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Asia and Pacific and Research Departments

Assessing External Sustainability in India

Prepared by Tim Callen and Paul Cashin[1]

Authorized for distribution by Christopher Towe and Peter Wickham

December 1999

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Abstract

This paper examines the solvency and sustainability of India's external imbalances and analyzes the optimality of its capital flows. We use three approaches: an intertemporal model of the current account that allows for capital controls; a composite model of macroeconomic indicators that yields probabilities of future balance of payments crises; and scenarios that examine the path of the current account consistent with the stabilization of India's external liability-to-GDP ratio. The results indicate that India's intertemporal budget constraint is satisfied and that the path of its current account imbalances is sustainable, with some support for the optimality (given capital controls) of its external borrowing.

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Keywords: capital controls, external sustainability, India.

Authors' E-Mail Addresses: tcallen@imf.org; pcashin@imf.org

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I. INTRODUCTION

An important issue facing borrowers and lenders in world capital markets is the ability of debtor countries to continue to run current account imbalances. Analysis of this issue typically involves answering three key questions: Is the debtor country solvent? Are its current account imbalances sustainable? Is the extent of international capital flows optimal? In this paper we assess external sector developments in India in relation to these questions.

India provides an interesting case study of these issues because while it has generally followed cautious external sector policies, with trade intervention and capital controls used extensively as instruments of balance of payments control and adjustment, it has nonetheless experienced several balance of payments crises. Most recently, in 1991 India came close to exhausting its external reserves before it entered into a program with the International Monetary Fund (IMF). Further, India's policy of restricting trade and capital flows may have entailed costs in terms of resources foregone. While there has been a considerable opening up of the Indian economy in recent years, it still retains one of the world's more restrictive trade regimes, while the inflow of foreign capital remains well below that received by other countries in the Asian region.

We adopt several different approaches to the examination of external sustainability. First, we estimate an intertemporal model of the current account to derive an estimate of the optimal path of the deficit. However, because the standard model assumes free capital mobility, which is unlikely to be applicable for India given the presence of capital controls, we extend the standard model to allow for constraints on capital flows. We then use this model as a benchmark to test for intertemporal solvency and the optimality of capital flows. Second, we examine the predictions of a composite model of external vulnerability indicators which generates probabilities of the occurrence of a balance of payments crises. Finally, we assess the sustainability of India's external position by examining long-run conditions for intertemporal solvency (the path of current account imbalances consistent with the stabilization of India's net external liabilities-to-GDP ratio).

Our results indicate that the path of India's current account deficits over the last four decades has been consistent with intertemporal solvency, but that the evidence on whether external borrowing has been optimal (in the context of the predictions of the intertemporal model) is mixed, although when we allow for the presence of capital controls there is some evidence of optimality. Interestingly, we find that the path of the current account prior to the 1991 balance of payments crisis was not consistent with intertemporal solvency. The composite model of early warning indicators also raised questions about sustainability during this period, yet the estimated probabilities of crisis have remained low since 1991. Finally, our examination of the long-run sustainability of external imbalances suggests that a current account deficit in the range of 1½ to 2½ percent of GDP could be sustainable depending on the rate of economic growth and the cost of external finance. The remainder of the paper is organized as follows. Section II provides an overview of external sector developments and

policies in India. Section III assesses the solvency, sustainability, and optimality of external imbalances in India, while Section IV provides some concluding comments.

II. Overview of External Sector Developments and Policies

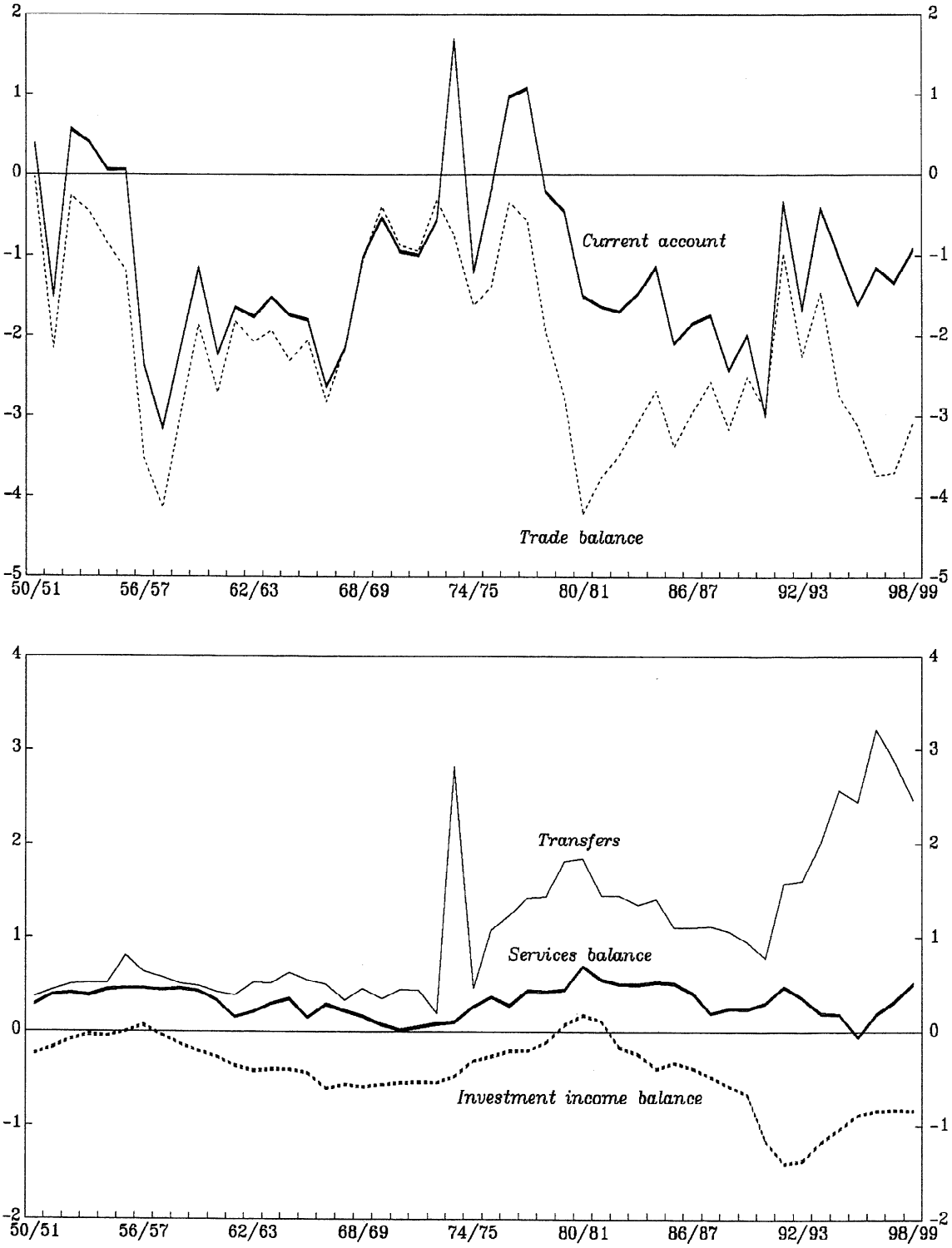
In this section we sketch the key external sector developments and policies in India since independence. Three broad periods are identified: (i) from independence to the end of the 1970s when the current account deficit widened sharply, but then returned to balance, and the deficits were mainly financed from concessional flows; (ii) the 1980s to 1991 when the first steps toward external liberalization began, but the current account deficit widened substantially and its financing moved toward shorter-term private debt financing; and (iii) the period since 1991 when more substantial steps toward liberalization occurred, the current account deficit narrowed, and capital flows shifted more toward equity financing.

In the period following independence, economic policies focused on the rapid industrialization of the economy with the aim of achieving economic self-sufficiency. This goal manifested itself in a trade system where imports were strictly controlled through comprehensive exchange controls and quantitative trade restrictions, which were supplemented by a complex tariff structure with high and differentiated rates across industries (Joshi and Little (1994)). Little emphasis was placed on promoting exports, and the inefficiency of domestic industry engendered by extensive protection and the overvalued exchange rate resulted in a distinct anti-export bias. However, by the 1960s, pressures on the external position led to a more supportive export environment, with the introduction of a number of export incentives and the devaluation of the rupee in June 1966.

