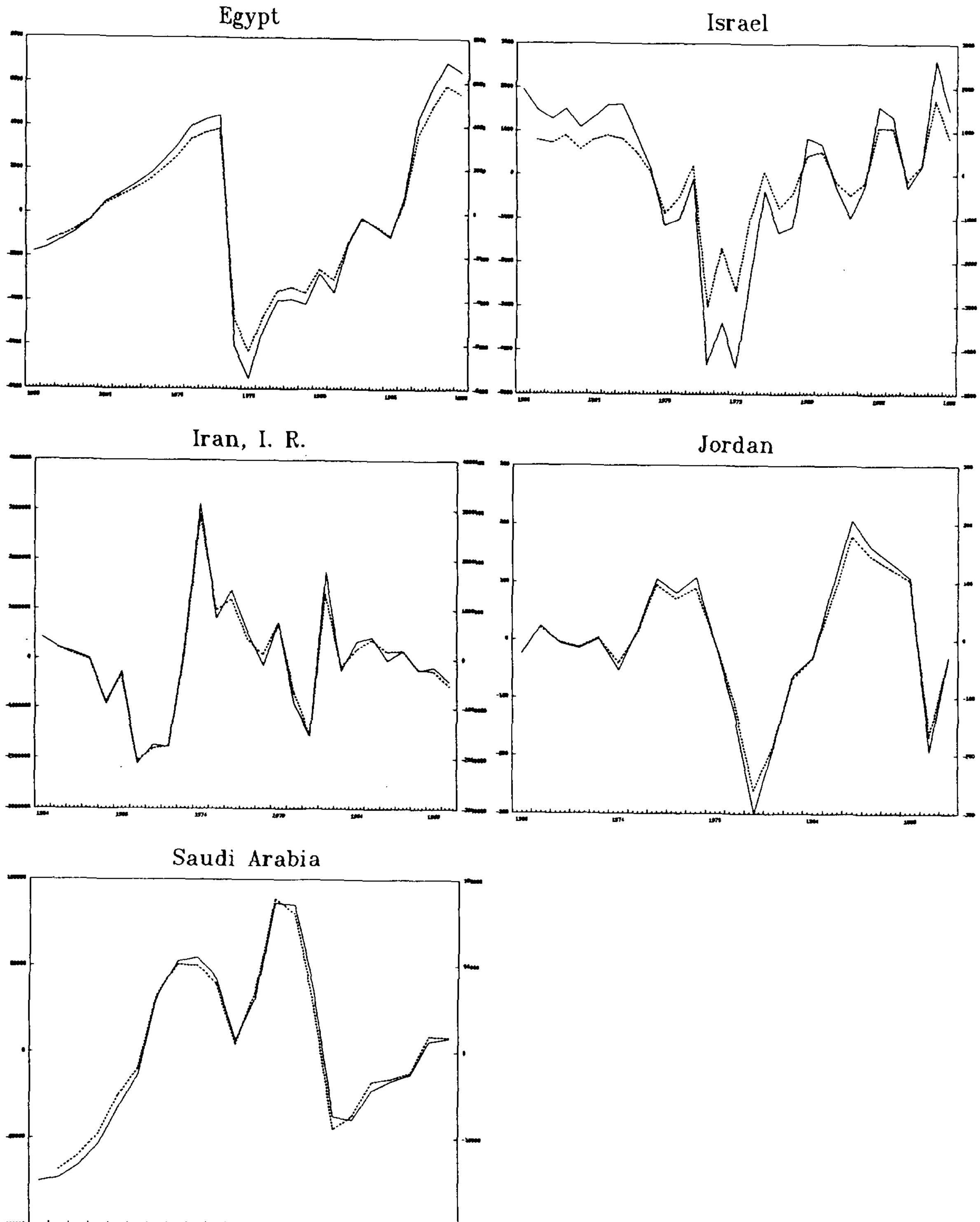
Thailand



— Actual - - Predicted

Chart 6

