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Debt Overhang, Debt Reduction and Investment: The Case of the Philippines

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Abstract

While there is a substantial body of literature on the effects of "debt overhang" on investment in heavily-indebted countries, there is surprisingly little empirical work available on this subject. This paper tests the hypothesis that the stock of foreign debt acts as a disincentive to private investment in the specific case of the Philippines. The empirical estimates provide support for this hypothesis, particularly after 1982. The estimates indicate that a $1.3 billion debt reduction (such as the one completed through the buyback operation in early 1990) would increase investment demand by something between one half and two percentage points of GNP.

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Contents

I. Introduction

The poor investment and growth performance of the highly indebted countries in the past few years is frequently attributed, at least to some extent, to the burden of their foreign debt, a phenomenon which has been termed the "debt overhang." Basically, the debt overhang hypothesis states that the accumulated debt act as a tax on future output, discouraging productive investment plans of the private sector and adjustment efforts on the part of governments. In a sense, foreign debt acts like a tax when the debt situation is such that an improvement in the economic performance of the indebted country has the side product of higher debt repayments; that is, creditors receive part of the fruits of increased production or exports by the debtor country. 1/

Despite the many persuasive theoretical arguments put forward for the debt overhang hypothesis, there has been remarkably little empirical effort to test it. 2/ Most empirical evidence at present consists of either the observation that in debtor countries there has been a decline of investment coincidentally with the onset of the debt crisis, or of investigations of the cross-country relation between levels of debt and the market price of debt in secondary markets, as in Cohen (1988), and Froot and Krugman (1990). 3/ A shortcoming of this type of empirical analysis is that it does not control for the effect of other factors affecting both economic developments and external debt, or for the endogeneity of foreign debt. For example, adverse shocks could cause a drop in domestic investment, a deterioration in economic performance, and an increase in foreign debt.

1/ There is by now an extensive literature on the debt overhang hypothesis. Important theoretical contributions in this area have been made by Dooley (1986), Krugman (1988), Sachs (1989), Froot (1989), and Calvo (1989). A review with empirical applications can be found in Froot and Krugman (1990)

2/ There are also theoretical counter-arguments against the debt overhang hypothesis, and models in which debt may have an at least ambiguous effect on effort, as in Helpman (1989), where the ambiguity comes from income and substitution effects, and Aizenman and Borensztein (1989) where the ambiguity arises from strategic consideration in a game-theoretic framework.

3/ An exception is the recent paper by Cohen (1990), where the author estimates the extent to which the trade balance turnaround of 1982-87 was obtained through the crowding out of productive investment. Contrary to this paper, the estimates obtained by Cohen (1990) are based on cross-sectional reduced-form regressions.

Attributing the negative economic developments to the debt overhang would obviously not be a correct inference. 1/

This paper attempts to test the existence of a debt overhang effect directly for one heavily-indebted country--the Philippines. The strategy is to estimate a standard neoclassical investment demand function, and then add a term representing the extent of debt overhang and test its significance. In this way it is possible to obtain a measure of the impact of the debt overhang that is not tainted by other influences. For example, policy actions and/or economic conditions may cause increases in real interest rates which may be responsible for the drop in investment. Although such increases in interest rates may be in some way related to the debt overhang situation, this approach attempts to isolate the reduction in investment stemming directly from the potential taxation due to foreign debt rather than from interest rate effects. Therefore, the estimation provides a differentiation between general macroeconomic conditions and the direct debt overhang effect. This differentiation is of critical importance in guiding policy measures to reactivate investment.

Complementing the estimation of the investment function with estimates of production and consumption functions, it is possible to simulate the general equilibrium-- direct and indirect--effects of debt reduction policies. This is done with the aid of a Solow-type growth model, extended to the case of an open economy. In addition to ameliorating the disincentive to investment created by the debt overhang, debt reduction makes more foreign savings available to augment the domestic resources available for investment. Both the direct and indirect effects of debt reduction are incorporated in the model simulations.

There might be, however, a more subtle way in which foreign debt discourages domestic investment. This would be the case in which there is perfect capital mobility, and the claims on the country held by commercial banks are close substitutes of domestic claims in the debtor country. One would then observe that the required contractual yield on foreign debt (that which results from considering the prevailing discounts on secondary markets for international debt) would equal the required contractual yield on domestic debt contracts. While it would not be possible to detect a debt overhang effect with the above methodology, it is clear that debt reduction, by changing the market discount, would have a definite and immediate effect on domestic investment. The paper also tests empirically this framework for the sample period for which data on prices for debt in secondary markets are available.

While the estimates obtained in the paper are only for the Philippines, the model itself has general applicability to other indebted countries as well. Also, as the results provide one of the few direct tests of the adverse effects of debt overhang on private investment, they

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1/ See Sachs (1990) and Bulow and Rogoff (1990) for contrasting interpretations of the causality between debt and economic performance in highly-indebted countries.

have a bearing on the overall validity of the hypothesis, and thus on the social profitability of debt-reduction schemes that have been put forward in both academic and policy making circles.

The plan of the remainder of the paper is as follows. Section II provides some factual background on the foreign debt problem of the Philippines. Section III introduces the investment function and outlines the estimation results which are then used to simulate a macroeconomic model that illustrates the impact of debt reduction. Section IV tests interest parity conditions with and without the inclusion of secondary market prices of debt. Some conclusions are offered in Section V.

II. An Application to the Philippines: Some Background

In terms of casual empiricism at least, the debt overhang story appears to have a good a priori case in the Philippines. The Philippine economy had shown steady growth and high investment rates in the Post-War period, comparable to several of its successful Asian neighbors. Foreign debt accumulated rapidly, however, and in 1982-83, as the country ran into economic difficulties and suspended payments on foreign debt, private and public investment collapsed, with total investment to GNP falling by as much as 10 percentage points. Although GNP growth rates have returned to historical levels since 1986, investment remained very depressed and only recovered briskly in 1989. Coincidentally, in 1989 the debt situation appeared to look brighter, as the Philippines was on the verge of completing a buyback of part of its outstanding private bank foreign debt in the context of the Brady initiative. Moreover, private investment growth accelerated in 1989 after some more modest gains in 1987-88.

The long-run trends on growth and investment in the Philippines are summarized in Table 1 and Charts 1a to 1d. The overall investment to GNP ratio had been moving steadily up from 15 percent in the fifties to over 25 percent, before collapsing to an average of 13.5 percent in 1985-87. Even discounting the increase in investment of the late seventies, which derived mainly from a sharp increase in public investments whose economic efficiency has been widely questioned (see, for example, D'Aquila (1987) and Dohner and Intal (1989)), the level of investment as of 1988 was still pretty low relative to the more normal periods of the sixties and early seventies. The recovery of investment in 1989 brings it to a level similar to historical values.