The large investments in capital goods and other materials essential for industrialization, and the continuing need to import many essential consumer items, including food during periods of drought, resulted in strong import growth in the late 1950s and early 1960s. With export performance remaining poor, the trade deficit widened, and the current account deficit increased to around 2½ percent of GDP as the surplus on the invisibles account also narrowed (Figure 1, upper panel). However, improved export performance in the late 1960s and 1970s, aided by the expansion of world trade and a depreciation of the real exchange rate, led to an improvement in the current account position. While this was temporarily reversed in the aftermath of the oil price shock of 1973, a tightening of import controls and restraint of domestic expenditures quickly brought import growth down. Remittances also increased strongly during the 1970s as the number of Indians employed

Figure 1. India: Current Account Balance, 1950/51-1998/99

(In percent of GDP)



Source: Data provided by the Indian authorities.

in the oil-producing nations of the Middle East increased, and the current account position improved substantially, recording a surplus in a number of years during the second half of the 1970s. During this period the current account was almost entirely financed by concessional aid flows, which increased from 1 percent of GDP in the early 1960s to a peak of 2½ percent of GDP in the middle of the decade. Recourse was also made to IMF financing on several occasions. Private capital movements were limited, with foreign investment policy being marked by very tight regulation during the late 1960s and 1970s, particularly following the introduction of the Foreign Exchange Regulation Act (FERA) in 1973 (Kapur (1997)).

The 1980s witnessed a gradual deterioration in the current account position and a profound change in its financing. The second oil price shock in 1979 placed considerable pressure on the balance of payments. Imports rose, exports slowed in response to the world-wide recession and the appreciation of the real exchange rate, and the current account moved back into deficit. As reserves fell critically low, India entered into a program with the IMF in 1981. However, unlike after the first oil price shock, no significant current account adjustment followed, and with large macroeconomic imbalances developing in the second half of the 1980s, particularly a deterioration in public finances, the current account deficit rose to a peak of 3 percent of GDP in 1990/91.[2] While the trade deficit remained in the 2-2½ percent of GDP range, the surplus on the invisibles account narrowed and moved into a small deficit in 1990/91. Transfers, which peaked in 1980/81, declined during the decade, and with the onset of the crisis in the Gulf region fell to only ¾ percent of GDP in 1990/91. Investment income payments also rose as the structure of external financing shifted away from concessional finance toward higher-cost debt (Figure 1, lower panel).

The proportion of concessional debt in total external debt declined from over 80 percent in the early 1980s to under 45 percent by the late 1980s, mainly reflecting the widening of the current account deficit, as well as constraints on access to concessional funds. The additional financing came from private sources, mainly rupee and foreign currency deposits from nonresident Indians (NRIs), which were encouraged by attractive interest rates, and external commercial borrowing from international banks which was largely undertaken by public enterprises and used to finance projects in the oil, power, aluminum, steel, and transportation sectors, and for on-lending by official financial institutions (Figure 2, top panel). While foreign direct investment (FDI) increased slightly it remained a marginal source of funds, and portfolio investment was not permitted. The stock of external debt rose rapidly, from 11 to 31 percent of GDP between 1980/81 and 1991/92, with short-term debt representing around 10 percent of this total from the mid-1980s compared to negligible amounts pre-1980 (Figure 2, bottom panel). The debt-servicing ratio also increased to over 30 percent of exports of goods and services.

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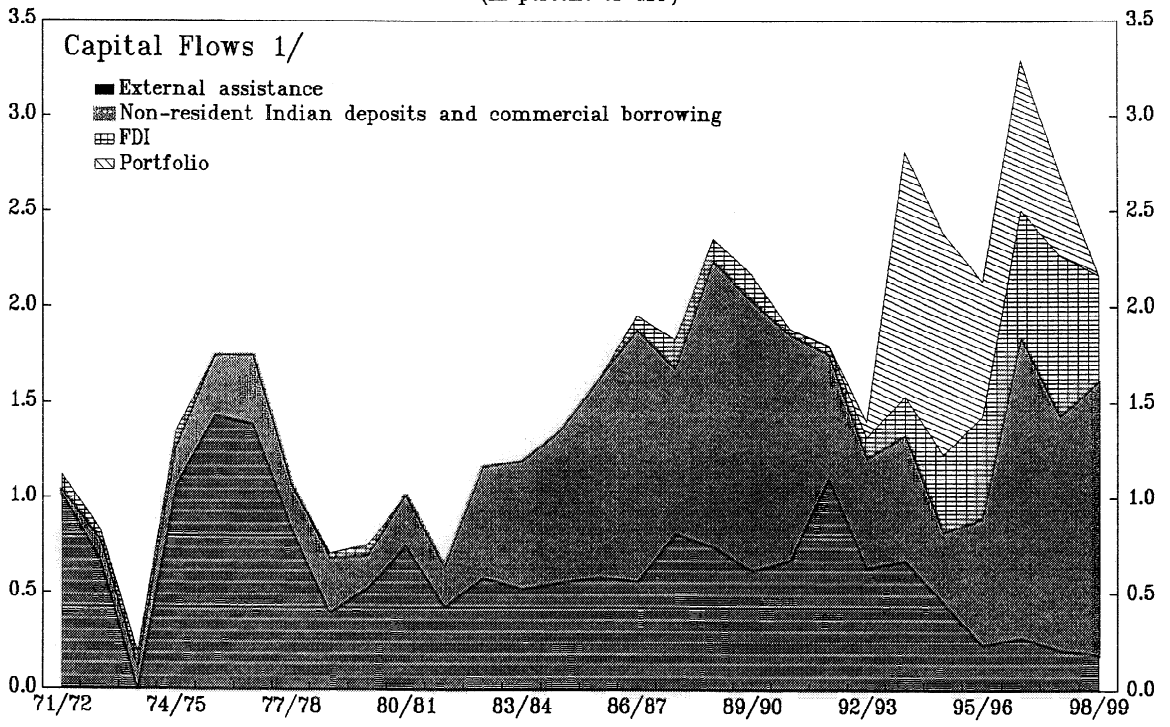
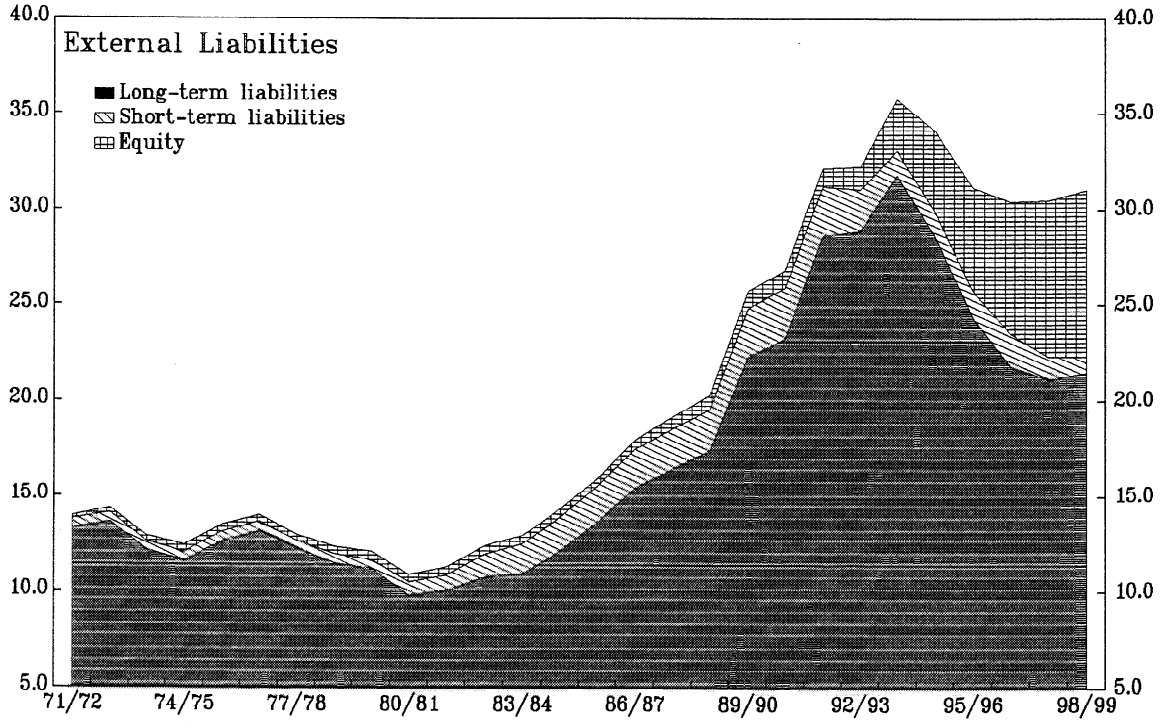
[2]The fiscal year in India runs from April 1 to March 31; accordingly, 1990/91 refers to the period from the beginning of April 1990 to end-March 1991.

Figure 2. India: Capital Flows and External Liabilities, 1971/72-1998/99

(In percent of GDP)





Sources: Data provided by the Indian authorities; and World Bank Global Development Finance Database.

1/ Not all components of the capital account are shown, hence, components do not sum to total capital flows.

