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OPTIMAL BORROWING AND OVERBORROWING: SOME SIMPLE SIMULATION LESSONS

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Abstract

This paper examines optimal foreign borrowing in a certainty world with a lending constraint that ensures that countries never have an incentive to repudiate. We find that the informational conditions under which countries pursue a socially optimal debt strategy are very stringent. Under alternative reasonable assumptions, there will be overborrowing initially, until the credit limit is reached. Once the new information about the limit is incorporated into the optimizing framework, major adjustments in key macroeconomic variables are required. Several observed characteristics of LDC loan markets are explained. These include: loan pushing by lenders and overborrowing by borrowers; credit crunches at specific times; non-concessional reschedulings; and adjustment in excess of the size of external shocks.

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I. INTRODUCTION

International lending to sovereign entities differs from domestic lending in that there is no collateral, no bankruptcy laws governing the distribution of assets in the event that borrowers fail to repay their obligations, and no provisions for establishing seniority of debt. These factors imply that international loan agreements are primarily enforced by implicit contracts (Crawford, 1984). In these, lenders' threats to terminate future lending (Eaton and Gersowitz, 1981) or to impose trade sanctions or other costs on borrowers (Sachs and Cohen, 1982) ensure that rational borrowers will always choose to honor their debt obligations. A general feature of these contracts is the existence of an endogenous aggregate credit ceiling. Credit limits can deal effectively with problems of moral hazard and adverse selection (Jaffee and Russell 1976; Stiglitz and Weiss, 1981). Reschedulings only arise in the presence of uncertainty in real variables, and provide a mechanism through which the impact of an adverse state of nature can be shared across borrower and lender.

This view of the world is suspect in terms of its empirical and theoretical validity. It does not provide an explanation for why developing countries were excluded from capital markets for long periods of time. And it suggests that reschedulings should have significant concessionality; in practice, they do not. In fact, the consumption loss of most developing countries seems to have been larger than warranted by the size of external shocks alone. Furthermore, there is a time-inconsistency problem with the setting of a credit limit. The lender cannot commit himself not to renegotiate in the future (Hellwig, 1977). Thus, borrowers will base their behavior not on announced credit limits (if such exist), but on their beliefs about how lenders will react when limits become binding. Given this, the assumption of symmetric information between borrowers and lenders is hard to justify. Finally, existing models assume optimal intertemporal behavior on the part of borrowers. But few developing countries had an institutional structure that permitted such optimization. Knowledge of aggregate debt was limited; much borrowing was done by decentralized public enterprises or local governments without central control. The central government, however, ex post bore most of the exchange losses associated with this borrowing. Individual and social costs and benefits of borrowing differed.

The purpose of this paper is to explore the effects of relaxing the assumptions that borrowers and lenders have symmetric information about the debt ceiling at which lenders will cut off future loans and that borrowers follow socially optimal intertemporal policies. It is simple, and somewhat tautological, to show that overborrowing can occur under these suboptimal conditions. Our concern is with the quantitative impact. We consider a model in which learning is endogenous. The key constraint relates the stock of debt to the country's capital stock. Given a low initial debt level, this will not be immediately binding on the flows of new borrowing. Information on the true level of the debt ceiling is only fully revealed to all parties when the stock of debt hits the ceiling. At that point, borrowers' ex ante expectations of economic developments, based on an erroneous perception of the debt limit, will adjust towards an ex post realization. We take the size of this unexpected adjustment as an indicator of the magnitude of the debt problem the country faces. If the required adjustment exceeds an undefined level that is politically feasible, then there is a debt crisis.

This view of a debt crisis differs greatly from that in the recent literature. (Eaton and Gersowitz 1981, Sachs and Cohen 1982 and Kletzer 1984) all focus on the random nature of output or the rate of interest. There, borrowers choose to repudiate debt repayment obligations when adverse states of nature raise the benefits and lower the costs of repudiation. Our view is closer in spirit to that of Hellwig (1977). We focus on the effects of moral hazard and strategic behavior as each party attempts to exploit the gains from the long-term credit relationship.

The basic model is described in the next section. This is extended into a discrete time simulation model which is calibrated to generate the stylized charactericss of a developing economy. Simulations are used to give quantitative orders of magnitude for the problems and to facilitate a realistic multi-period analysis. They do, however, require assumptions about specific production and utility functions. In Section III, we discuss the informational asymmetries between borrowers and lenders and show how this can lead to a need for major adjustment and a sudden cut-off of new lending in a manner similar to recent experiences in 1982 and 1983. Section III also extends the analysis to cases where socially optimal borrowing is not achieved. The magnitude of the debt problem increases accordingly.

II. THE BASIC MODEL AND BENCHMARK SIMULATION

A. The Basic Model

In this section, we first consider a basic theoretical model of international lending and then extend this to a simulation in order to quantify some of the key effects. One major assumption is that reschedulings are devices to assist countries in adjustment. They do not involve concessionality, or a loss of debt value to the creditor. This implies that creditor behavior is straightforward. They will charge a competitive interest rate up to an endogenously determined credit limit. At that point, the loan supply curve becomes vertical.