The growth rate remained relatively steady at about 5-6 percent per annum before the crisis years of 1983-86. Population growth was on a declining trend from 3.0 to 2.5 percent during this sample period. Technological progress may be responsible for another 1-1 1/2 percentage points of annual growth on average, with the remainder being attributable to the growth of fixed capital. 1/ As the data show, the Philippine

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1/ See Section IV.

Table 1

Philippines: Investment Ratios and Growth Rates

Period	Investment/GDP	GDP growth rate
1951-60	13.9	6.5
1961-70	16.8	5.2
1971-80	20.5	6.2
1981-89	18.3	1.6
1951-55	12.6	8.2
1956-60	15.2	4.8
1961-65	16.0	5.2
1966-70	17.6	5.1
1971-75	17.6	6.1
1976-80	23.5	6.2
1981-85	20.2	-0.5
1986-89	14.0	4.5

Source: National Income Accounts of the Philippines.

Chart 1
Philippines

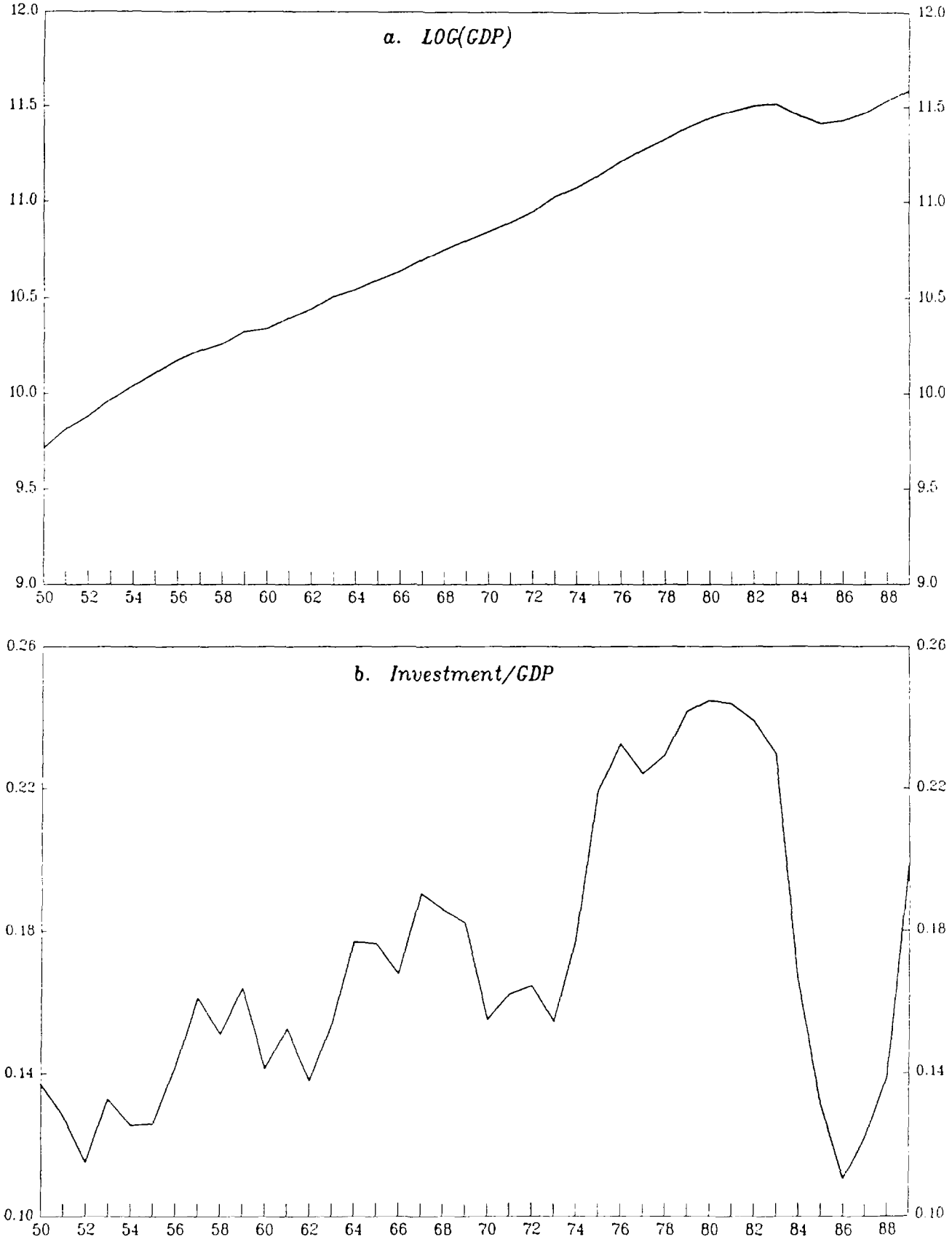
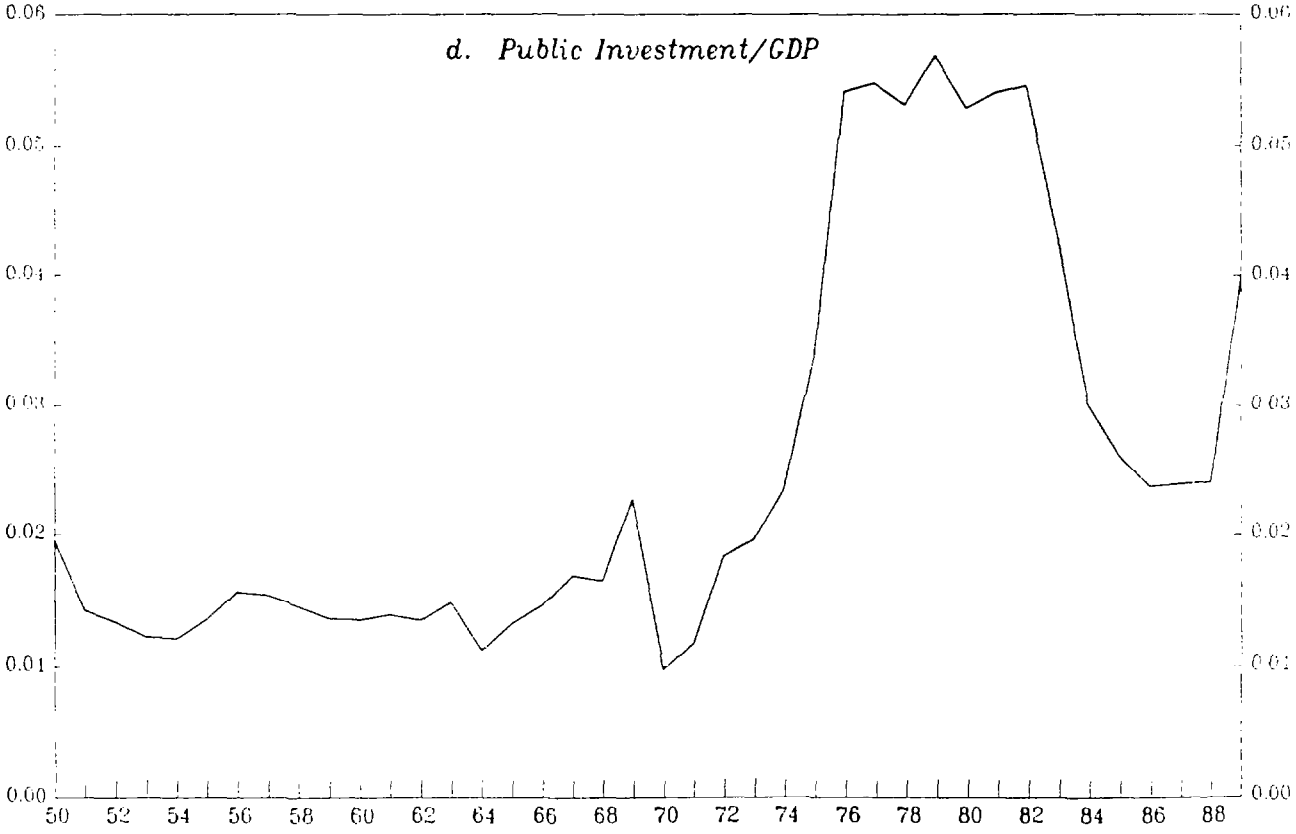