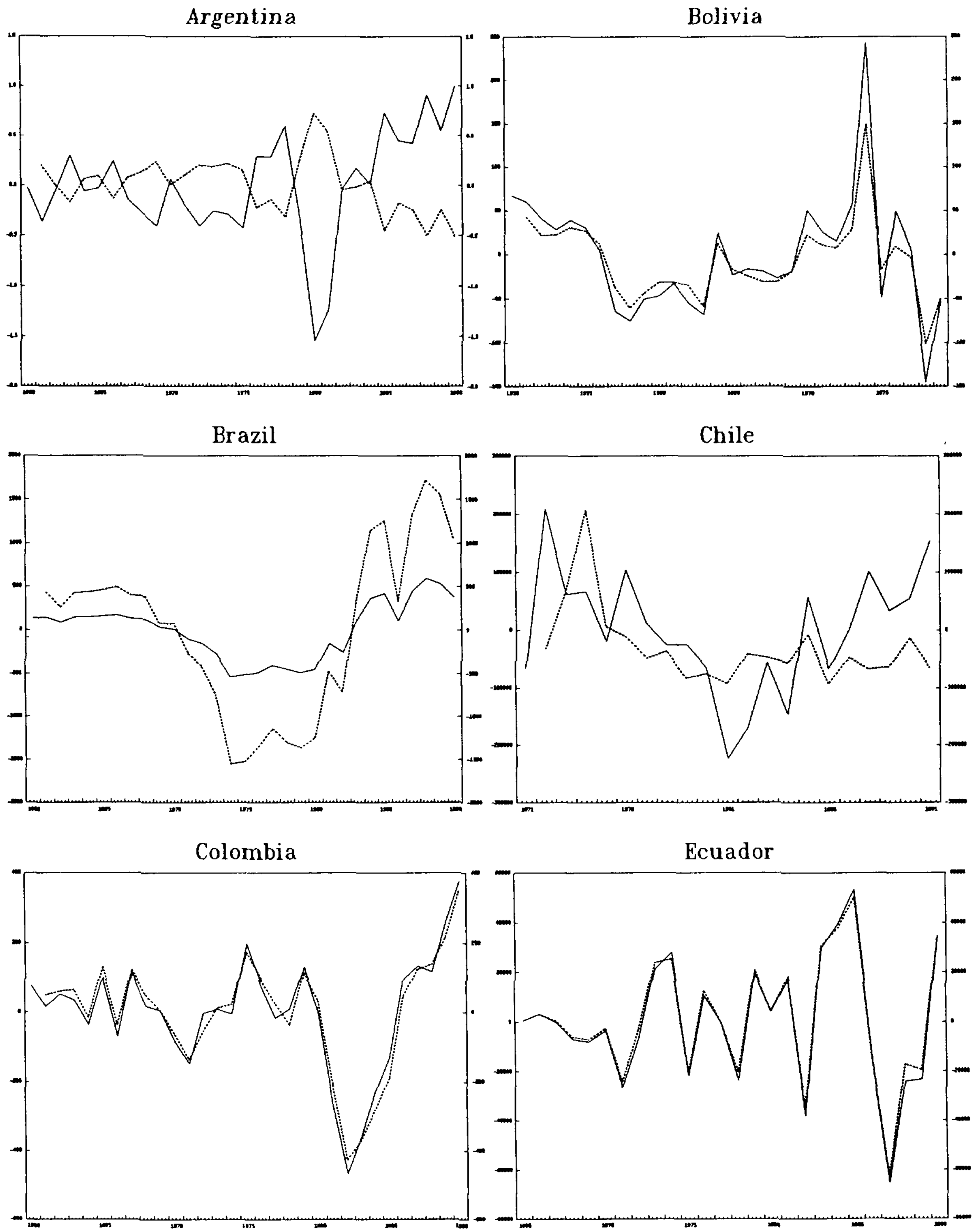
Predicted and Actual Current Account: Middle East