Consider a deterministic world. Countries have an incentive to borrow from abroad because of profitable growth opportunities. Access to international capital markets permits higher investment and output growth than in autarchy. There is also a demand for intertemporal consumption smoothing by the borrower. Thus, higher borrowing also leads to higher consumption. Lenders cannot control the use to which funds are put. Borrowers, meanwhile, cannot precommit themselves not to repudiate debt in the future. As there is no uncertainty in output, there will be a time when borrowers no longer gain from participating in capital markets. They then have an incentive to repudiate debt, unless lenders can impose a penalty. Assume there exists some enforceable penalty that lenders can impose. A portion of assets might be seized; or, lenders might force the country into trade autarchy, as well as financial autarchy, leading to a loss in the efficiency of production. By rationing aggregate debt to be below the size of the penalty, lenders can ensure that it is never optimal for a country to repudiate. This permits mutually-beneficial loan contracts to be written.

The problem that the borrower faces is to choose levels of investment and net foreign borrowing in each period to generate a consumption path that maximizes discounted lifetime utility. Constraints on feasible choices are given by an intertemporal constraint that keeps the stock of debt below the penalty that the country faces in the event of a repudiation. Technological opportunities, material balances and accounting equations linking stocks and flows complete the model.

Assume that the economy is small, produces nontraded and traded goods with labor (exogenous) and capital that are fully mobile across sectors. The interest on foreign debt is fixed at r^*. Debt is available up to some fraction, λ, of the total capital stock. 1/

1/ We assume that the penalty at repudiation, P, can be written as a linear, homogeneous function of the total capital stock: $P = \lambda K$.

Welfare is given by discounting static utility. The arguments of utility are consumption of each good. The problem is to maximize

$$W = \sum_{t=1}^{\infty} U_t \, (C_{Tt}, C_{Nt})/(1 + \delta)^{t-1} \qquad (1)$$

subject to

$$Q_{it} = f_{it}(K_t, P_t) \qquad i = N, T \qquad (2)$$

$$C_{Tt} = Q_{Tt} + B_t - r^*D_t - I_t \qquad (3)$$

$$C_{Nt} = Q_{Nt} \qquad (4)$$

$$I_t = (1 + \frac{v}{2} \frac{J_T}{K_T})J_T \qquad (5)$$

$$K_t = J_{t-1} + K_{t-1} \qquad (6)$$

$$D_t = D_{t-1} + D_t \qquad (7)$$

$$D_t \leq \lambda K_T \qquad (8)$$

where P_t is the price of nontraded goods relative to traded goods in period t; J_T is real fixed capital formation; I_t is investment expenditure. Other notation is standard. The assumption that there are adjustment costs to investment is derived from a Tobin's q theory of investment (Hayashi 1982). This formulation is useful for preventing an immediate jump of the capital stock to its long-run desired level. Note that the assumptions of perfect factor mobility and exogenous labor permit the sectoral production functions to be written in terms of the total capital stock and the relative price.

For the special case, where

$U_t = [C_{Tt}^{a} \, C_{Nt}^{1-a}]^{1-b} / (1 - b)$, the first-order conditions for an optimum are as follows (see Kharas and Glick, 1984):

$$(1 + \delta) \left(\frac{C_{t+1}}{C_t}\right)^{b} = [1 + \rho] \left(\frac{P_{t+1}}{P_t}\right)^{a-1} + \lambda \xi_{t+1} \left(\frac{\partial J_t}{\partial I_t}\right) \qquad (9)$$

$$(1 + \delta) \left(\frac{C_{t+1}}{C_t}\right)^{b} = [1 + r^*] \left(\frac{P_{t+1}}{P_t}\right)^{a-1} + \xi_{t+1} \qquad (10)$$

where C_t is the Cobb-Douglas aggregate of consumption goods, ρ is the value marginal product of a unit of investment expenditure, and ξ is a term related to the constraint on debt accumulation.

$$\xi_t \equiv \frac{\lambda(1 + \delta)}{a} \cdot \left(\frac{a}{1 - a}\right)^{1 - a} \cdot C_t^{\,b} \cdot \Phi_t \cdot P_{t-1}^{\,1 - a} \qquad (11)$$

and Φ_t is the shadow price of inequality (8).

The left-hand-side of equations (9) and (10) is the ratio of the contribution to welfare of one unit of the aggregate consumption bundle in period t relative to period t+1, i.e., the real social discount rate (RSDR). The right-hand-side of (9) is the real return to investment. It comprises a term which reflects the increase in output, deflated by $(P_{t+1}/P_t)^{a-1}$ which is simply the rate of inflation of consumer prices, plus a term reflecting the increased foreign borrowing opportunities associated with higher investment. Similarly, the right-hand-side of (10) is the real cost of foreign borrowing (RCFB) comprising the real interest rate in home good terms and a cost of reduced future borrowing opportunities associated with present borrowing.

It is easy to see that the solution is locally stable. When the social discount rate is less than the cost of foreign borrowing, the level of current borrowing declines. This reduces present consumption but increases future consumption as debt service payments are lowered. Thus, the growth of consumption rises, raising the discount rate until equality with the cost of borrowing is achieved. Similar reasoning applies for investment.