Chart 1(contd.)

Philippines



economy has proven fairly resilient to downturns since the Post-War years to the debt-crisis years. This casual empiricism, however, is not sufficient to establish causality between debt problems and economic performance.

Early in 1990, the Philippines concluded a buyback operation with its commercial creditors, under the auspices of the Brady initiative. This was the first stage of a proposed two-stage operation, and included both the cash buyback and new money offers from commercial banks. A second round of debt reduction operations will take place at a later stage. The total resources made available by multilateral and bilateral agencies for cash buyback and "enhancements" of new debt securities are estimated at $1.5 billion of which $650 million were used in the first stage buyback. The amount of commercial bank medium- and long-term debt eligible for the debt reduction operations was about $ 7.0 billion.

Market reaction to the debt reduction plan was very positive. Philippine debt was trading at about 36 cents per dollar in early March 1989, prior to the announcement of the Brady initiative. By mid-April the price had climbed to 46 cents and by mid-May to around 50 cents, where it stabilized. The buyback was carried out at a price of 50 cents. This positive reaction is not surprising, since the value of claims on the Philippines should be favorably affected by the debt reduction initiative on two accounts: first, the $ 1.5 billion provided by third parties should increase, to some extent, total expected payments to Philippines commercial creditors; and second, the expected improvement in investment and growth resulting from the reduction in total contractual obligations should also improve repayment prospects.

III. Private Investment and Debt: Empirical Estimates

This section presents the specification and estimation of an investment function used to test the debt overhang hypothesis for the Philippines. This investment function is then incorporated in a general equilibrium framework to simulate the effects of debt reduction schemes.

1. Investment function

The investment function is formulated along the lines of the neoclassical "q" model, which derives the investment decision of a representative firm from profit maximization over an infinite time horizon. This implies that investment is a function of the increase in profits that it may bring about and of its cost, which comprises the direct purchasing cost of the capital goods and associated adjustment costs such as resources spent by the firm in planning and putting into operation the new capital units, disruptions of the productive process, etc. Since capital is long-lived--it depreciates only partially every period--the present value of the increase in profits must be computed. In this present value computation, the firm uses the cost of capital that is determined in

financial markets; this expected discount rate will be taken as exogenous in the formulation. 1/

Thus, the investment function can be derived from the maximization of the following function:

$$(1) \quad V(K_t) = \max \sum_{i=0}^{\infty} \frac{P(K_{t+i}, I_{t+i})}{R_{t+i}}$$

$$s.t. \quad K_{t+1} = (1-\delta)K_t + I_t$$

where $P(K_{t+i}, I_{t+i})$ is the level of profits obtained by the firm in period t+i, 2/ *K is the capital stock, I is investment spending, R is the* appropriate discount factor, and δ is the depreciation rate of capital. $V(K_t)$ represents the market value of the firm in period t. The discount factor R_{t+i} discounts flows from period t+i back to period t using the expected cost of capital corresponding to such periods, that is,

$$R_{t+i} = \prod_{j=1}^{i} 1+r_{t+j}$$

where the r's are the one-period *expected* rates of return demanded by financial markets from this firm. The above maximization problem yields an investment function of the following form 3/

$$(2) \quad \frac{I}{K} = a_1 p^I + a_2 E \sum_{i=0}^{\infty} \left(\prod_{j=0}^{i} \beta_{t+j} \right) M_{t+i}$$

where p^I is the (relative) price of investment goods, E is the mathematical expectation operator, β is the relevant discount factor, and M is the marginal product of capital. The discount factor β is given by:

$$\beta_{t+i} = \frac{1-\delta}{1+r_{t+i}}$$

1/ This formulation and estimation generally follows that of Abel and Blanchard (1986).

2/ This specification excludes the effects of other productive factors that may be used. However, this simplification does not alter the derivation of the investment function.

3/ For more detailed derivations see Abel (1988) and Shapiro (1986.)

with δ and R as defined above. To facilitate estimation, a linear approximation to the right hand side of (2) is taken, which yields the following

$$(3) \quad \frac{I}{K} = a_1 p^I + a_2 \left(\bar{M} \frac{\bar{\beta}}{1-\bar{\beta}} + \frac{\bar{M}}{1-\bar{\beta}} \sum_{i=0}^{\infty} \bar{\beta}^i (\beta_{t+i} - \bar{\beta}) + \sum_{i=0}^{\infty} \bar{\beta}^{i+1} (M_{t+i} - \bar{M}) \right)$$

where $\bar{M}$ and $\bar{\beta}$ are the values of M and β around which the approximation is taken.

Two problems must be solved to obtain an estimable form of equation (3). The first is to obtain measures of the marginal product of capital and of the *expected* real interest rate, and the second is to compute the value of the infinite sums of future marginal products of capital and discount factors. The marginal product of capital was taken to be equal to the average product of capital, which is measurable. 1/ The expected real interest rate series was constructed by obtaining a prediction of the inflation rate using lagged inflation and the current nominal interest rate. The infinite sums were computed applying the Hansen and Sargent (1981) methodology, making use of a prediction formula for future values of the marginal product of capital and of the expected real interest rate inferred from the application of standard Box-Jenkins (1976) time-series techniques to those two variables.