These problems came to a head with a sovereign debt rating downgrade in October 1990 (subsequent downgrades followed in March and May 1991). The rollover of short-term loans became more difficult, and expectations of a depreciation of the rupee rose, leading to a loss of confidence among investors and a flight of NRI deposits out of the country. With the rise in oil prices and the decline in remittances following the crisis in the Gulf region, the external position became untenable. As reserves declined, India was brought to the brink of default in January 1991 (Jalan (1992)). This was avoided by purchases through the IMF's Compensatory Financing Facility (in January and July 1991) and by the adoption of an IMF program in October 1991.

The reforms implemented in the wake of the 1991 crisis have resulted in a more open external sector. Exports and imports have both risen as a share of GDP; exports have responded strongly to the liberalization measures and the decline in the real exchange rate, while imports have grown rapidly in response to strong domestic growth and the reduction in tariffs and quantitative restrictions. The current account deficit has been markedly smaller than in the 1980s, averaging only 1 percent of GDP. Although the trade deficit has deteriorated to around 3 percent of GDP, a strengthening in the invisibles balance has largely offset this as private transfers have risen strongly and the investment income balance has improved as world interest rates have fallen and the high-cost debt contracted in the 1980s has been repaid.

The financing of the deficit has also been much different in the 1990s than in the 1980s, with a shift away from short-term debt financing toward equity and longer-term debt flows. Restrictions on FDI and portfolio inflows have been eased, while the government has imposed minimum maturity limits on external commercial borrowing and removed the very attractive terms previously available on NRI deposits. Consequently, between 1991/92 and 1998/99, FDI accounted for 21 percent of total capital inflows and portfolio investment a further 25 percent, while the outstanding stock of external debt fell to around 22 percent of GDP. By end-1998/99, short-term debt (on a contracted maturity basis) accounted for only 4½ percent of the outstanding stock of external debt.

III. The Sustainability of India's External Imbalances

Three key, closely-related, questions are commonly asked in evaluating the implications of external imbalances:

- Is the debtor country solvent?

Solvency requires that the present discounted value of future current account surpluses equals the value of its existing net external liabilities—that is, a country is expected to generate sufficient earnings to repay all its external liabilities.

- Is the extent of international capital flows optimal?

Optimality of capital flows requires that in the face of shocks to net output, capital flows are used to smooth private consumption to ensure that no avoidable welfare losses are incurred.

- Are the current account imbalances sustainable?

Even if a debtor country is technically solvent, questions about the sustainability of its current account imbalances may arise if lenders perceive that the intertemporal falls in consumption implied by the path of the deficits raise doubts about the willingness of the country to meet its obligations. Sudden reversals of capital flows could result in a solvent external position becoming unsustainable ((Milesi-Ferretti and Razin (1996), Cashin and McDermott (1998)).

In this section we use several methodologies to examine these concepts of national creditworthiness as they pertain to India over the period 1952/53-1998/99. First, we estimate a consumption-smoothing model of the current account (which allows for the presence of capital controls) to derive the optimal current account deficit. We then use this optimal benchmark to assess the solvency and optimality of India's current account. However, because the standard consumption-smoothing model assumes free capital mobility, which is unlikely to be applicable for India given the presence of capital controls, we extend the model to allow for constraints on capital flows. Second, we assess the sustainability of India's external position by examining the predictions of both: a composite model of external vulnerability indicators, which generates the probabilities of the occurrence of balance of payments crises; and a model which sets out long-run conditions for intertemporal solvency (the path of current account imbalances consistent with the stabilization of India's external liabilities-to-GDP ratio).

A. Capital Controls and the Intertemporal Approach to the Current Account

The question as to whether a given current account position is appropriate can only really be answered within the context of a model that yields predictions about the optimal path of external imbalances and level of external liabilities. The most common such model is the intertemporal model of the current account, in which the current account is used to smooth consumption in the face of shocks to the economy.

The intertemporal approach to the current account is derived from the permanent income theory of consumption and saving. In the context of a small open economy with access to world capital markets, the permanent income theory implies that temporary shocks (which by definition have a larger impact on current resources than on lifetime resources) may lead to large fluctuations in national saving and the current account. As Sachs (1982) has pointed out, movements in the current account can be decomposed into two components. First, the consumption-*tilting* motive, whereby a country tilts its consumption toward the present or the future (driven by differences between the subjective discount rate and the

world real interest rate). Second, the consumption-*smoothing* motive, which smooths aggregate consumption in the presence of shocks to output, investment or government spending. It is the consumption-smoothing component of the current account which is the focus of much of the analysis in this section of the paper.

In deriving the intertemporal model of the current account, it is assumed that the representative consumer maximizes:

$$E_t \sum_{j=0}^{\infty} \beta^j u(c_{t+j}), \qquad 0<\beta<1, \tag{1}$$

where E_t is the expectations operator, c_t is private consumption at time t, $u(\bullet)$ is a separable utility function such that $u'>0$, $u''<0$, and β is the subjective discount factor.[3] The world real interest rate, r, is exogenously given, and the only traded asset is assumed to be a consumption-indexed bond with a fixed face value that pays net interest at the rate r between two periods. Letting b_t denote the economy's stock of net external liabilities at the beginning of period t, y_t real output (GDP), i_t real investment, g_t real government consumption, and Δ the first difference operator, the consumer's budget constraint can be written as:

$$\Delta b_{t+1} = rb_t - (y_t - c_t - i_t - g_t). \tag{2}$$

The representative consumer maximizes equation (1) subject to equation (2). Following Sheffrin and Woo (1990), Fisherian separability is assumed to hold so that in solving for the optimal path of consumption, output appears as stochastic returns to exogenously-determined investment (which can be optimally chosen to maximize the net present value of income). The government has access to lump-sum taxation to finance its expenditure, choosing a spending and taxation path that results in intertemporal solvency. The optimal level of consumption, c_t^*, is given by:

$$c_t^* = (r/\Theta)\left[-b_t + (1+r)^{-1} E_t\left(\sum_{j=0}^{\infty} (1+r)^{-j} z_{t+j}\right)\right] \tag{3}$$

where $\Theta = \beta r(1+r)/[\beta(1+r)^2-1]$ and $z_t = y_t - i_t - g_t$ is known as national cash flow (GDP net of investment and government expenditure). Along the optimal path, private consumption depends on net wealth (the present discounted value of the expected future stream of cash flows) and the existing stock of net external liabilities. The consumption-tilting parameter, Θ,

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[3]For the purpose of the empirical implementation, a quadratic utility function is chosen ($u(c_t) = c_t - c_t^2/2$, which requires that $c_t<1$ for the marginal utility of consumption to remain positive) and the 'no Ponzi games' constraint is imposed. The quadratic approximation ensures that $u'''(\bullet)=0$, which implies that the optimal path for consumption is invariant to uncertainty over future consumption or the variability of income.

reflects the consumption-tilting dynamics of consumption which may arise if there is a divergence between the world interest rate and the domestic rate of time preference ($r \neq (1-\beta)/\beta$). The consumption-tilting component of the current account is the current account that would occur if national cash flow was at its permanent level (implying there would be no need to smooth consumption across time).

On a national accounts basis the current account equals gross national product (GDP plus interest income on the outstanding stock of financial assets, $y_t + rb_t$), net of private and public expenditure ($c_t + i_t + g_t$). If we define the consumption-smoothing component of the current account as $CA_t^* = z_t - \Theta c_t^* - rb_t$ and given that the current account equals the accumulation of net external liabilities ($b_{t+1} - b_t$), then after manipulations using equations (2) and (3) the consumption-smoothing component of the current account is given by:[4]

$$CA_t^* = -E_t \left[\sum_{j=1}^{\infty} (1+r)^{-j} \Delta z_{t+j} \right]. \qquad (4)$$

The consumption-smoothing component of the current account is the current account that would occur if a country was neither more nor less impatient to consume than the rest of the world (that is, its domestic rate of time preference equaled the world real interest rate). Equation (4) shows that the current account acts as a buffer to smooth consumption in the presence of temporary disturbances to national cash flow. The current account will be in deficit when future changes in national cash flow are expected to be positive (reflecting temporary adverse shocks to cash flow), so that future output is transferred to the present (by external borrowing) to smooth the path of consumption. For example, a temporary adverse shock to exports implies that expected future cash flows will be higher, and that the

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[4]Given that the current account is composed of smoothing and tilting components, the tilting component is equal to $(\Theta - 1)\, c_t^*$. This (nonstationary) component, which results from such factors as shifting demographics, is removed to construct the consumption smoothing (stationary) component of the current account. This is necessary to ensure the validity of the statistical tests reported later.

consumption-smoothing component of the current account deficit will widen.[5] In contrast, permanent shocks, which by implication have no effect on expected changes in the cash flow variable, will have no impact on the current account. The following subsections set out our empirical approach to analyzing whether India's current account imbalances are consistent with consumption-smoothing behavior.