There are three characteristics of this solution on which the remainder of this paper is focused. First, note that the size of the penalty, λ, enters into the return on investment. If the country believes that lenders are willing to lend large amounts because of the severe penalties that could be imposed in the event of a repudiation, (high λ), then the marginal return to investment is raised above the value marginal product. This encourages higher investment that drives up the real social discount rate which, in turn, encourages greater foreign borrowing. Thus, beliefs of a high λ will involve higher investment and foreign borrowing. The second point is that the social cost of foreign borrowing includes a term, ξ, that is not borne by individual borrowers. A laissez-faire economy will, therefore, also tend to overborrow initially. Finally, note that the change in the real exchange rate affects the cost of borrowing and the return to investment (see Dornbusch, 1983). In general, a depreciation of the real exchange rate raises the real cost of foreign borrowing. The intuition is that debt service must be paid with traded goods when they are dear relative to the time when borrowed funds were received. If individuals do not have rational expectations on real exchange rate movements, they will not borrow optimally. We shall argue below that overborrowing will occur if exchange rate expectations are adaptive.

B. Benchmark Simulation

The previous sub-section considered the theoretical case for overborrowing. In this sub-section, we develop a discrete-time simulation model in order to quantify key effects. The model equations are the same as above. We add an exogenous labor force growth of 2 percent per year. The only other difference is that we are forced to solve the system over a finite horizon. We use a planning period of eleven years. 1/ Terminal valuations of capital and debt stocks are required. These are calculated on the assumption that the economy has reached a steady-state by the end of the planning horizon. This implies that optimal net

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1/ Extension of the planning horizon added substantially to computational costs with very limited changes in results.

investment and net borrowing are zero from the eleventh period onwards. Given the capital and debt stocks outstanding at the beginning of the eleventh period, we calculate the resultant permanent consumption stream. The terminal value of capital and debt stocks reflect their marginal contribution to the steady-state consumption level.

The initial conditions chosen are: 100 units of capital stock, 25 units of labor and zero debt. Other parameter values were chosen to replicate the major characteristics of a representative developing country in terms of production structure, consumption behavior, investment and growth. Table 1 shows these values.

Table 1: Model Parameter Values

Symbol	Description	Value
δ	Pure rate of time preference	0.05
b	Inverse of intertemporal elasticity of substitution	0.8
a	Share of traded goods in aggregate consumption	0.5
α_T	Share of profits in traded sector	0.6
α_N	Share of profits in nontraded sector	0.4
q_T	Efficiency parameter in traded sector	0.4
q_N	Efficiency parameter in nontraded sector	1.0
g	Labor force growth rate	0.02
r*	World interest rate	0.068
v	Investment adjustment cost parameter	5
λ	Penalty for repudiation as a fraction of the capital stock	0.125

Note: The price of traded goods is taken as a numeraire. Production functions are taken as Cobb-Douglas in capital and labor.

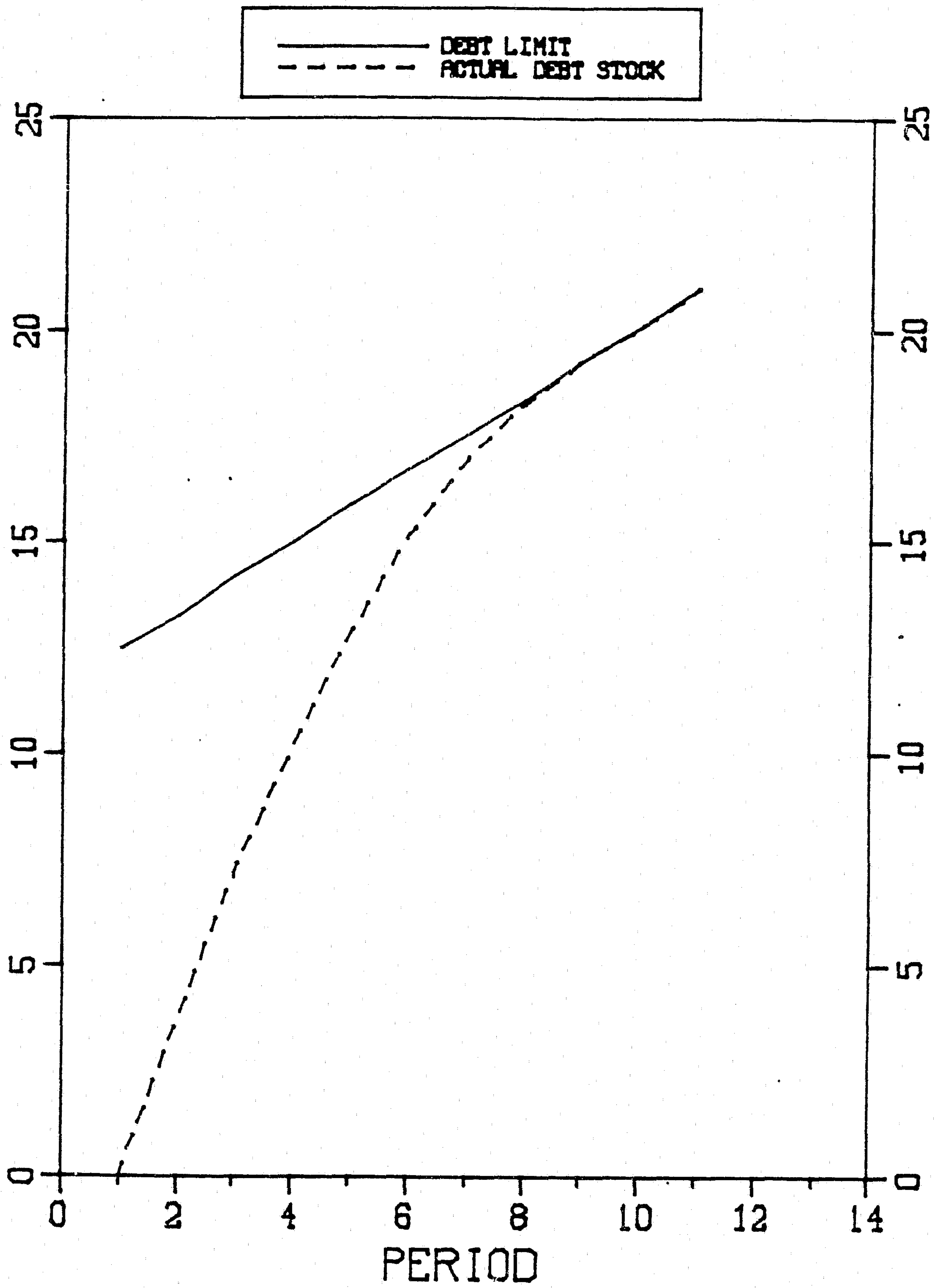
As indicated above, the nontradeable sector is labor intensive by assumption. 1/ At constant relative prices, therefore, capital accumulation would reduce its output (the Rybczynski effect). As the pure rate of time preference is fixed below the world real interest rate, however, aggregate consumption rises over time. A built-in feature of the model, then, is a tendency for the real exchange rate to appreciate over time, despite our assumption of unitary income elasticities for each good.