The marginal product of capital is thus measured as:

$$(4) \quad M = \frac{(1-\alpha)Y}{p^I K}$$

where α is the share of labor in GNP and Y is GNP. The regression used to obtain expected inflation is the following 2/

1/ This equality is an implication of profit maximization under constant returns to scale.

2/ In all regressions, the values reported in parenthesis below the estimated coefficients are their respective standard errors; $\bar{R}^2$ is the adjusted coefficient of determination; DW is the value of the Durbin-Watson statistic; Rho is the coefficient of first-order autocorrelation of the error term; and the Durbin-h is the value of the test statistic for autocorrelation in models with lagged endogenous variable.

$$(5)\quad \Pi = -0.042 - 0.440\,\Pi(-1) + 0.018\,i$$
$$\qquad\quad (0.043)\quad (0.143)\qquad\quad (0.003)$$

Sample: 1956-1988; $\bar{R}^2 = 0.52$
Rho = 0.69
(0.16)

where Π is the rate of inflation (GNP deflator) and i is the interest rate (one-year Treasury Bills.)

From an examination of the time series properties of the marginal product of capital and the expected real interest rate, the following time-series processes were identified:

$$(6)\quad M = 0.016 + 0.80\,M(-1)$$
$$\qquad\quad (0.005)\quad (0.062)$$

Sample: 1951-1988; Durbin-h = 0.03; $\bar{R}^2 = 0.82$

$$(7)\quad r^e = 0.031 + 0.229\,r^e(-1)$$
$$\qquad\quad (0.009)\quad (0.181)$$

Sample: 1958-1988; Durbin-h = 0.14 $\bar{R}^2 = 0.02$

Notice that, in contrast ot the process followed by the marginal product of capital, the expected real interest rate process is very nearly a constant plus a white noise residual. This lack of variance in the real interest rate creates, as will be seen, considerable difficulty in estimating accurately its effect in an investment function.

The identification of the above processes implies that one term in the marginal product of capital and one term in the expected real interest rate is all that is necessary to forecast any future value of those two variables conditional on information currently available. 1/ This means that a reduced form of equation (3) requires the inclusion of one lagged term in the marginal product of capital and the current term in the expected real interest rate. This specification produces the following estimates

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1/ The timing convention is that information available as of time t-1 includes the value of the marginal product of capital at t-1 and the value of the expected real interest rate at time t. The expected real interest rate at time t requires knowledge of the nominal interest rate for time t (which is known at the end of period t-1) and the forecast of inflation for period t, which is conditional on variables that are all known as of period t-1.

$$(8)\quad \frac{I}{K} = \underset{(0.046)}{0.078} - \underset{(0.034)}{0.092\ p^{I}} + \underset{(0.331)}{1.36\ M(-1)} - \underset{(0.106)}{0.162\ r^{e}}$$

Sample: 1957-1988; DW = 0.79 $\bar{R}^2$ = 0.52

The regression results are relatively good. All the coefficients have the right sign, although the coefficient on the real interest rate is not significant. However, the low value of the Durbin-Watson statistic indicates some misspecification problem. There are a number of reasons that may cause an equation such as (8) to be misspecified, but the presumption here is that an omitted variable, representing the debt overhang problem, is the main reason. In addition, a global test of the model can be obtained by exploiting the intra- and cross-equation restrictions on the values of the parameters that arise from the overlap between the coefficients in equation (6), (7), and (8). The result is a failure to reject these parameter restrictions. The value of the chi-square statistic (2 degrees of freedom) is 2.72. 1/

2. Measuring the effect of foreign debt

The economic literature has identified several direct and indirect channels through which a large foreign debt affects productive investment negatively: the "debt overhang" effect, which refers to the reduced incentives to invest; the high domestic real interest rates due to the impaired access to international credit; the low profitability due to a downturn in economic activity; the decrease in public investment that is complementary to private investment, etc. Most of these effects are already captured by the explanatory variables in the regression, such as the domestic real interest rate and the expected marginal profitability of investment. However, the presumably strong incentive problem associated with the debt overhang effect may largely escape the estimated equation, because it is in large measure associated with expectations about future events.

A simple approach to incorporate the debt overhang effect in the estimated equation was followed. From the point of view of a private investor, the debt overhang can be translated into the potential increase in (the present value of) taxation which will become necessary to repay foreign debt. Therefore, the debt to GNP ratio could be an approximate measure of the magnitude of (the present value of) taxation that would be necessary to obtain the required resources. Because by equation (2) investment is a function of the present value of net profits, the inclusion of a debt variable in the regression is all that is necessary. This debt term will measure the reduction in net expected profits generated by the overhang effect. The addition of the debt term to the regression produces the following result.

1/ The critical value at the 5 percent level is 5.99.

$$(10)\quad \frac{I}{K} = \underset{(0.06)}{-0.024} + \underset{(0.059)}{0.028\ p^I} + \underset{(0.309)}{1.25\ M(-1)} - \underset{(0.111)}{0.034\ r^e} - \underset{(0.056)}{0.136\ \frac{D}{Y}}$$

Sample: 1957-1988; DW = 0.88 $\bar{R}^2$ = 0.59

The coefficient on the debt to GNP ratio is significant and has the right sign; its value implies that a reduction in bank debt of $1.3 billion increases investment demand by nearly one percentage point of GNP. However, the coefficients on the interest rate and the relative price of investment goods lose their statistical significance, and the Durbin-Watson statistic does not improve.

In regression (10), foreign debt is measured as medium- and long-term debt with private banks. Other measures of foreign debt could be used instead, each consistent with different interpretations of the debt overhang problem. The debt variable could be total debt, private bank debt or some measure of the "excess" debt, that is, of the amount of debt above the level which can be normally handled and does not create an incentives problem. The regression was therefore re-estimated using different specifications of the debt variable.

A first important distinction is whether to include private debt or total (private plus official) debt. The distinction is in terms of the nature of the creditor. Official debt is a substantial fraction of total debt in the Philippines but its actual importance in creating a debt overhang problem is questionable. First, there is some element of concessionality in at least part of official debt. Second, despite the alleged seniority of official debt over private debt, it can be expected that to the extent that the debtor country is following policies that are judged appropriate, access to official loans would not be curtailed even if exogenous factors make the country less creditworthy. Thus, official debt would not become burdensome in many unfavorable situations.