Estimating consumption-tilting

The first step in our empirical analysis is to obtain an estimate of Θ, the consumption-tilting parameter, in order to construct the stationary consumption-smoothing component of the current account by removing the nonstationary component of the current account series associated with consumption tilting.[6] Since consumption tilting has implications for the current account that are entirely distinct from consumption smoothing, it is important to ensure that the optimal consumption-smoothing component of the current account derived from equation (4) is only compared to that component of the current account that relates to

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[5]From equation (4), the optimal level of capital flows is that which allows rational agents to fully smooth their consumption in the presence of shocks to output net of investment and government spending. Output temporarily below its long-run discounted average (that is, its expected annuity value at the prevailing interest rate), or investment or government spending temporarily above its long-run discounted average, all else held constant, will each result in agents smoothing consumption by borrowing foreign savings (running a higher current account deficit), rather than lowering contemporaneous consumption.

[6]National accounts data for 1950/51-1998/99 are used in the empirical work in this section. Hence the estimates of the actual current account differ slightly from those in other sections, which are on a balance of payments basis. Further, while the CSO has recently released revised national accounts data (rebased to 1993/94), we have chosen to use the old series in the estimation work given the lack of a comprehensive breakdown on the expenditure side of the accounts in the new data. The old series was updated for the most recent years by applying growth rates from the new series. As the revised series raised the estimated level of nominal GDP by around 10 percent relative to the old series, the ratios to GDP presented in this section need to be scaled down by about 10 percent to achieve ratios consistent with those in other sections. All nominal series were deflated by the implicit GDP deflator. Consistent with earlier work by Sheffrin and Woo (1990), r was set at 4 percent for all calculations reported below.

consumption smoothing, and not to the actual current account (which potentially includes *both* consumption-smoothing and consumption-tilting components).[7]

The smoothed component of the current account ($\hat{CA}_t^{sm}$) is defined by the residuals of the cointegrating relationship between private consumption (c_t) and national cash flow (including transfers from abroad) less payments on the outstanding stock of foreign liabilities ($z_t' - rb_t$).[8] [9] This cointegrating relationship was estimated using the Phillips and Hansen (1990) Fully Modified (FM) method, which yields an asymptotically correct variance-covariance estimator when estimating cointegrating vectors in the presence of serial correlation and endogeneity. To confirm the regression was cointegrated, the Phillips and Ouliaris (1990) $Z(t)$ residual-based cointegration test was employed, and the null hypothesis of no cointegration between national cash flow and consumption could be rejected at the 5 percent level of significance.[10] In addition, the stability of the relationship between these two variables was examined using Hansen's (1992) tests of parameter stability (mean-F, sup-F, and Lc). The null hypothesis of constant parameters in the FM cointegrating regression (that is, a stable relationship between national cash flow and consumption) is not rejected.[11]

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[7]Without an explicit model of intergenerational welfare it is not possible to decide whether deferring/bringing forward consumption (that is, consumption tilting) is desirable. However, as long as the economy's objective function is of a form like equation (1), there will be avoidable deadweight costs from a failure to smooth consumption.

[8]In India, transfers from abroad are an important component of income available for domestic consumption. So while in the standard set-up of the intertemporal model transfers are usually excluded from the definition of national cash flow (see, for example, Obstfeld and Rogoff, (1996)) we include them here in cash flow (z_t') for the test of intertemporal solvency. Hence, the measure of income used is consistent with the concept of gross national income.

[9]Phillips-Perron (1988) unit root tests (with an intercept) reveal that ($z_t' - rb_t$) and c_t are I(1), as is z_t. Accordingly, the possibility of cointegration exists. The first differences of ($z_t' - rb_t$), c_t and z_t had Phillips-Perron test values of -6.484, -6.405 and -7.058, respectively; the 5 percent critical value for t=50 observations is -2.93. The lag length for the Phillips-Perron test was determined using the Bartlett kernel and the automatic bandwidth selector developed by Andrews (1991).

[10]The Phillips-Ouliaris (1990) cointegration test result was -4.39; the 5 percent critical value for this test (with an intercept) is -3.37. Both the Phillips-Hansen FM estimation method and the Phillips-Ouliaris cointegration test were computed using the Bartlett kernel and the automatic bandwidth selector developed by Andrews (1991).

[11]Hansen's (1992) mean-F, sup-F and Lc tests have values of 3.86, 7.28 and 0.33; the relevant critical values at the 5 percent level of significance are 4.57, 12.4 and 0.58, respectively.

From the cointegrating regression of $(z_t' - rb_t)$ on c_t an estimate of the consumption-tilting parameter, Θ, of 0.967, with a long-run standard error of 0.006 was obtained, implying that India has consumed more than its permanent cash flow. This estimate is similar in magnitude to the 0.95 obtained for India by Ghosh and Ostry (1995), but is higher than their estimates of Θ for most other developing countries with current account deficits. From the estimate of Θ, and given an exogenous world real interest rate of 4 percent, an estimate of the Indian rate of time preference ($(1-\beta)/\beta$) of 4.14 percent for the sample period can be derived.

The stationary (consumption-smoothing) and nonstationary (consumption-tilting) components of the current account deficit are separated out and presented in Figure 3. It is notable that the consumption-smoothing component of the current account has been in surplus for most of the sample period, excepting the late 1980s. As expected, with the estimate of Θ less than one, India's consumption-smoothing current account deficit is smaller than its actual current account deficit. The trend (consumption-tilting) component of the current account is proportional to net wealth, and has been expanding steadily over the sample period. This is consistent with India's rate of time preference being above the world real interest rate, and its desire to tilt consumption into the present.

Solvency of capital inflows to India

The above cointegration results have implications for determining the solvency of capital inflows to India, given that the consumption-smoothing model has as a maintained hypothesis that countries remain intertemporally solvent. The current account deficit is formed as the difference between national cash flow (including transfers from abroad) net of payments on the outstanding stock of external liabilities, $(z_t' - rb_t)$, and private consumption, c_t. As both c_t and $(z_t' - rb_t)$ are I(1) variables, cointegration between c_t and $(z_t' - rb_t)$ is a necessary and sufficient condition for satisfaction of the intertemporal budget constraint (Hakkio and Rush (1991)). If these two variables are cointegrated, then over the long run, consumption cannot deviate too far from movements in the available resources of the economy (as described by $(z_t' - rb_t)$). As the cointegration test of the previous subsection rejected the null hypothesis of no cointegration between c_t and $(z_t' - rb_t)$, this indicates that capital inflows to India were not in breach of the solvency condition over the 1952/53-1998/99 period.

While the intertemporal budget constraint is satisfied over the full sample period, it is interesting to examine whether it was satisfied in the period prior to the 1991 balance of payments crisis. Accordingly, the Phillips-Ouliaris cointegration test (with an intercept) was employed over the subperiod 1952/53-1990/91—the test result was -1.655—implying the null hypothesis of no cointegration between national cash flow (net of payments on liabilities) and consumption could not be rejected at the 5 percent level of significance. This indicates that during this period, movements in the path of private consumption tended to deviate from movements in the available resources of the economy. Accordingly, under unchanged policies, capital inflows during this period were not consistent with the satisfaction of India's intertemporal budget constraint, and the return to smaller current account deficits during the 1990s has been needed to re-establish solvency.

Figure 3. India: Current Account Balance, Consumption-Smoothing and Consumption-Tilting Components, 1952/53-1998/99

(Bns. of 1990 rupees)