In the benchmark run, the economy evolves given optimal borrowing and investment levels under full information. The immediate prospects are for moderate GDP growth of 3.6 percent per year over the first 10 years (the eleventh year is the steady-state). The tradeable sector grows at 4.6 percent while nontradeables grow by 1.9 percent. Their growth is fuelled by investment that is initially 30 percent of GDP. A sizeable portion of this investment is financed by borrowed funds. The current account deficit is 17 percent in the first year but quickly declines towards zero. The net resource transfer from abroad, the difference between net inflows and interest payments to foreigners, turns negative after the seventh year. This resource outflow is financed through higher traded goods output and, eqivalently, through an increase in gross domestic saving. Consumption growth is 2.1 percent, substantially lower than GNP or output growth.

1/ This is borne out by Kravis et al (1983).

The evolution of the key state variables, capital and debt, is shown in Figure 1. The capital stock grows steadily, expanding the potential credit limit in each year. Debt, which has an initial value of zero, accumulates rapidly with the large current account deficits. By the fifth year, debt reaches 55 percent of GDP and finally climbs to 73 percent in the steady-state. The figure shows the level of debt climbing gradually towards the credit limit. In an infinite horizon model, debt would tend asymptotically towards the ceiling.

FIGURE 1: BENCHMARK RUN



III. OVERBORROWING AND ADJUSTMENT PROBLEMS

In this section, we quantify the degree of overborrowing that can emerge from behavior undertaken on the basis of partial information. First, we consider optimistic expectations about the credit ceiling. Next, we simulate a laissez-faire borrowing strategy. Finally, we explore the impact of following adaptive expectations on the real exchange rate.

Optimism

One feature of the base case result is that there is no way for the borrower to confirm his beliefs about lenders' credit limits. In fact, debt only tends asymptotically towards the limit. The borrower is never sure whether or not he could have borrowed more. Furthermore, there is an asymmetry between the costs of overborrowing and the costs of underborrowing. For small changes, the latter will be larger. To see this, consider the costs of acting as if the debt limit was ε lower than in reality. One feasible strategy would have been to have borrowed an additional ε in period 1 without changing borrowing in any other period. Assuming the debt constraint is binding, the social discount rate exceeds the foreign real interest rate in home goods terms. There is a strictly positive loss in welfare from foregoing the borrowing opportunity equal to ε (RSDR - RCFB). Now consider acting as if the debt limit was ε higher than reality. Then, at some time τ, the debt limit will be reached. If borrowing at that period were ε less than planned, the remainder of the borrowing strategy could remain unchanged. The welfare cost is $\varepsilon\,(\text{RSDR} - \text{RCFB})/(1 + \delta)^{\tau-1}$, which tends to zero as τ tends to infinity. This asymmetry in costs implies that if a borrower views λ as being drawn from a normal distribution, he would not act on the basis of $E(\lambda)$ but on the basis of $E(\lambda) + \partial$ in order to maximize expected welfare. There is an in-built bias towards 'optimistic' expectations on λ.

A similar argument can be advanced from a lenders' viewpoint. As long as lenders retain debt below the penalty level, there is no danger of repudiation. The borrowing path that leads up to that debt level does not affect the probability of repudiation, which remains at zero. In a certainty world, lenders are indifferent as to how countries manage their borrowing. This is only true, however, if there are zero profits associated with each loan. But this need not be a good assumption. As shown below and argued elsewhere (Sachs and Cohen 1982), a critical feature of international credit markets is that they are restricted to a small number of identifiable creditors such that reschedulings are feasible. One cannot then argue that competition will be sufficient to reduce expected profits from LDC lending to zero. The impact of relaxing the zero profit assumption is dramatic. It implies that lenders prefer some borrowing paths over others. Those that maximize the present discounted value to the lender from the loan relationship are preferred. Thus, from a lender's point of view, the optimal lending strategy is to push borrowers up to the credit limit as quickly as possible. From the lenders' point of view, overborrowing by borrowers should be encouraged.

