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SOVEREIGN DEBT REPURCHASES: NO CURE FOR OVERHANG

Jeremy Bulow

Kenneth Rogoff

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ABSTRACT

We show, in a reasonably general model, that if a highly indebted country has good investment projects available to it, then it will not benefit from using any of its resources to buy back debt at market prices. Debt buybacks and debt-equity swaps only make sense for the country if these programs are heavily subsidized by creditors. This result holds for all buyback programs large and small, so long as they involve voluntary creditor participation and are not part of a larger deal including offsetting concessions from lenders.

Our analysis therefore casts doubt on the popular argument that unilateral debt repurchases benefit HICs by relieving "debt overhang".

Jeremy Bulow
Graduate School of Business
Stanford University
Stanford, CA 94305

Kenneth Rogoff
Department of Economics
University of Wisconsin
1180 Observatory Drive
Madison, WI 53706

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I. Introduction

Investment in highly indebted countries (HICs) has fallen dramatically in this decade, from 25.2 percent of gross domestic product in 1980 to 17.2 percent in 1984, rebounding only to 19.6 percent in 1987. [1] Over the same period, net capital flows have sharply reversed so that most HICs are now making interest payments in excess of new borrowing. Given their failure to grow over the past decade, there is now a widespread view that the HICs will never pay their debts in full; HIC bank loans trade in the secondary market at large discounts to par. [2]

Recently, many countries have tried to alleviate their debt burdens either by repurchasing part of their debt at discount or by engaging in debt-equity swaps. Mexico, Chile, and Bolivia have already conducted debt repurchases, and Costa Rica is considering one. Debt-equity swaps have been tried to varying degrees by most of the major debtor countries. In a debt-equity swap, a foreign investor purchases debt on the secondary market and swaps it with the debtor country in exchange for direct foreign investment (that is, physical investment in the debtor country). Using swaps, Brazil may have cut its $120 billion foreign debt by as much as $6 billion in 1988 alone. Chile has retired $4.2 billion through swaps and other mechanisms since the end of 1984, reducing its bank debt outstanding by more than 36 percent. [3] From the debtor country's point of view, debt-equity swaps differ from

[1] See *World Development Report*, 1988, p. 190. The IMF's and World Bank's list of highly indebted third world countries (major problem debtors) includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cote d' Ivoire, Ecuador, Jamaica, Mexico, Morocco, Nigeria, Peru, Phillipines, Uruguay, Venezuela, and Yugoslavia. Of the seventeen, all but Chile, Colombia, Mexico and Yugoslavia invested a lower fraction of GNP in 1980-86 than in 1973-80.

[2] Secondary trading in government-guaranteed HIC debt held by private Western banks now equals about $15 billion per year and may soon double that. See, for example, Hobart Rowen,"Wall St. Takes on Debt Crisis - And Prospers", *Washington Post*, May 8, 1988, p. H1.

[3] See World Bank *World Debt Tables*, 1988-89 ed., Volume 1, p. 23; Peter Truell, "Banks, Latin American Nations Are Fed Up With Debt: New Methods Have Been Found to Reduce the Burden of Shaky Loans", *Wall Street Journal*, September 22, 1988; Alan Riding, "Debt-Equity Swaps Draw Latin Criticisms", *New York Times*, January 2, 1989; and Clyde H. Farnsworth, "Banks Ask for Backing For Third World Loans", *New York Times*, January 12, 1989.

conventional direct foreign investment (DFI) only in that the country receives some of its own bonds instead of foreign exchange for the DFI. Therefore, a debt-equity swap is really a combination of conventional DFI and a debt buyback.

Among the many experts who favor buybacks, some argue that repurchases can benefit both debtors and creditors. They contend that the "overhang" of existing debt discourages new investment because creditors will skim off part of the returns. [4] If countries and their creditors are unable to devise mechanisms to get around this problem, then countries face a wedge between private and social returns to investment. Allowing the debtor to repurchase debt at a discount, so the theory goes, would increase investment incentives and provide efficiency gains to both debtors and creditors.[5]

We do not propose to debate the existence of debt overhang; throughout most of our analysis we will assume that a HIC has unused investment opportunities which have zero or positive net present value (NPV). Our point is that under fairly general assumptions a country with profitable investment opportunities never benefits by devoting any of its resources to a voluntary buyback scheme, unless the buyback is part of a larger deal including concessions from creditors. Simply put, if a country is considering spending x dollars on buybacks in order to spur investment by y dollars, it will be better off devoting the entire x plus y to investment.[6]

Our result generally holds even if foreign creditors can extract most or even all of the returns from any new investment, whenever the country fails to repay its debt in full. The point is that there is also a "tax" on buybacks since the marginal debt the country retires is worth less than the average debt price it must pay. The problem with buybacks is that they

[4] See, for example, Steven Greenhouse, "New Goal: 3d World Debt Reduction", *New York Times*, October 4, 1988, p.C1. "In impassioned speeches [at the 1988 annual meeting of the IMF] in West Berlin, officials from ....developing nations said all the money they devoted to debt service had crippled consumption and investment. That, they say, has starved economic growth and caused per capita income to fall in Africa and Latin America since 1982."