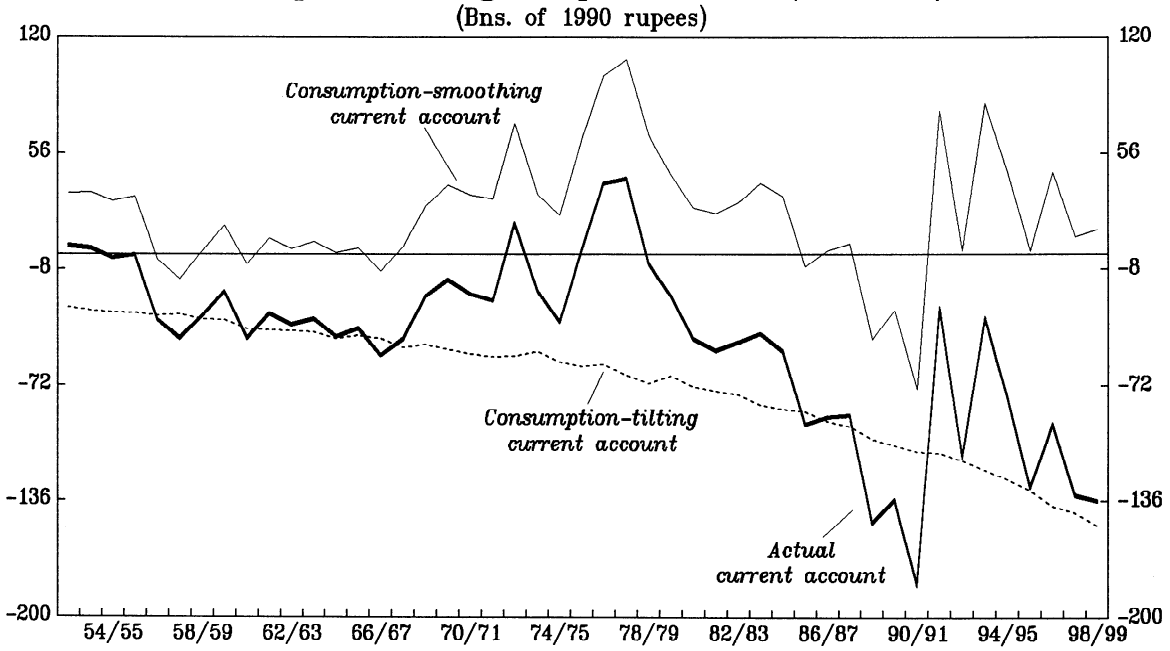
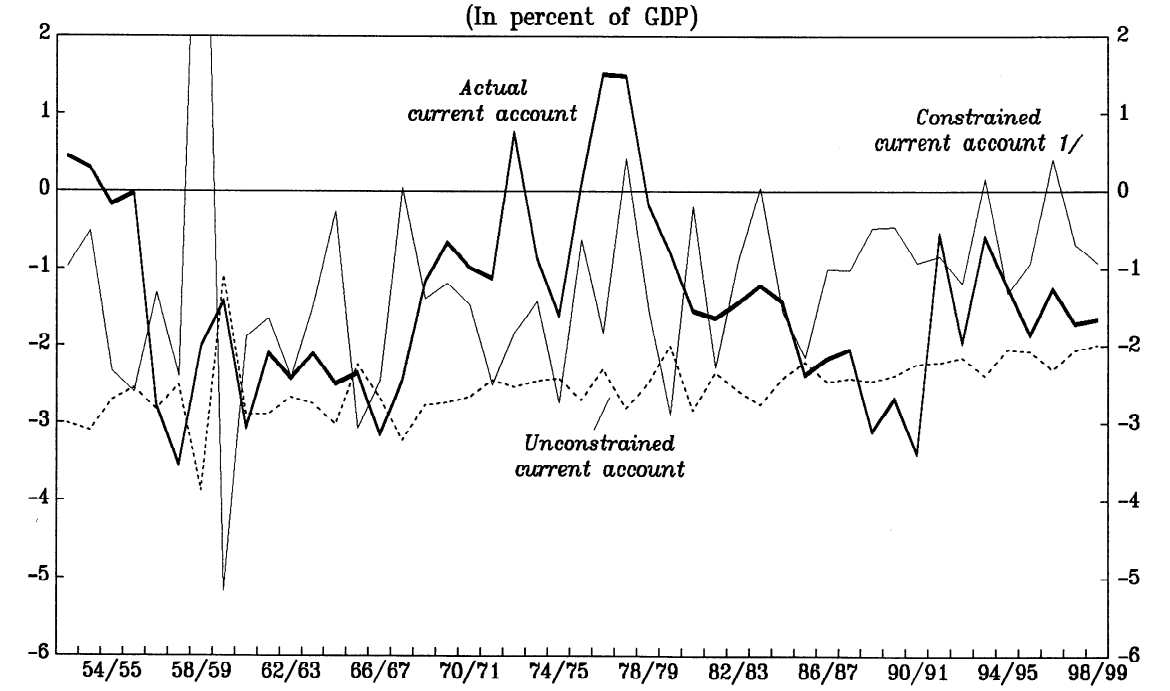


Figure 4. India: Current Account Balances, 1952/53-1998/99

(In percent of GDP)



Sources: Data provided by the Indian authorities; and IMF staff calculations.

1/ Figure for 1958/59 is 6.8 percent of GDP.

Consumption-smoothing with and without capital controls

A test of the relevance of the consumption-smoothing hypothesis set out in equation (4) requires some means to measure the expected changes in national cash flow. That is, the derivation of the optimal (consumption-smoothing) current account requires a measure of anticipated future changes in national cash flow. One approach is to use current and lagged changes in national cash flow to predict future changes in national cash flow. In addition, and following Campbell and Shiller (1987), under the null hypothesis that consumption-smoothing holds, then the smoothed current account itself reflects all available information about the future evolution of national cash flow. This proxy of the expected values in equation (4) can formally be accomplished by estimating a bivariate autoregressive (VAR) model of current and lagged values of the consumption-smoothing component of the current account ($\hat{CA}_t^{sm}$) and current and lagged changes in national cash flow (Δz_t) of the form: $W_t = AW_{t-1} + \epsilon_t$, where $W_t = (\Delta z_t \; \hat{CA}_t^{sm})'$, ϵ_t is a 2×1 vector of disturbance terms, and A is a 2×2 matrix of coefficients. With the estimate of A from the VAR model and using the fact that $E_t[W_{t+j}] = A^j W_t$, an estimate of the optimal consumption-smoothing component of the current account can be computed as:

$$\hat{CA}_t^* = [-1 \;\; 0]\left[(1+r)^{-1}\hat{A}\right]\left[I_2 - (1+r)^{-1}\hat{A}\right]^{-1} W_t \equiv \hat{\Gamma} W_t \qquad (5)$$

where I_2 is the 2×2 identity matrix.[12] The values of $\hat{CA}_t^*$ (derived from equation (5)) can then be compared to $\hat{CA}_t^{sm}$ to determine the extent to which the consumption-smoothing component of India's current account imbalances is consistent with optimizing behavior.

An important limitation of the standard consumption-smoothing model for analyzing the sustainability of current account imbalances in India is its assumption of unfettered access to world capital markets, as controls on capital movements are an important component of India's external sector policy. While a number of studies have suggested that the degree of effective capital mobility in developing countries is higher than generally supposed because of widespread evasion of capital controls, Montiel (1994) finds that capital controls have been relatively effective in India. In this situation, deviations of current account imbalances from an

[12]Expression (5) is valid as long as the infinite sum in equation (4) converges. This requires that the variables appearing in the W matrix of the VAR system be stationary. Assuming that z_t is I(1), then Δz_t will be I(0) and since under the null hypothesis the smoothed current account is a discounted sum of Δz_t, then it will also be I(0).

optimal benchmark derived on the assumption of free capital mobility could simply reflect the presence of capital controls.[13]

Accordingly, we take up the suggestion of Kent (1997) and extend the consumption-smoothing model to allow for asymmetric behavior on the part of economic agents in seeking to respond to temporary shocks to national cash flow. Specifically, we assume that agents are constrained from responding to a temporary reduction in national cash flow (that is, there are restrictions on capital inflows so they are unable to access external finance to smooth consumption), but are able to respond to a temporary increase in national cash flow (that is, there are no restrictions on capital outflows to smooth consumption). We test the extent to which capital controls affect the current account through the constraints imposed on the ability to smooth consumption.[14]

To implement the constrained consumption-smoothing model, the smoothed current account ($\hat{CA}_t^{sm}$) is broken into two separate components as follows:

$$\hat{CA}_t^{smP} = D_t^P \hat{CA}_t^{sm} \quad \text{where} \quad D_t^P = \begin{cases} 1 \text{ if } \hat{CA}_t^{sm} > 0 \\ 0 \text{ if } \hat{CA}_t^{sm} \leq 0 \end{cases}$$

$$\hat{CA}_t^{smN} = D_t^N \hat{CA}_t^{sm} \quad \text{where} \quad D_t^N = \begin{cases} 1 \text{ if } \hat{CA}_t^{sm} < 0 \\ 0 \text{ if } \hat{CA}_t^{sm} \geq 0 \end{cases} \tag{6}$$

where $\hat{CA}_t^{smP}$ ($\hat{CA}_t^{smN}$) equals $\hat{CA}_t^{sm}$ when $\hat{CA}_t^{sm}$ is positive (negative) and $\hat{CA}_t^{smP}$ ($\hat{CA}_t^{smN}$) is zero otherwise.[15] The variables Δz_t^P and Δz_t^N are defined similarly. It is expected that credit constraints will limit the ability of agents to smooth through temporary adverse shocks to national cash flow, so that $\hat{CA}_t^{smP}$ will Granger-cause (help predict) future changes in national cash flow, but that $\hat{CA}_t^{smN}$ will not.