Having established that borrowers will act as if the lending constraint is higher than it actually is, and that lenders will willingly finance this delusion, we turn now to a quantitative assessment of overborrowing under an optimistic λ. In the initial stages, the borrower is able to receive money as expected. Once the debt limit is reached, however, and lenders cut-off funds, the true λ is revealed. The borrower then reoptimizes over investment. The difference between the expected values of key macrovariables and the ex post values is an indication of the size of adjustment that the borrower must undertake. In the simulation below, we assume perceived λ is 0.14, while actual λ is 0.125.

Figure 2 shows the evolution of debt. The perceived credit limit is AB. Debt is expected to grow along the path IXB. The actual limit, however, is $A'B'$. Thus, the ex post debt path is IXB'. Clearly, there is overborrowing relative to the benchmark run. In the first year, borrowing is 7.4 percent higher than its ex post optimal level. This pattern continues for the first five years. In the sixth year, the true credit limit is learnt and adjustment must occur. Table 2 shows the difference between expected and actual levels of key variables. Net borrowing is cut in half: the current account deficit narrows from 8.7 to 4.6 percent of GDP. Real consumption falls 2 percent below expectations. Investment also declines substantially from 28 to 25 percent of GDP (Table 2).

FIGURE 2: OPTIMISTIC PERCEPTION OF DEBT LIMIT