— Actual - - Predicted

Chart 7

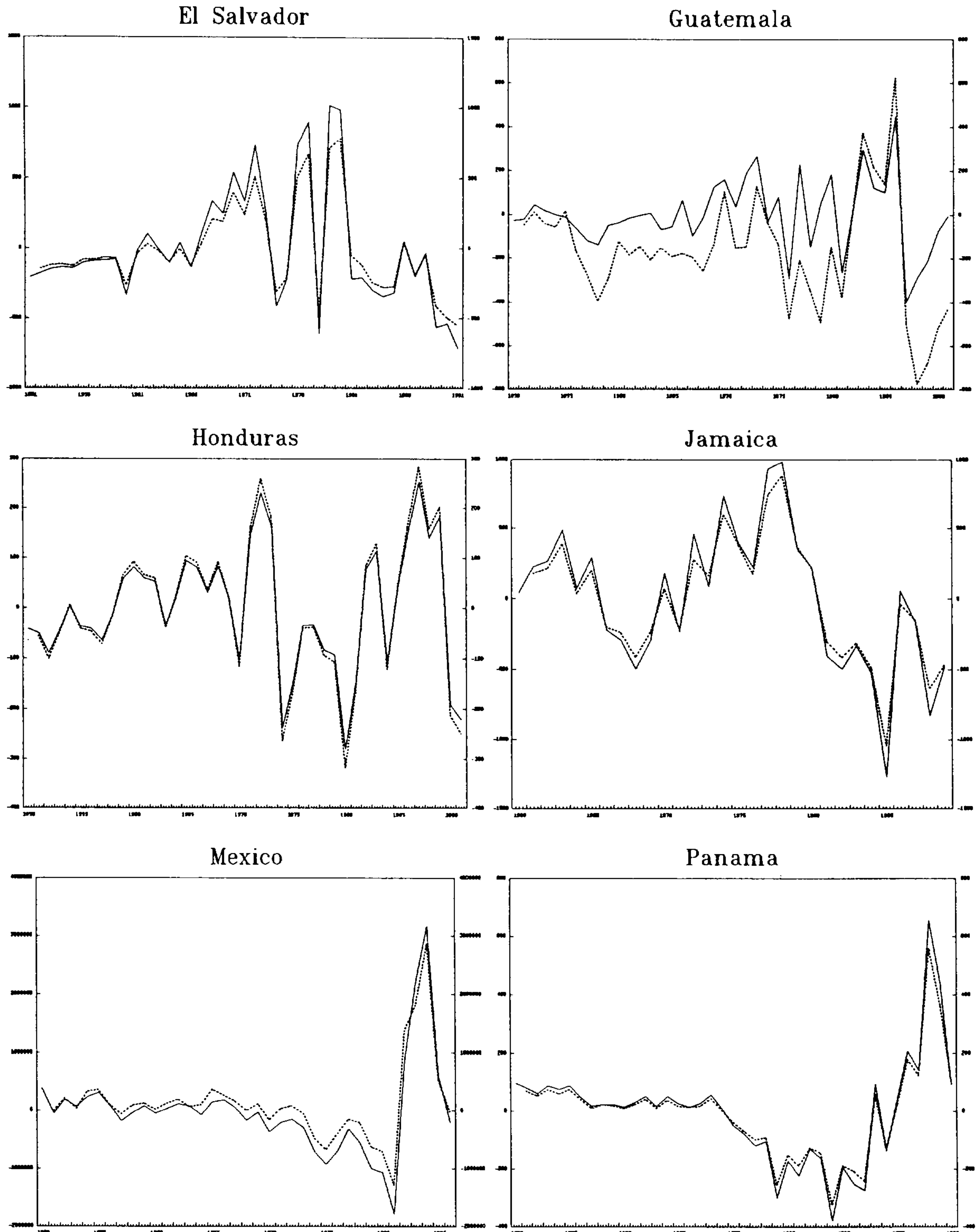
Predicted and Actual Current Account: Western Hemisphere



— Actual - - Predicted

Chart 8

Predicted and Actual Current Account: Western Hemisphere (continued)