To examine this revised hypothesis we estimate a four-variable VAR of current and lagged values of the consumption-smoothing component of the current account ($\hat{CA}_t^{smP}$ and $\hat{CA}_t^{smN}$) and current and lagged changes in national cash flow (Δz_t^P and Δz_t^N) of the form $X_t = \Psi X_{t-1} + \varepsilon_t$, where $X_t = (\Delta z_t^P \; \Delta z_t^N \; \hat{CA}_t^{smP} \; \hat{CA}_t^{smN})'$, ε_t is a 4×1 vector of disturbance terms, and Ψ is a 4×4 matrix of coefficients. With the estimate of Ψ from the VAR and using

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[13]The presence of capital controls may also affect agents' ability to tilt consumption given their lack of access to world capital markets.

[14]Given that controls on outflows exist, this is still not an ideal characterization of India's capital account regime.

[15]$\hat{CA}_t^{smP}$ ($\hat{CA}_t^{smN}$) indicate periods when national cash flow is temporarily high (low).

the fact that $E_t[X_{t+j}] = \Psi^j X_t$, an estimate of the constrained (optimal) consumption-smoothing component of the current account can be expressed as a nonlinear function of the VAR parameters:

$$\begin{aligned} \hat{CA}_t^{**} &= -[1\ 1\ 0\ 0]\left[(1+r)^{-1}\hat{\Psi}\right]\left[I_4 - (1+r)^{-1}\hat{\Psi}\right]^{-1} X_t \equiv \hat{\Phi} X_t \\ &\equiv \left[\hat{\Phi}_{\Delta z^P}\ \hat{\Phi}_{\Delta z^N}\ \hat{\Phi}_{\hat{CA}^{smP}}\ \hat{\Phi}_{\hat{CA}^{smN}}\right] X_t \end{aligned} \tag{7}$$

where I_4 is the 4×4 identity matrix. The constrained current account ($\hat{CA}_t^{**}$) of equation (7) is the optimal (smoothed) current account, given the presence of capital controls. In contrast, the unconstrained current account ($\hat{CA}_t^{*}$) of equation (5) is the optimal (smoothed) current account, given an absence of restrictions on capital flows. The validity of the constrained consumption-smoothing hypothesis can be tested by comparing $\hat{CA}_t^{sm}$ (the estimated smoothed current account) with $\hat{CA}_t^{**}$ to determine the extent to which the consumption-smoothing component of India's current account imbalances can be explained by optimizing behavior in the presence of capital controls.

Empirical results: optimality of capital inflows to India

A testable implication of the constrained consumption-smoothing model is that the detrended component of the constrained current account should Granger-cause (help predict) subsequent changes in national cash flow (Ghosh (1995)). A current account deficit today should signal that an increase in future cash flows is expected, associated (for example) with an expected reduction in future expenditure on government consumption. A standard F-test of the null hypothesis of no Granger causality from $\hat{CA}_t^{smP}$ and $\hat{CA}_t^{smN}$ to Δz_t^P and Δz_t^N is rejected at the 5 percent level—it has a value of 13.197 and a p-value of 0.000. The results of the Granger causality tests are consistent with the existence of important asymmetries in the effects of credit constraints on consumption smoothing, in that $\hat{CA}_t^{smP}$ and $\hat{CA}_t^{smN}$ jointly Granger cause (help predict) Δz_t^P and Δz_t^N. This is in contrast to the standard (unconstrained) consumption-smoothing model, which fails to reject the null hypothesis of no Granger causality from to $\hat{CA}_t^{sm}$ to Δz_t.[16] Clearly, the positive and negative (detrended) components of the constrained current account are a superior signal of future movements in national cash flow than the detrended component of the standard (unconstrained) current account.

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[16]For the standard (unconstrained) model, an F-test of the null hypothesis of the absence of Granger causality from $\hat{CA}_t^{sm}$ to Δz_t is not rejected at the 5 percent level—it has a value of 1.361 and a p-value of 0.250. This failure of the standard consumption-smoothing model indicates that economic agents extract little or no additional information about the evolution of national cash flow than they observe from lagged values of the variable itself.

The actual current account, and estimates of the standard (unconstrained) and constrained current account (in the latter two cases, after adding back the consumption-tilting component of the current account to $\hat{CA}_t^*$ and $\hat{CA}_t^{**}$, respectively), are shown in Figure 4. As noted in Section II, the actual current account has been in deficit in most years of the sample, excepting the early-1950s and mid-1970s. The unconstrained deficit has typically been larger than the actual and constrained deficits, indicating that in the absence of constraints on capital flows, a larger deficit (implying more external borrowing) would have been appropriate to smooth consumption in the presence of shocks to national cash flow. Such borrowing was most likely inhibited by the presence of binding capital controls—this issue is examined further below (see Chopra et al. (1995)). Since the mid-1980s, the constrained current account deficit has typically been smaller than the actual deficit, with the difference between them narrowing in the 1990s.[17] Of interest is the growth in the actual deficit during the 1980s—by the end of the decade the actual deficit exceeded both the unconstrained and constrained deficits. This is indicative of external borrowing in excess of that predicted by the standard and constrained versions of the consumption-smoothing model. As outlined in Section II, this excessive borrowing was corrected in the wake of the balance of payments crisis of 1991.

A simple method to examine the performance of the constrained consumption-smoothing model is to compare the correlation between the actual current account and the constrained current account (after adding back the consumption-tilting component of the current account to $\hat{CA}_t^{**}$). This correlation is 0.230 for 1952/53-1998/99, was 0.023 between 1960/61-1969/70, rose to 0.269 during 1970/71-1984/85, but has since fallen to 0.205 during 1985/86-1998/99. This decreased correlation is consistent with gradually reduced constraints on capital inflows to India during the 1980s and 1990s.

A more formal test of the appropriateness of the constrained consumption-smoothing model can be carried out by estimating the VAR system (including constants) of equation (7). The null hypothesis of consumption smoothing and the absence of credit constraints is consistent with $\Phi_{\Delta z^P} = \Phi_{\Delta z^N} = 0$ *and* $\Phi_{\hat{CA}^{smP}} = \Phi_{\hat{CA}^{smN}} = 1$ in equation (7). This restriction implies that movements of the smoothed current account ($\hat{CA}_t^{sm}$) reflect those of the unconstrained (optimal) smoothed current account. The alternative hypothesis is that credit constraints on capital inflows generate asymmetries in the ability of economic agents to smooth consumption, that is, $\Phi_{\Delta z^P} \neq \Phi_{\Delta z^N} \neq 0$ *and* $\Phi_{\hat{CA}^{smP}} = 1$ *and* $\Phi_{\hat{CA}^{smN}} \neq 1$.

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[17]The constrained current account imbalance for 1958/59 far exceeds the actual and unconstrained imbalance, most likely reflecting an overestimate of the magnitude of the temporary positive shock to national cash flow.

The joint (nonlinear) restrictions are tested using a Wald test, and the value of the test statistic (distributed as a χ^2 with four degrees of freedom) was *Wald* = 0.003 (with a p-value of 1.00), indicating acceptance of the restrictions.[18] The VAR parameter estimates $[\hat{\Phi}_{\Delta z^P} \hat{\Phi}_{\Delta z^N} \hat{\Phi}_{\hat{CA}^{smP}} \hat{\Phi}_{\hat{CA}^{smN}}] = [0.355 \;\; 0.131 \;\; 0.103 \;\; -0.093]$ are not close to the theoretical values consistent with the null hypothesis of consumption smoothing in the absence of capital controls, yet the Wald test is unable to reject the null due most likely to the lack of precision with which the model is estimated.[19]

In summary, the results presented in this section indicate that India's intertemporal budget constraint was satisfied over the full sample period (1952/53-1998/99). However, when estimated on data up to 1990/91, the results indicate that the rapid accumulation of external liabilities during the 1980s resulted in the violation of the solvency criteria. Using a model which allows for credit constraints, there was some support for the notion that India's consumption path was consistent with smoothing behavior in the presence of capital controls.

B. External Sustainability—Application of Early Warning System Indicators

A recent approach to assessing external sustainability is to develop a systematic empirical framework for predicting balance of payments crises (a so-called "early warning system") using economic and financial indicators that provide a timely indication of the potential vulnerability of a country's balance of payments position. This approach to sustainability attempts to determine if a current account imbalance is vulnerable to liquidity constraints being imposed by foreign investors, who may become unwilling to continue to lend on current terms if a country experiences short-run economic difficulties. These limits on the current account may be over and above those imposed by intertemporal solvency (the traditional approach to gauging current account sustainability), and will be reflected in a diminished willingness by foreigners to lend, and will often take the form of capital flow reversals (Milesi-Ferretti and Razin (1996), Cashin and McDermott (1998)).