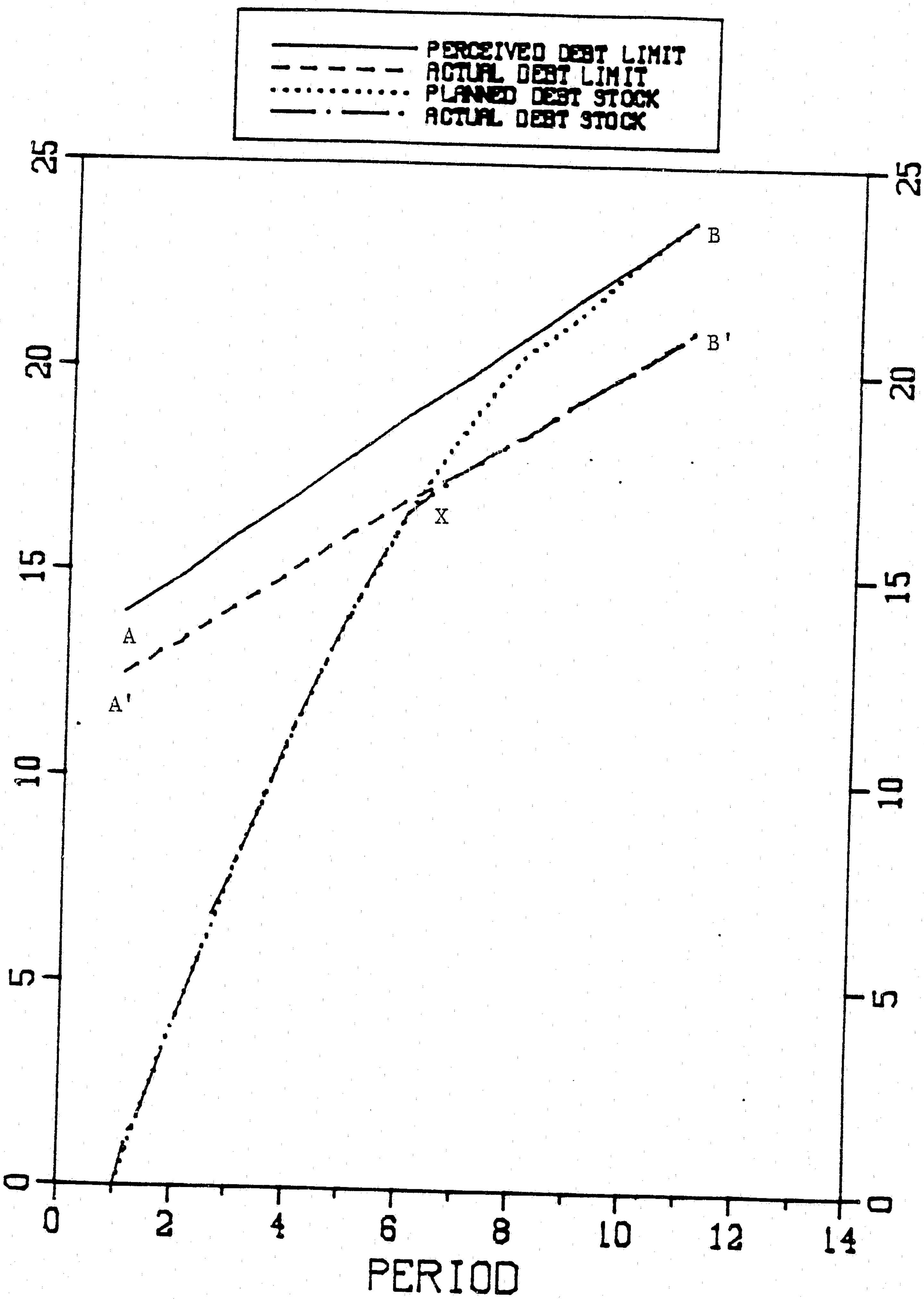


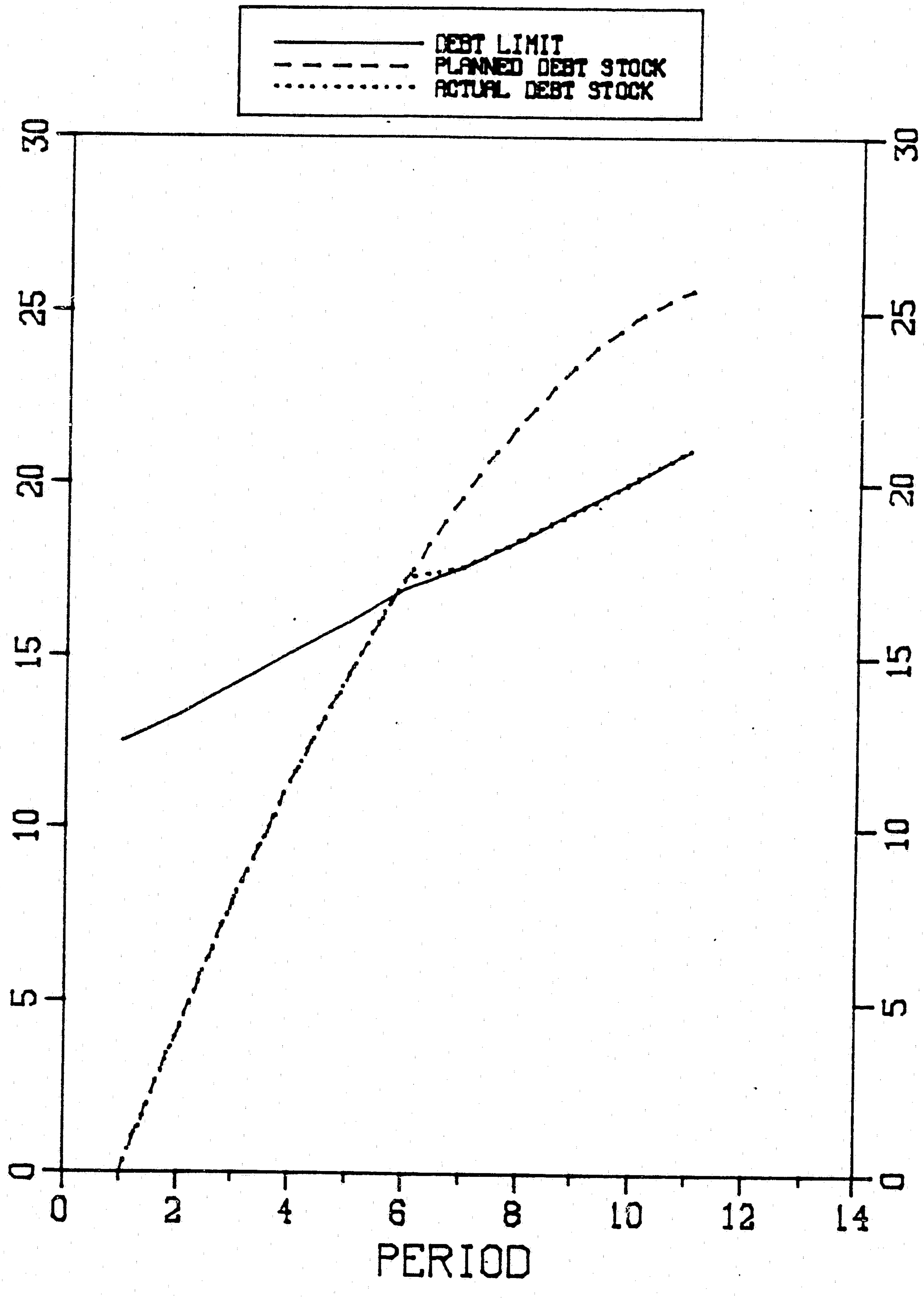
Table 2: Adjustment to Unanticipated Credit Ceiling [a/]

	Optimistic Ceiling		Laissez-faire		Adaptive Expectations	
	% Change	Change as a % of GDP	% Change	Change as a % of GDP	% Change	Change as a % of GDP
Borrowing	-46.7	-4.1	-86.2	-8.5	-104.4	-39.8
Investment	-8.5	-2.3	-17.4	-5.0	1.9	0.7
Aggregate Consumption	-2.0	-1.5	-3.8	-2.8	-45.8	-42.5
Tradeable Consumption	-2.0	-0.7	-3.8	-1.4	-46.1	-21.4
Tradeable output	1.2	0.7	2.2	1.4	39.3	21.1

Laissez-Faire

One feature of the optimistic expectations run is that it assumes a single social optimizer borrower. The existence of an intertemporal credit constraint implies that there is an externality that individual borrowers impose on others. A laissez-faire borrowing strategy would therefore lead to too rapid an accumulation of debt. Such a simulation is shown in Figure 3. Initial borrowing is even higher than in the previous run, and 9.2 percent higher than optimal. Although investment is also slightly higher, leading to an increase in the credit limit, most of the additional foreign funds go into consumption. The credit limit is reached in the fifth year and major adjustments occur in year 6 (Figure 3). The current account deficit must be close to 1.4 percent of GDP, when it was expected to be 9.9 percent. This is achieved by a 17.4 percent cut-back in investment, a 4 percent fall in consumption and a 2 percent rise in traded output (Table 2).