A more refined variable is one that considers the "overhang" part of debt only. Arguably, not every dollar of foreign debt generates a negative incentive problem; it is only when debt surpasses a certain level that it becomes a potential tax on future returns to investment. Two specifications of this measure were used: first, the debt overhang was measured as the difference relative to the 1982 level, assuming that the level of indebtedness up to that date was a normal "nonproblem" one; and second, the discount applied to transactions on Philippine debt in the secondary market was used, measuring the debt overhang as the product of the discount times the face value of private debt. A problem with this measure is that, because data on prices on secondary market transactions are available only since 1986, the price had to be assumed to be unity before that year.

All the different versions of the debt variable have the expected negative sign and are statistically significant when included in the investment function (see Table 2.) The best fit appears to correspond to

Table 2

Philippines: Estimated Debt Overhang Effect

Variable	Estimated Coefficient	DW	Effect of $1.3billion Debt Reduction on I/Y K/Y=2.0	K/Y=2.5 1/
Private Debt	-0.136 (0.056)	0.88	0.80	1.00
Private plus Official Debt 2/	-0.062 (0.032)	0.83	0.18	0.22
Private Debt in excess of 1982 level	-0.313 (0.083)	1.25	1.85	2.31
Private plus Official Debt in excess of 1982 level 2/	-0.183 (0.043)	1.16	0.54	0.68
Private "overhang" (discount times face value)	-0.195 (0.119)	0.84	1.15	1.44
Private and Official Debt separately 3/	-0.146 (0.067)	0.90	0.86	1.08

1/ Change in the Investment to GDP ratio, in percentage points, for assumed constant capital/output ratios of 2.0 and 2.5, respectively.

2/ $0.65 b of debt reduction.

3/ Coefficient corresponds to private debt.

the private debt "overhang" measured as the excess over the critical level of 1982; in this case also, the Durbin-Watson statistic is considerably higher and falls in the ambiguous range in terms of rejection of error autocorrelation. The value of the coefficients on the alternative debt variables indicate that the median effect of a $1.3 billion debt reduction operation is to increase investment demand by one percentage point of GNP. The highest effect for debt reduction occurs when the debt variable is the private debt overhang using the secondary market discount, and the lowest effect obtains in the specification in which the sum of both private and official debt is used.

In addition, the proposition that debt from private and official sources have the same effect was also statistically tested. The test fails to reject the equality at confidence levels higher than 90 percent. 1/ However, when private and official debt are included as separate explanatory variables the coefficient on official debt has the wrong sign and is insignificant, and the coefficient on private debt has the right sign and is significant. The results from such regression are the following:

$$(11)\quad \frac{I}{K} = \underset{(0.066)}{-0.017} + \underset{(0.064)}{0.022\ p^I} + \underset{(0.315)}{1.24\ M(-1)} - \underset{(0.115)}{0.039\ r^e}$$

$$- \underset{(0.067)}{0.146}\ \frac{D^P}{Y} + \underset{(0.065)}{0.017}\ \frac{D^O}{Y}$$

Sample: 1957-1988; DW = 0.90 $\bar{R}^2$ = 0.64

where D^P is debt to private creditors and D^O is debt to official creditors.

3. Debt reduction and macroeconomic variables

The estimated investment demand function can be used to obtain a measure of the possible macroeconomic impact of the first stage of debt reduction operations. This requires the consideration of the investment function in a general equilibrium framework that is able to capture both the direct and indirect effects of debt reduction and the reaction of interest rates, consumption, etc. For this purpose, a simple open-economy growth model was developed and its main components estimated. The results, detailed below, indicate that a debt buyback operation of $1.3 billion (such as the one completed early in 1990) may increase private investment by 2 to 3 percentage points of GDP, and it may account for an increase in the rate of growth of GDP of 0.5 to 1 percentage points.

1/ Test statistic distributed as F(5,25) = 2.045.

The framework adopted has two basic components: a savings/investment equilibrium and an output supply equation. The savings/investment equilibrium represents the ex ante equality between foreign savings (the current account balance) and national savings and investment, and can be represented by the standard open economy macroeconomic balance equation

$$(12) \quad CA = Y - G - I^G - C - I$$

where CA is the current account excluding net international factor payments, Y is GDP (which is determined by a production function), G and I^G are government consumption and investment, and C and I are private consumption and investment, respectively.

In this framework the current account and all the fiscal variables are taken as exogenous. The current account balance is assumed exogenous because the Philippines has not yet been able to restore access to voluntary lending; therefore, in the present situation, the change in foreign debt is assumed to be determined mainly by direct negotiations with commercial banks plus inflows of official money, which are both exogenous to this system. The fiscal variables are taken as exogenous on grounds that they represent intermediate targets that the government wishes to control. The other three variables that are part of the macroeconomic equilibrium are behavioral functions and have been econometrically estimated. In addition to the investment function, they comprise a production function, and a private consumption function.

a. Production function

The production function has a standard Cobb-Douglas form. The estimates are the following.

$$(13) \quad \ln\left(\frac{Y}{L}\right) = \underset{(0.617)}{-0.048} + \underset{(0.303)}{0.532} \ln\left(\frac{K}{L}\right) + \underset{(0.004)}{0.012}\, t$$

Sample: 1951-1987; DW = 0.17 $\bar{R}^2$ = 0.83

where Y is GDP, K is total capital, L is total employment, t is a time trend, and the standard errors of the coefficients are given in parenthesis. The Durbin-Watson statistic clearly indicates the existence of some misspecification problem, which is most likely due to serially correlated deviations of GDP from capacity and some adjustment costs to capital and labor. However, since the emphasis is put on long term growth of production capacity, no attempt was made to improve the estimation.

b. Private consumption

The underlying model is that of a representative consumer that has a utility function with constant intertemporal elasticity of substitution and

makes its expenditure plans over an infinite time horizon. This setup gives rise to a well-known first-order condition:

$$(14) \quad \ln C_{t+1} = \ln C_t + b_1 + b_2 r_t^e$$

where C is per capita consumption, r_t^e is the expected real interest rate between time t and time t+1, and b_2 is the inverse of the intertemporal marginal rate of substitution. Equation (14) is complemented by the budget constraint that states that life-time consumption must be equal to life-time income. Equation (14) was estimated directly to yield:

$$(15) \quad \ln C_t = \underset{(0.139)}{0.162} + \underset{(0.020)}{0.978} \ln C_{t-1} + \underset{(0.111)}{0.046} r_t^e$$

Sample: 1957-1988; Durbin test = 3.11 $\bar{R}^2 = 0.99$

The econometric results are supportive of the theoretical framework. The coefficient on lagged consumption is very close to unity. The equation also passes Hall's (1978) test, that is, other variables (such as lagged disposable income) are not statistically significant once lagged consumption is included. However, the Durbin test indicates some weakness of the estimation, which most likely arises from durability of consumption expenditures.