The predictability of balance of payments crises has been examined in a number of recent papers (Kaminsky, Lizondo, and Reinhart (1998), and Berg and Pattillo (1999)). In this section we apply the model developed in Berg et al. (1999) to India. The basics of their approach are as follows. A multivariate probit model is estimated on monthly data for a panel

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[18]The derivation of the Wald test of the nonlinear restrictions in the VAR of equation (7) is described in White (1984, p.77).

[19]Similarly, for the standard (unconstrained) intertemporal model, the null hypothesis of a close association between the actual and unconstrained (smoothed) current accounts (the joint restriction that $\Gamma = [0 \; 1]$ in equation (5)) is again unable to be rejected, due most likely to the lack of precision with which the model is estimated.

of 23 developing economies.[20] The dependent variable in the model takes a value of one if there is a balance of payments crisis within the next 24 months, and zero otherwise. A crisis is defined to have occurred when a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in reserves exceeds its mean by more than three standard deviations. The independent variables in the model include: real exchange rate overvaluation relative to trend; current account deficit as a percentage of GDP; reserve and export growth; and the ratio of short-term debt to reserves. The probability of a crisis is found to increase when the bilateral real exchange rate is overvalued relative to trend, reserve growth and export growth are low, and the ratio of the current account deficit to GDP and short-term debt to reserves are high.

The estimated coefficients from the model can then be used to generate predictions in the form of the probability of a crisis occurring in any one country during the next 24 months, given the current values of the explanatory variables. Predicted probabilities above a certain threshold (typically taken as either 25 or 50 percent) indicate that the model is signaling the likelihood of a crisis (assuming unchanged policies) within the next 24 months. In effect, the signaling of an imminent crisis is tantamount to the model indicating that under unchanged policies, the path of external sector imbalances is unsustainable. Of course, a crisis may not eventuate if appropriate policy actions are taken to address the underlying problems.

The estimated crisis probability for India was high and rising during the second half of the 1980s and well above the 25 percent threshold (Figure 5). If the threshold level was instead taken as 50 percent, this was crossed on two occasions, in mid-1988 and late 1990. The crisis probability reached a peak in May 1991 at over 60 percent, just five months before the commencement of the IMF program. Crises as defined in the model occurred in April and July 1991, and also in March 1993 (represented by the bold vertical lines in Figure 5).[21] These results are in line with the evidence that India was in breach of its solvency constraint prior to 1991.

The aggregate crisis probability can be decomposed into the contributions made by each of the five variables. The steadily rising probabilities during the second half of the 1980s were largely due to the widening current account deficit and the increase in short-term debt. The crisis probabilities declined quickly following the wide-ranging reform program introduced in the wake of the 1991 crisis, and have generally remained low since that time. It is notable that during 1997 and 1998, when the economy was buffeted by the Asian crisis,

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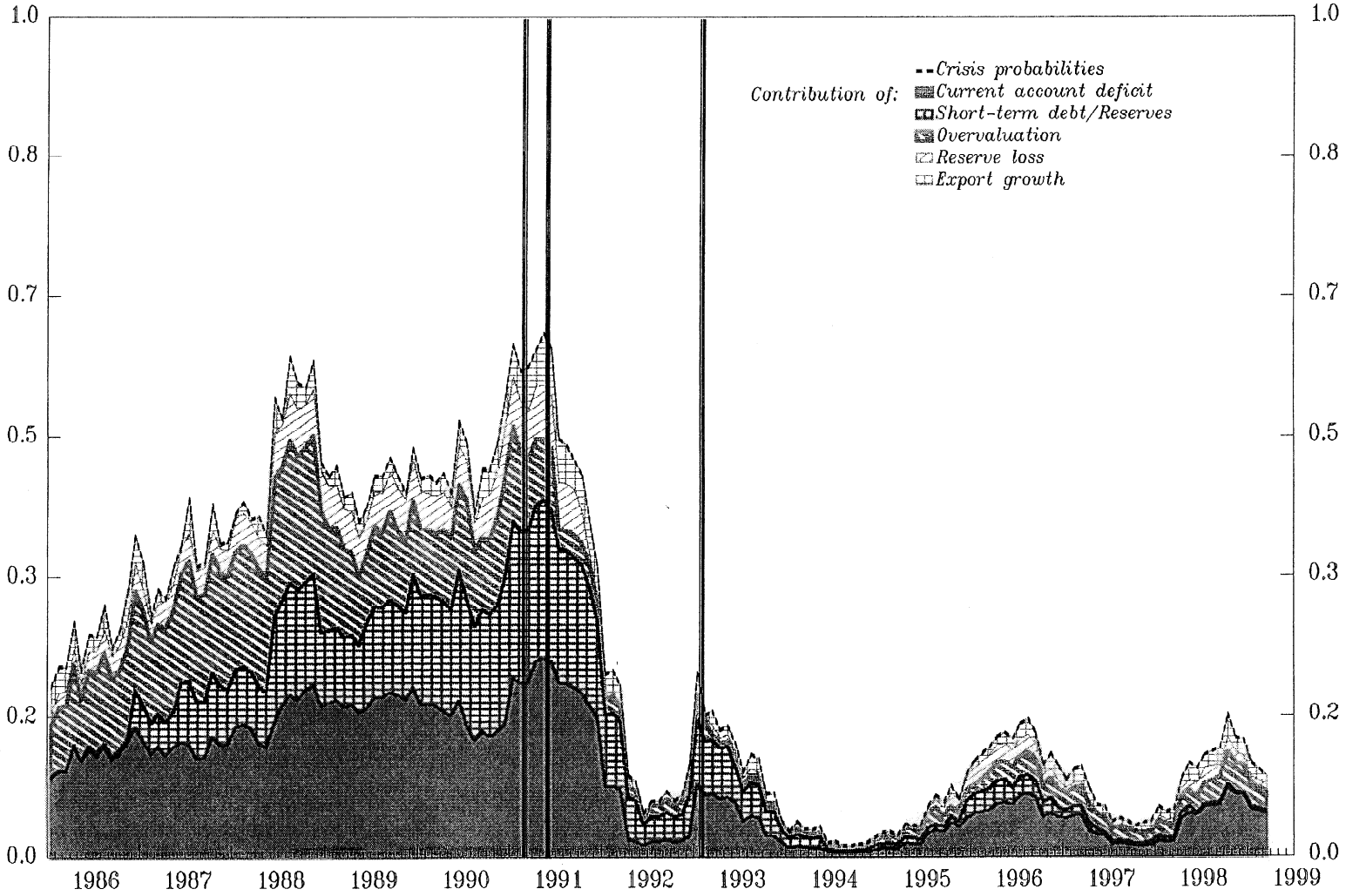
[20]The sample countries comprise: Argentina, Bolivia, Brazil, Chile, Colombia, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Pakistan, Peru, Philippines, South Africa, Sri Lanka, Taiwan, Thailand, Turkey, Uruguay, Venezuela, and Zimbabwe.

[21]The model's dating of the third crisis of March 1993 can be explained by that month's unification of the dual exchange rate system previously in place, which resulted in a large effective devaluation of the rupee.

Figure 5. India: 24-Month Ahead Crisis Probabilities and Relative Contributions of Economic Factors, 1986-99 1/



Source: IMF staff calculations.

1/ Calculations are based on the Berg et al (1999) model. The solid vertical lines represent crisis dates (as defined in the model).

sanctions following the nuclear tests of May 1998, and the turmoil in world financial markets following the Russian default in August 1998, the probabilities rose only moderately and remained well below the 25 percent threshold. This suggests that the reforms undertaken since the early 1990s, which have sought to encourage equity and longer-term debt flows while also liberalizing current account transactions, have laid the basis for a more sustainable external sector position.

C. Current Account Sustainability—Satisfying the External Borrowing Constraint

A commonly-used approach to assessing the sustainability of a given path of current account imbalances relies on projecting into the future the current stance of macroeconomic policy and private sector behavior, and sustainability is ensured if the resulting path of trade imbalances does not breach the country's intertemporal budget constraint. Obviously the choice of the "sustainable" external liabilities ratio is crucial to this analysis. For an indebted country, it is typical to target the ratio of net external liabilities (NEL) to GDP at its current level (on the assumption that if this level is currently sustainable, then it should remain sustainable into the future), and then calculate the level of the current account deficit which would achieve this goal. However, for a country such as India this may not be an appropriate choice, so we also present scenarios which target both a higher and low external liability ratio.