FIGURE 3: NO PERCEPTION OF DEBT LIMIT



Adaptive Expectations

Even under laissez-faire, we make the assumption that individuals have rational expectations about the real exchange rate, conditional on their beliefs about the supply of capital. But a stylized fact of LDC commercial borrowing is that exchange rates have been increasingly overvalued. It is also true that governments have borne a significant portion of the exchange losses on foreign debt due to devaluations. Under these circumstances, it is unreasonable to assume that individual borrowers correctly anticipated that they would bear the full cost of real exchange rate changes. Accordingly, we modify individual behavior such that they borrow and invest with adaptive expectations of the real exchange rate.

$$P^e_t - P^e_{t-1} = \Phi(P_{t-1} - P^e_{t-1}) \qquad (12)$$

or

$$P^e_t = \Phi\, P_{t-1} + (1 - \Phi)\, P^e_{t-1} \qquad (13)$$

Here, agents are using information on past forecasting errors to modify current expectations.

The first-order conditions that characterize agents' optimal decisions are now altered to incorporate their expectations of price movements, rather than actual price movements. For borrowing, the condition is:

$$(1+\delta)\left(\frac{C_2}{C_1}\right)^b = (1+r^*)\left(\frac{P^e_{t+1}}{P_t}\right)^{a-1} = (1+r^*)\left(\Phi + \frac{(1-\Phi)P^e_{t-1}}{P_t}\right)^{a-1} \qquad (14)$$

For investment

$$(1+\delta)\left(\frac{C_2}{C_1}\right)^b = (1+\rho_{t+1})\left(\Phi + \frac{(1-\Phi)P^e_{t-1}}{P_{t-1}}\right)^{a-1} \qquad (15)$$

When $\Phi = 1$, individuals expect future prices to equal current prices. This then determines the equilibrium growth rate of real consumption. The initial level of real consumption must then be such that the discounted value of total expenditure equals that of total income. Borrowing and investment are then derived to support this consumption stream.

When $\Phi \neq 1$, the social discount rate will not be fixed. Agents make rational predictions about the next period's consumption. Borrowing and investment are then chosen to support present consumption and present prices such that (14) and (15) are satisfied.

The results of the evolution of debt and capital are shown in Figure 4. 1/ Borrowing in the first years is over twice as high as in

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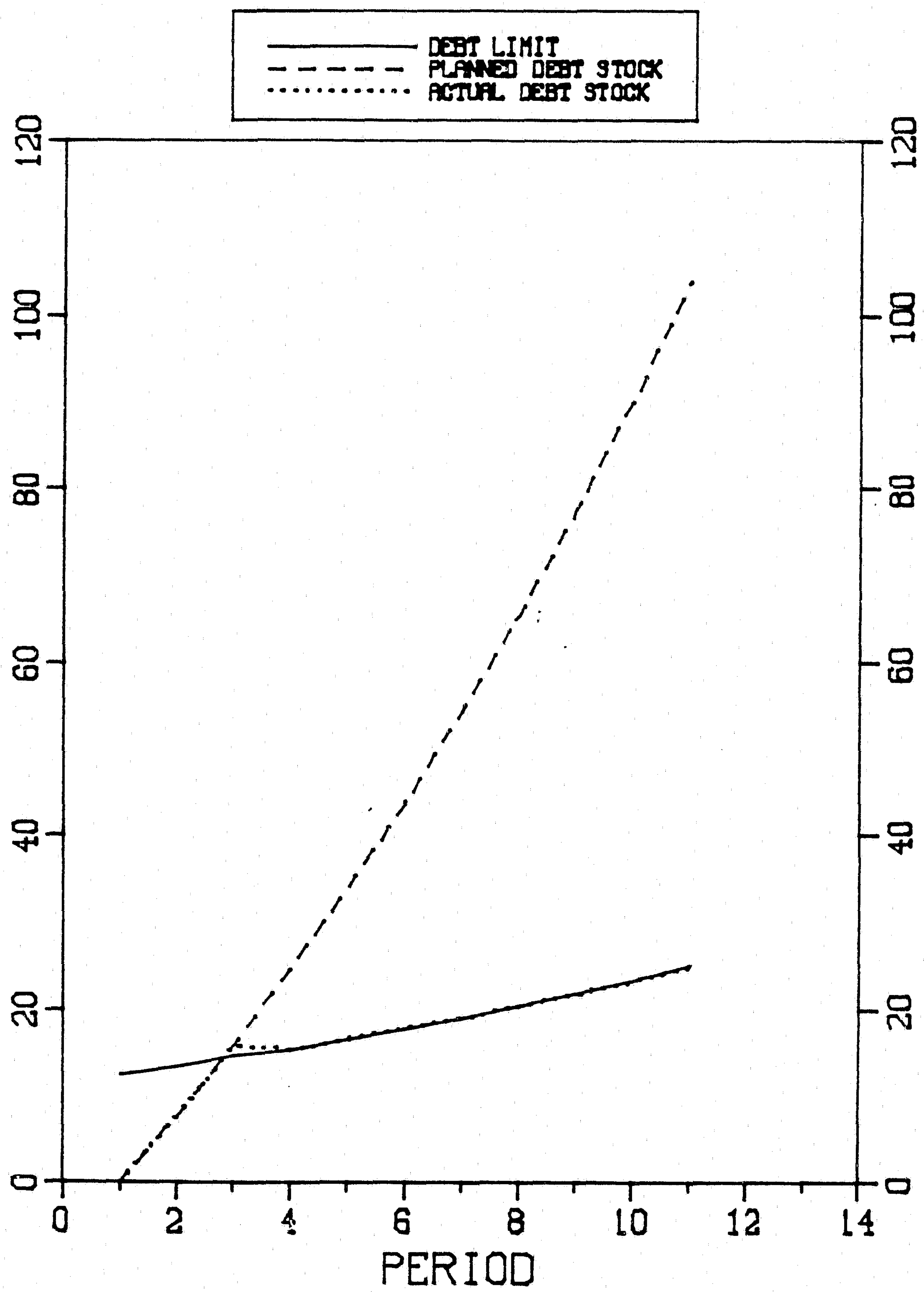
1/ - We set $\Phi = 0.5$ and P^e_1 = price in autarchy.