Equation (15) cannot be directly used for the simulations but it is necessary to go back to the underlying framework. In this consumer model, equation (15) indicates the desired rate of growth of consumption expenditures, subject to the (intertemporal) budget constraint. The current value of consumption must be set such that, when the desired rate of growth is applied, the present value of consumption spending equals the present value of lifetime income. The relationship between consumption, income, and the interest rate is then obtained from that budget constraint. A linearization of that relation yields:

$$(16) \quad C - \bar{C} = a_1(Y - \bar{Y}) + a_2(r - \bar{r})$$

where $a_1 = \dfrac{(1+\bar{r})\left(1 - (1+\bar{r})^{\beta-1}\right)}{\bar{r}}$; $a_2 = -\dfrac{\bar{Y}}{\bar{r}}\left(1 + (1+\bar{r})^{\beta-1}(1+r(\beta-1))\right)$, and the variables with bars over them indicate the values around which the linear approximation is taken. In (16), $\bar{Y}$ is the "permanent income" value of private wealth, and β is the rate of time preference. Also, a_2 corresponds to a permanent change in the interest rate. The corresponding value of a_2 for a one-period change in the interest rate is the smaller:

$$a_2 = -\frac{\bar{Y}}{\bar{r}} \quad \frac{1-(1+r)^{\beta-1}}{1+\bar{r}} \quad \left(1+(\beta-1)(1+\bar{r})^{\beta-1}\right)$$

c. The effects of debt reduction

Using the above econometric estimates, the general equilibrium impact of debt reduction operations on investment and growth was simulated through the year 1995. This simulation is based on the savings/investment balance relationship (12), where the estimates of private consumption and private investment functions are used. The dynamics of the system are given by the capital accumulation relationship:

$$(17) \quad K_{t+1} = (1-\delta)K_t + I_t$$

where δ is the fixed rate of depreciation. Therefore, investment in any given period determines the change in the stock of capital, which will be used for production in the next period and will determine GDP according to the production function (13).

In the simulations, the baseline projection incorporates the effect of a $1.3 billion buyback (financed through official loans.) The other scenarios show the contribution of this debt reduction to the baseline scenario under different specifications of the debt overhang on investment demand. In other words, the scenarios show how much lower investment and growth would be in the absence of the debt reduction operation. The model was calibrated to present a baseline scenario for the period 1990-1995 in which the growth rate of GDP is between 5.5 and 6.5 percent, private investment is in the range of 16 to 19 percent of GDP, private savings is between 17 and 20 percent of GDP, and the non-interest current account surplus (the current account exclusive of interest flows) declines from 2 to 1 percent of GDP.

Two alternative assumptions were used: a low-impact case, in which the level of private medium and long term debt is the relevant measure of the debt overhang, and a high-impact case in which the debt overhang is measured as the current stock of debt in excess of its 1982 level. In both cases, there is also an increase in the flow of foreign savings available to the economy. This increase arises from the savings on interest payments resulting from the reduction in foreign debt. It is probably an underestimate of the full effect, because the improvement in country risk considerations generated by the debt reduction would help attract additional foreign savings in the form of loans and direct investments. 1/ Also, the fiscal variables are assumed to be unchanged across the different simulations, and this may also underestimate the effect of debt reduction

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1/ However, an opposite argument could also be made. If the current debt reduction package generates expectations among lenders of future unfavorable debt reduction measures, country risk would in fact be higher.

on growth to the extent that the improvement in the indebtedness situation of the government may facilitate a higher level of public investment. Thus, the simulations presented here are a conservative estimate of the full impact of debt reduction operations.

The results, presented in Table 3 and Charts 2a to 2c, indicate an increase in private investment of up to 1 and 2 percentage points of GDP during the simulation period. This is the combined effect of the increase in investment demand derived from the reduction in the debt overhang, and the effect of larger availability of foreign savings. This change in productive investment has a slow but persistent effect on the growth rate of GDP. The cumulative effect, which can be observed in Chart 2a, generates a gap in the GDP level of over 1.4 percentage points by the year 1995 in the high-impact scenario.

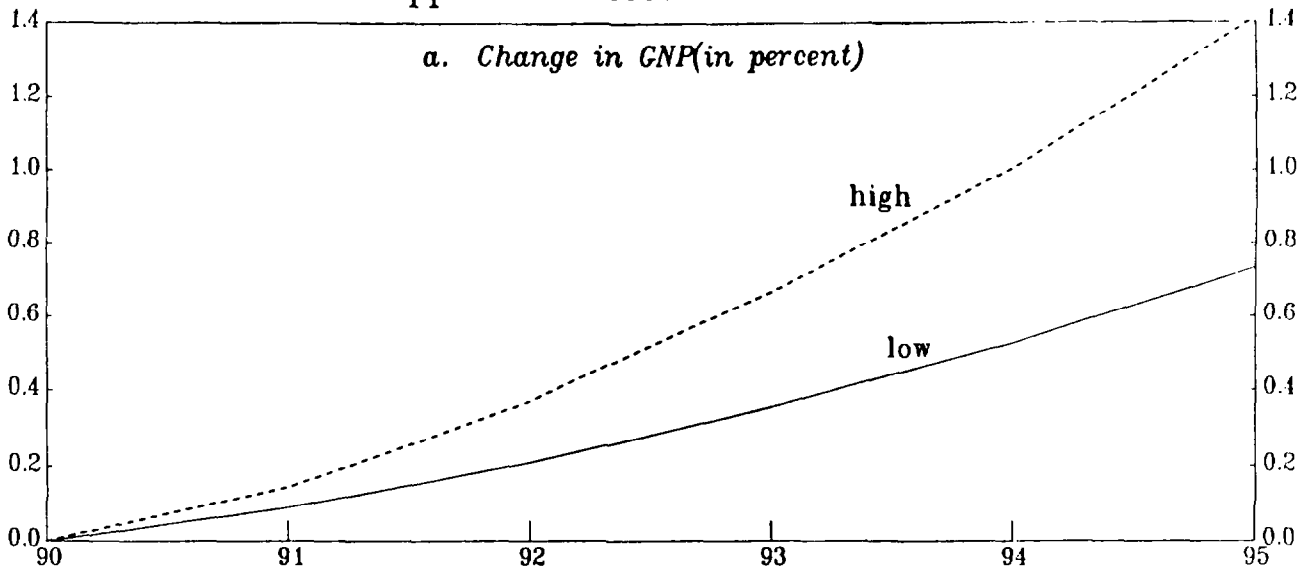
IV. Interest Parity and the Secondary Market Price of Debt