From equation (2), the change in NEL (and thus the current account balance) is given by output net of private and public expenditure, and net of foreign investment payments. Assuming the 'no Ponzi game' constraint is valid, dividing by y_t, allowing for any change in the real value of NEL held in foreign currency, and assuming that the economy's GDP grows at a given rate of γ, the NEL dynamics are given by:

$$\Delta b'_{t+1} = \left(\frac{r-\gamma-\lambda\epsilon-\gamma\lambda\epsilon}{(1+\gamma)(1+\lambda\epsilon)} \right) b'_t - q'_t \qquad (8)$$

where $'$ indicates that the variable is a ratio to GDP, λ is the fraction of NEL denominated in foreign currency,[22] ϵ is the rate of real appreciation of the domestic currency, r is the real cost of external liabilities, the goods and services balance (inclusive of transfers from abroad) is defined as $q_t = y_t - c_t - i_t - g_t$ and the current account (goods and services balance less interest payments) is $q_t - rb_t$. Using equation (8), we can calculate the adjustment in q_t' required to stabilize b_t'.

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[22]At end-1998, around 11 percent of India's external debt was denominated in rupees (Government of India (1999)). In the following sustainability scenarios, we assume that this ratio also applies to total external liabilities.

In the first scenario (Table 1) we calculate the current account deficit that stabilizes the NEL-to-GDP ratio at its current (end-1998/99) level of 31 percent, given a constant real exchange rate and varying assumptions about the real growth rate and the real cost of foreign liabilities.[23] For example, assuming that India's long-run real GDP growth rate is 5 percent a year and the real cost of foreign liabilities is 4 percent, then the goods and services deficit (inclusive of transfers) must average 0.3 percent of GDP in the future to maintain the NEL-to-GDP ratio at 31 percent. With the cost of servicing the outstanding stock of external liabilities at 1.24 percent of GDP, this results in an overall annual current account deficit of 1.54 percent of GDP, somewhat above the actual outcome for 1998/99 (a deficit of 0.9 percent of GDP). If India is able to maintain a higher growth rate of 7 percent per annum, then a current account deficit of around 2.1 percent of GDP could be run. For each one percentage point increase in the cost of external liabilities or fall in the Indian economic growth rate, the required increase in the surplus on the goods, services, and transfers balance (to keep the ratio of NEL-to-GDP constant) is about 0.3 percent of GDP. If, instead, a real depreciation of the rupee of 1 percent per year is assumed, a current account deficit of 1.26 percent of GDP would stabilize the NEL-to-GDP ratio at 31 percent of GDP, for a growth rate of 5 percent (Scenario 2). This implies that net investment in India could increase by about 0.3 percent of GDP and change the current account deficit from its 1998/99 level to a level that would stabilize the NEL-to-GDP ratio at 31 percent by 2008/09.

Given that the choice of maintaining a constant NEL-to-GDP ratio is somewhat arbitrary, two other scenarios are presented for comparison. If the objective is to lower NEL to 21 percent of GDP over the next ten years, then under the same growth and interest rate assumptions as above, a current account deficit of only 0.54 percent of GDP would have to

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[23]While official estimates of external debt are regularly published, no estimates of equity liabilities are readily available. To derive an estimate of the outstanding stock of NEL, we therefore added the stock of external debt (23 percent of GDP at end-1998/99) to an estimate of the stock of equity liabilities calculated by accumulating (from 1970 onward) the flows of foreign direct and portfolio investment flows in the capital account of the balance of payments. This methodology obviously does not allow for valuation changes that have occurred since the flows were received. Using this method, the outstanding stock of equity liabilities was estimated at about 8 percent of GDP at end-1998/99.

Table 1. Scenarios of India's Current Account Position

(In percent of GDP)

Real Interest Rate (percent)	Net Investment Balance	Scenario 1 (Stabilize NEL) Growth Rate of Real Income 3.00	5.00	7.00	Scenario 2 (Stabilize NEL with depreciation) Growth Rate of Real Income 3.00	5.00	7.00	Scenario 3 (Reduce NEL) Growth Rate of Real Income 3.00	5.00	7.00	Scenario 4 (Increase NEL) Growth Rate of Real Income 3.00	5.00	7.00
Current Account Balance													
2	-0.62	-0.92	-1.51	-2.07	-0.65	-1.24	-1.80	0.08	-0.51	-1.07	-1.92	-2.51	-3.07
3	-0.93	-0.93	-1.52	-2.09	-0.65	-1.25	-1.82	0.07	-0.52	-1.09	-1.93	-2.52	-3.09
4	-1.24	-0.94	-1.54	-2.11	-0.66	-1.26	-1.84	0.06	-0.54	-1.11	-1.94	-2.54	-3.11
5	-1.55	-0.95	-1.55	-2.13	-0.66	-1.27	-1.86	0.05	-0.55	-1.13	-1.95	-2.55	-3.13
6	-1.86	-0.96	-1.56	-2.15	-0.67	-1.28	-1.87	0.04	-0.56	-1.15	-1.96	-2.56	-3.15
Of which: Goods, Services, and Transfers Balance													
		-0.30	-0.89	-1.45	-0.03	-0.62	-1.18	0.70	0.11	-0.45	-1.30	-1.89	-2.45
		0.00	-0.59	-1.16	0.28	-0.32	-0.89	1.00	0.41	-0.16	-1.00	-1.59	-2.16
		0.30	-0.30	-0.87	0.58	-0.02	-0.60	1.30	0.70	0.13	-0.70	-1.30	-1.87
		0.60	0.00	-0.58	0.89	0.28	-0.31	1.60	1.00	0.42	-0.40	-1.00	-1.58
		0.90	0.30	-0.29	1.19	0.58	-0.01	1.90	1.30	0.71	-0.10	-0.70	-1.29

Notes: The entries in the upper panel of the table are the minimum current account balances required to meet certain objectives. The objective under Scenario 1 is to stabilize India's net external liabilities (NEL) at its current level of 31 percent of GDP, under the assumption of a constant real exchange rate. The objective under Scenario 2 is to stabilize NEL at its current level of 31 percent of GDP, given a real exchange rate depreciation of one percent per year. The objective under Scenario 3 is to reduce NEL to 21 percent of GDP by the year 2008/09, under the assumption of a constant real exchange rate. The objective under Scenario 4 is to raise NEL to 41 percent of GDP by the year 2008/09, under the assumption of a constant real exchange rate. In Scenario 2 it is assumed that the share of external debt which is denominated in foreign currency is 89 percent.

be maintained (Scenario 3). If, however, a rise in the NEL-to-GDP ratio to 41 percent could be accommodated, then a much larger current account deficit (2.54 percent of GDP) could be run (Scenario 4). Under this latter scenario, given a growth rate of 5 percent and a real interest rate of 4 percent, then net investment in India could increase by about 1.6 percent of GDP and change the current account deficit from its 1998/99 level to a level that would stabilize the NEL-to-GDP ratio at 41 percent by 2008/09.

These scenarios are designed to be illustrative of the size of the current account deficits that could be sustainable into the future. What will actually prove sustainable will depend on a large number of other factors. For example, if the deficits were mainly financed from direct investment flows, a larger outstanding stock of foreign liabilities could be more comfortably maintained than if they were financed out of short-term debt flows (as was the case in the second half of the 1980s). Further, the sustainable level of capital flows is likely to be dependent on the continuation of structural reforms in the domestic economy, which will influence the return on the investment projects undertaken (represented by the high growth scenarios in Table 1). Finally, as indicated in the previous subsection, what may be a sustainable deficit under certain conditions in world capital markets may prove not to be sustainable under different circumstances. For example, a downturn in international investor confidence in developing markets may result in a reduction in capital inflows to India.

IV. Summary and Conclusions

This paper has examined the sustainability of India's current account imbalances using the three main concepts of national creditworthiness—the solvency, sustainability, and the optimality of the external capital flows. As India has generally followed a cautious approach to external sector policies, yet has still experienced a number of balance of payments crises in recent decades, these issues remain of continuing relevance.

Our results indicate that the path of the current account deficit in India during 1952/53-1998/99 has been consistent with intertemporal solvency in that it did not breach the intertemporal budget constraint. However, the intertemporal budget constraint was not satisfied in the period prior to 1990/91, and the return to smaller current account deficits during the 1990s has been needed to reestablish solvency. A composite model of early warning indicators (which generate probabilities of the occurrence of a balance of payments crisis) also indicate that the path of the current account deficit in the period leading-up to the balance of payments crisis of 1991 was not sustainable. However, the crisis probabilities remained low during the 1997-98 Asian economic crisis, suggesting that the reforms undertaken since the early 1990s have laid the basis for a more sustainable external position.

The evidence on whether external borrowing has been optimal to smooth shocks to national cash flow is less clear cut. When we adapt the intertemporal model to allow for capital controls there is some evidence that external borrowing has been consistent with consumption-smoothing behavior in the presence of capital controls. Finally, our scenarios examining the long-run sustainability of external imbalances suggest that a current account deficit in the range of 1½ to 2½ percent of GDP could be consistent with the stabilization of India's net external liabilities-to-GDP ratio at its current level, depending on the underlying rate of economic growth and the cost of external finance.

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