the base case. Investment is only slightly higher. The expectations for borrowing are explosive. Aggregate debt/GDP explodes upwards. Within two years, the credit limit is reached. Individuals are now rationed in foreign markets, and re-optimize over investment. The binding debt constraint implies that returns to investment are high as this raises debt carrying capacity. In contrast to the previous runs, investment rises above its anticipated level following the bump against the debt ceiling. This increases the contraction in consumption beyond the contraction in net borrowing. Aggregate and tradeable consumption fall by about 26 percent. The current account deficit is forced to zero (actually slightly negative because of a numerical slack that permits small temporary excess of debt over λK). The scale of adjustment is clearly very high (Table 2).

The simulation runs presented above have several features in common with the actual experience of developing countries. They reflect initial overborrowing, supported by lenders. This is followed by a credit crunch once a limit on the stock of debt is reached. Lenders are no longer willing to supply fresh credits. This corresponds to the charges of 'herd-instinct' governing lender behavior. Associated with the crunch is a significant adjustment of consumption relative to its expected value. It in no way relates to exogenous shocks. This is an indicator of the magnitude of the debt problem. We suggest that reschedulings may be useful devices to help effect this adjustment.

FIGURE 4: ADAPTIVE EXPECTATIONS OF REAL EXCHANGE RATE



IV. SUMMARY AND CONCLUSIONS

One feature of international capital markets is that borrowers cannot rid themselves of the option to repudiate. There are limits on the scope of legally binding contracts. Lenders can, however, threaten to retaliate. This threat permits some lending to happen up to a ceiling in the total stock of debt. We formulate this ceiling as endogenous, linked to the value of the capital stock in the economy. We first show that an optimal borrowing strategy is one where the level of debt tends asymptotically towards the credit ceiling. We then argue that there are inherent pressures that will lead the system to overborrow initially, until the credit ceiling is hit, and then borrow as much as lenders are willing to lend. We discuss three cases of overborrowing. In the first, the borrower has full knowledge of the capital stock, but cannot directly observe the lenders' threat point. Nor can this information be inferred along a debt path based on the expected value of the penalty, because debt only tends asymptotically to its ceiling. An optimal strategy that maximizes expected utility is to 'buy' information by overborrowing initially until the credit ceiling is hit. Lenders would be indifferent to, or would support, such a strategy.

In the second case of overborrowing, we simulate a laissez-faire economy. Each individual borrower has an incentive to obtain funds quickly, before rationing is introduced. The intertemporal credit constraint acts as an externality that borrowers do not incorporate into their individual costs. The result is that initially borrowing is substantially higher than in the optimum (by 10 percent).

The third case of overborrowing occurs when agents do not have sufficient information to forecast expected real exchange rate movements accurately. We demonstrate that optimal borrowing and investment under an adaptive expectations setting lead to explosive debt accumulation which is only halted by lenders' imposition of a credit ceiling.

In each of the three cases, bumping up against the credit ceiling reveals information to borrowers that causes a readjustment of plans. We view the scale of adjustment as an indicator of the magnitude of the debt problem. Our intention is to show that reasonable deviations from full information can lead to a need for significant adjustment.

It is debatable whether adjustment of the degree that is indicated is politically or economically feasible for weak LDC governments with limited control over macroeconomic developments. If the adjustment cannot be achieved with the contractual debt service obligations, reschedulings may be a useful device for smoothing adjustment and recontracting under the new information set. In our model, there is no uncertainty over real variables. The reschedulings would retain intact the value of the debt. They occur because of the information that becomes available only when lending limits are reached. This view is very different in spirit from that discussed elsewhere in the literature. There, reschedulings are the result of uncertainty in real variables. One way to differentiate between these approaches is to look at other features of lender behavior. If reschedulings were related to real uncertainty, lenders (and borrowers) would be able to hedge themselves partially on commodity and bond markets. This is not observed. Similarly, there would be no grounds for the kind of overborrowing that appears to have occurred. Finally, it appears that the degree of adjustment of consumption would be smaller than the size of the external shock. In practice, there is no clear link between adjustment and the size of the shock. On the other hand, our view suggests a sanguine approach to potential losses on LDC debt. For some countries this may be reasonable; for others, it is evidently not. It would seem that both stories have some merit in explaining observed phenomena.

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