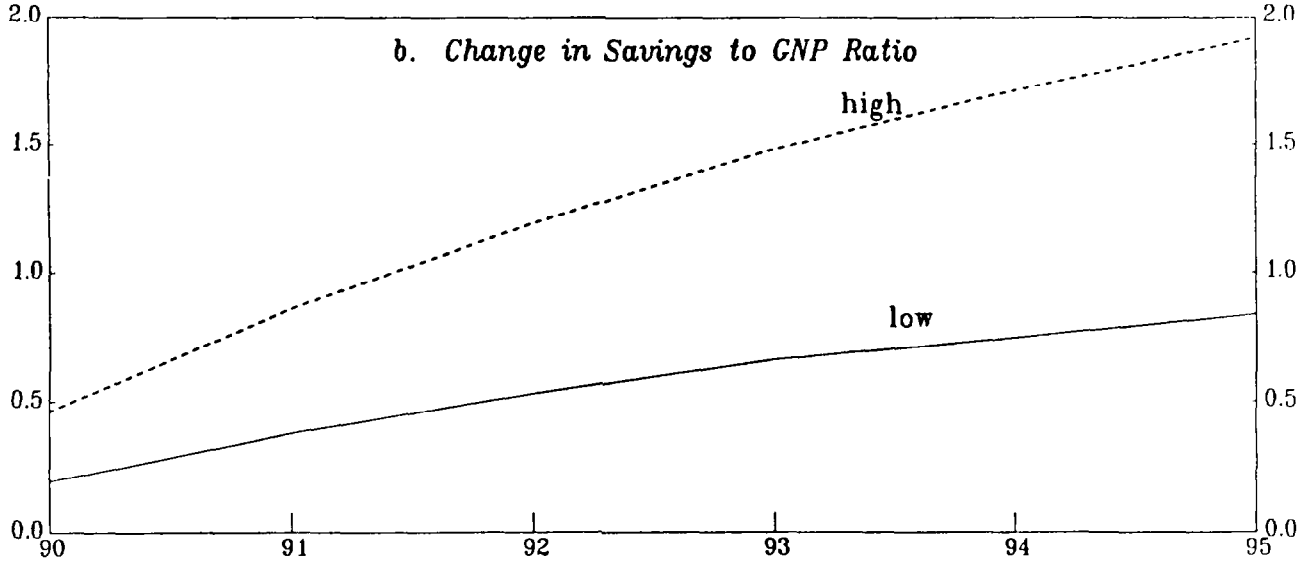
Under suitable conditions, the debt overhang effect may also be operating through a different channel, being mostly reflected in the level of domestic interest rates. This argument starts by noting that the existing discount on outstanding bank debt implies that any new loan (that has equal status to commercial bank debt) would have to carry a proportionately higher *contractual* interest rate in order to support the same *expected* interest rate. If there are free capital movements and domestic assets also carry the same interest rate (after correction by the expected rate of depreciation) then a potential investor would find that few investment projects are profitable at the high prevailing interest rates on domestic borrowing.

The equality between contractual rates on domestic and international debt (after allowing for expected depreciation) has, however, the stringent implication that the return on foreign debt must be perfectly correlated with the return on domestic (private) debt. Although it is easy to conceive of situations in which the debt overhang generates a premium on domestic debt (for example if there is an expected tax on bank deposits to finance foreign debt payments) a perfect correlation may be too extreme a case. In many situations, expected payments on foreign debt and expected taxes on domestic assets would move in opposite directions; for example, if the government decides to repudiate foreign debt the price of foreign debt should fall but the price of domestic debt should rise because there is less risk of a tax on domestic residents to finance foreign debt payments.

However, the proposition that there is some correlation between developments in secondary market for debt and domestic interest rates cannot be dismissed offhand. A strategy to test this proposition is the following. Under "normal" conditions, interest parity between domestic and foreign assets implies

Chart 2
Philippines: Effect of Debt Reduction





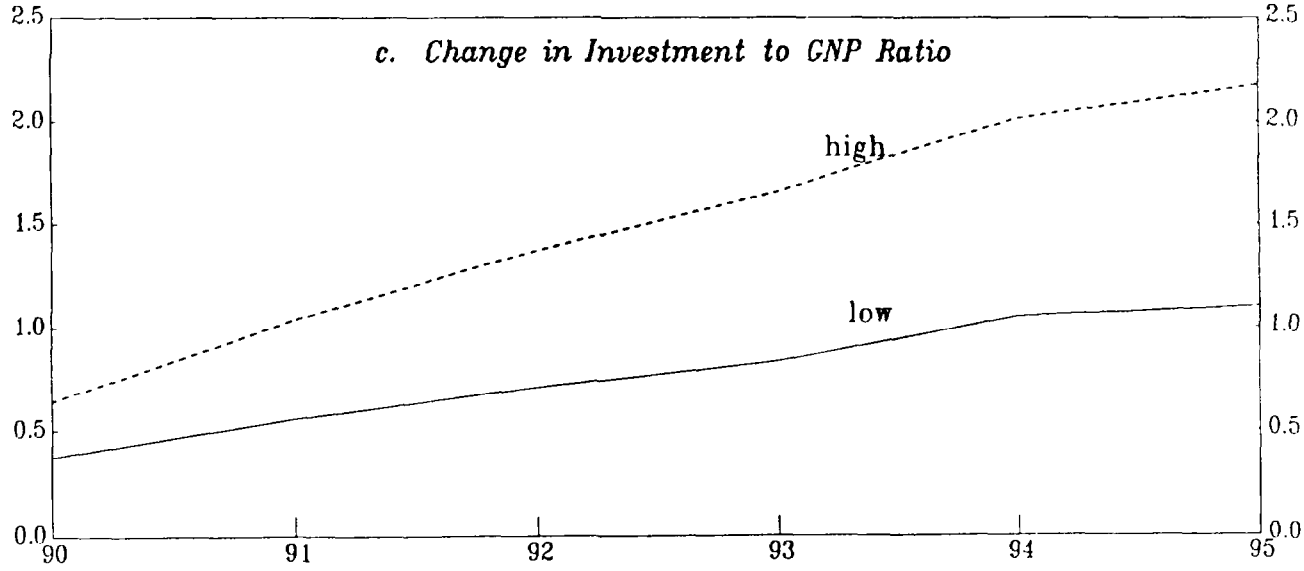


Table 3
Philippines: Simulation of Debt Reduction
Baseline Projection (with $1.3 billion Debt Reduction)

Year	GDP growth rate	Private Savings	Private Investment	Public Consumption	Public Investment	Non-interest Current Account	Foreign Debt
			— as percent of GDP —				
1989	...	18.10	15.80	8.40	4.10	2.20	64.7
1990	5.50	17.60	16.60	8.30	4.90	2.00	61.5
1991	6.50	19.00	18.20	7.90	5.20	1.40	57.3
1992	6.50	20.20	19.40	7.80	5.30	1.10	55.1
1993	6.50	20.32	18.90	7.70	5.80	0.88	52.4
1994	6.50	19.53	18.90	7.00	5.80	0.97	47.9
1995	6.50	19.13	18.90	6.50	5.80	0.87	45.8