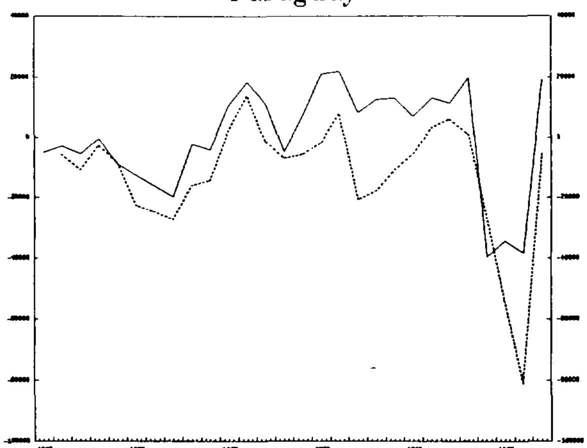


— Actual - - Predicted

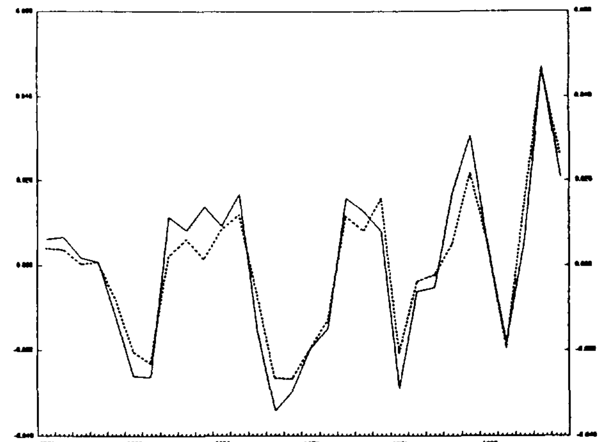
Chart 9

Predicted and Actual Current Account: Western Hemisphere (concluded)

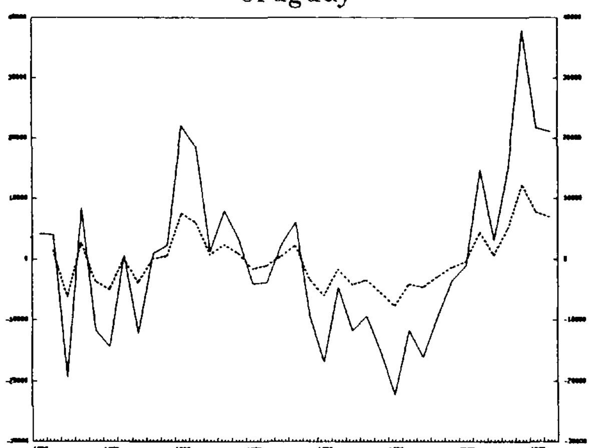
Paraguay



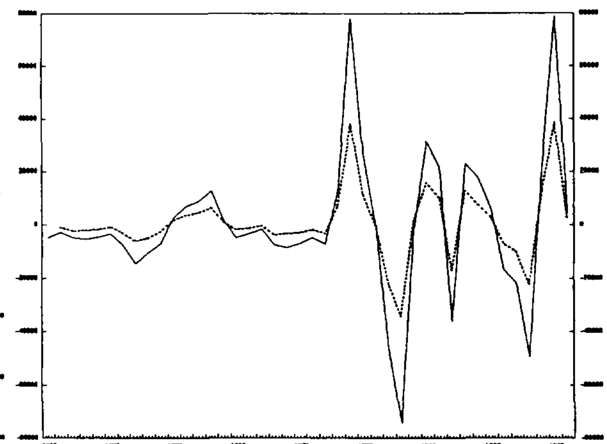
Peru



Uruguay



Venezuela



— Actual - - Predicted

section of developing countries, we found considerable support for the intertemporal model. Specifically, in line with Campbell's "saving for a rainy day" hypothesis applied to a closed economy, we found that in a majority of countries, the current account is a good predictor of future movements in national cash flow (output less investment less government expenditure). In addition, we found that the level and volatility of capital movements predicted on the basis of the consumption-smoothing model are very close to the actual level and volatility of such movements observed in the data, again reinforcing the view that capital flows in developing countries are largely determined by economic fundamentals and, in line with previous research using different analytical approaches, that effective capital mobility in developing countries may be quite high. These conclusions were supported for the vast majority of the countries in the sample, both using formal statistical testing of the model's restrictions, and through simple time series plots of the predicted and actual data.

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