Simulations without Debt Reduction

Lower Impact Scenario

Year	GDP growth rate	Private Savings	Private Investment	Public Consumption	Public Investment	Non-interest Current Account	Foreign Debt
			— as percent of GDP —				
1989	...	18.10	15.80	8.40	4.10	2.20	66.25
1990	5.50	17.40	16.22	8.30	4.90	2.18	62.88
1991	6.41	18.62	17.64	7.90	5.20	1.58	59.06
1992	6.37	19.67	18.69	7.80	5.30	1.28	56.97
1993	6.34	19.66	18.06	7.70	5.80	1.06	54.29
1994	6.32	18.78	17.85	7.00	5.80	1.28	49.74
1995	6.28	18.29	17.80	6.50	5.80	1.13	47.62

Higher Impact Scenario

Year	GDP growth rate	Private Savings	Private Investment	Public Consumption	Public Investment	Non-interest Current Account	Foreign Debt
			— as percent of GDP —				
1989	...	18.10	15.80	8.40	4.10	2.20	66.25
1990	5.50	17.14	15.96	8.30	4.90	2.18	62.88
1991	6.35	18.14	17.17	7.90	5.20	1.58	59.10
1992	6.26	19.01	18.03	7.80	5.30	1.28	57.08
1993	6.19	19.84	17.25	7.70	5.80	1.06	54.48
1994	6.14	17.82	16.89	7.00	5.80	1.28	50.01
1995	6.07	17.21	16.72	6.50	5.80	1.13	47.98

$$(18) \quad \frac{e_{t+1}}{e_t} = c + i_t - i_t^* + u_{t+1}$$

where e is the exchange rate, c is a constant, i is the one-period domestic interest rate, i^* is the one-period foreign interest rate, and u is a white noise disturbance which is independent of all economic information available as of time t:

$$E(u_{t+1} | I_t) = 0$$

In contrast, if the relevant return on foreign assets incorporates the market discount on debt, equation (18) becomes:

$$(19) \quad \frac{e_{t+1}}{e_t} = c + i_t - \frac{i_t^*}{p_t} + u_{t+1}$$

where p is the price of foreign commercial bank debt in secondary markets, and u has the same properties as above. 1/ Therefore, the test can be performed by estimating the following model

$$(20) \quad \frac{e_{t+1}}{e_t} = c + \lambda \left(i_t - i_t^*\right) + (1-\lambda) \left(i_t - \frac{i_t^*}{p_t}\right) + u_{t+1}$$

and testing λ=1 vs λ=0. The parameter λ is interpreted as the probability that the sample comes from model (18), and 1-λ as the probability that the sample comes from model (19).

Equation (20) was estimated using data on 30-day domestic deposits, 180-day LIBO rates, and secondary market Philippine debt prices as collected by Solomon Brothers. The data are monthly from April 1987 to December 1989. The maturity of foreign bank loans presents a problem for the accuracy of estimation. These loans have a 12-year maturity but their implicit rates of return are effectively used as 30-day rates of return for the computation of interest parity, which is certainly a strong term-structure assumption. However, the length of the sample makes this type of assumption unavoidable if any estimation is to be possible at all. The results are the following

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1/ In fact, the return on foreign assets in this case is somewhat more complicated than i^*/p, which is only true in the case of perpetuities.

c	λ	DW	$\bar{R}^2$
-3.65	1.48	1.54	.047
(3.23)	(0.33)		

The estimated value of λ is, in fact, larger than 1, but not significantly. A likelihood ratio test of the hypothesis that λ is equal to one produces a statistic of 2.14 which has a chi-square distribution with one degree of freedom. The statistic fails to reject the hypothesis at the usual confidence levels, having a probability value of 0.856. In contrast, a similar test applied to λ equal to 0 produces a statistic of 16.0, which rejects the hypothesis with a higher than 0.999 probability value.

These results show no evidence of a close relationship between domestic interest rates and discounts on Philippine external debt on secondary markets. This absence of a close correlation does not mean that the foreign debt situation is not an important factor in determining interest rates or transactions in the domestic financial markets, but rather that foreign debt with commercial banks and private domestic debt are not very close substitutes.

V. Conclusions

The relative scarcity of empirical work on the debt overhang hypothesis is symptomatic of the difficulties implicit in attempting such evaluation. Two key elements are unobservable: the perceptions about the determination of future repayments from a heavily-indebted and non-performing debtor country; and about the financing of such payments by the debtor country government. But both economic reasons and casual evidence on investment and growth make the case for the debt overhang effect a priori a strong one.

Taking the case of the Philippines, this paper used econometric estimates of a private investment demand function to test for the existence of a debt overhang effect. The Philippines appears to be an appropriate country to study because of the relative stability of the investment and growth performance until the early eighties, and the apparent severity of the debt problem. The empirical estimates found that it is possible to discern a debt effect as a factor depressing private investment after 1982. The estimates indicate that a $1.3 billion bank debt reduction (such as the one completed through the buyback operation in early 1990) would increase investment demand by something between 1/2 and 2 percentage points of GNP. The exact mechanism through which this debt overhang effect operates is not identified in the estimation, but it is a direct effect, over and above the effect that foreign debt may have on domestic interest rates or current profitability; in an additional test, maximum returns on foreign bank debt (resulting from the application of the secondary market price) were not found to be closely correlated with contractual returns on domestic debt instruments.

A better specification of the investment demand function may serve to refine the estimates obtained in this paper. Even though the parameter estimates obtained in the original specification have the right sign, the significance level of some of them--in particular the coefficient on the real interest rate--is marginal at best. Perhaps a different investment specification could prove more consistent with the data. For example, theoretical literature has stressed models in which investment is irreversible, that is, once capital is installed it cannot be removed. This type of technology could provide the basis for a much larger impact of the debt overhang because firms will tend to wait for a resolution of the associated uncertainty before embarking in investment projects. However, an empirical implementation of this type of investment function is difficult; although it seems possible to formulate an irreversible investment demand for a single firm, the aggregation problems appear insurmountable.

In conclusion, the model specified and estimated in the paper can be considered a first step in the development of models designed to determine the effects of debt overhang, and thus by implication the effects of debt reduction schemes, on economic performance. This simple model says that for the case of the Philippines the stock of external debt has created disincentives for private investment, and consequently debt reduction will have a beneficial effect on investment and growth. Whether this conclusion will hold up if the analysis is extended to other countries, or more elaborate specifications, remains a question worthy of serious study.

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