[5] Krugman (1989) argues that buybacks at market prices would generally benefit countries at the expense of their creditors, even if there is no inefficiency in investment. Froot (1989) provides a technical analysis of debt reduction in the presence of "debt overhang", assuming like Krugman that creditors can take a country's entire investment income if it defaults on its debts. Sachs and Huizinga (1987) are among the many other advocates of the debt overhang theory, and they support a wide variety of debt reduction schemes as means of encouraging greater investment.

[6] And maybe better off still if it divides the x plus y between investment and consumption.

generally raise the value of any remaining debt outstanding, since there are less creditors left to split any repayments when the country partially defaults. This increase in expected future repayments to creditors who did not participate in the buyback effectively constitutes a "buyback tax" that is almost always larger than the "investment tax". If, in addition, investment yields higher social returns than a buyback, as the debt overhang theory implies, then the case for preferring investment to buybacks only becomes stronger.

II. A Model of the Buyback Problem

A. *Timing*

We model the buyback problem as part of a five stage, complete information process. In the first stage the country "inherits" a stock of debt, D. [7] In the second stage the country chooses the amount of its reserves to devote to a debt buyback.[8] After the buyback, in stage three, the country chooses its level of investment. In stage four uncertainty is resolved, determining gross investment income. Finally, in stage five, the country makes payments on its debt and consumes the remainder of its gross investment income plus any resources it did not allocate to either investments or buybacks. Figure 1 outlines the timing of events.

[Insert Figure 1 Here]

One may think of stages (2) and (3) occurring almost simultaneously, some time passing, and then stages (4) and (5) occurring almost simultaneously.

B. *Definitions and Assumptions*

1. *Production Technology*

The country has a production function $y(I, \theta)$, where y is output, I is total investment, and θ is a stochastic disturbance; $\theta \in [\underline{\theta}, \overline{\theta}]$, with density function $f(\theta)$, and cumulative density function $F(\theta)$. We assume that $y_1, y_2 > 0$ and that $y_1(0, \theta) = \infty$.[9] All borrowers

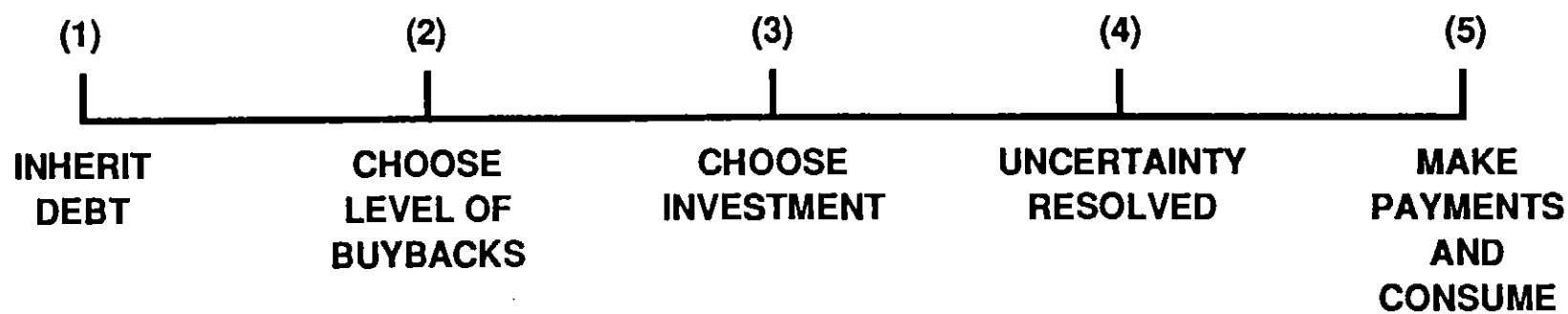
[7] Any negotiated restructuring of the country's debt occurs at stage one, prior to the start of the "game". Our concern here is to analyze the efficacy of *unilateral* buybacks; therefore we treat D as given. For interesting analyses of debt restructurings, see Krugman (1989), Froot (1989), or Helpman (1988).

[8] International lending contracts typically contain certain clauses prohibiting the country from repurchasing its debt, because such repurchases technically violate the clause that all lenders must be treated equally. However, for reasons that will become apparent, lenders are often quite happy to waive these clauses.

[9] This Inada condition is imposed for simplicity and is not necessary for our results. A weaker assumption that would also achieve the same simplification is that $y_1(0, \theta) = \infty$ for some range of θ occurring with positive probability.

FIGURE 1

SEQUENCE OF EVENTS



and lenders are assumed to be risk neutral, an assumption to be discussed in detail in section VI. For simplicity, the riskless interest rate is assumed to be zero.[10]

2. *Enforcement Technology*

Once investment returns are realized (i.e., after stage four), creditors are able to extract repayments equal to the minimum of the face value of the debt and an amount $\sigma(I,\theta,C)$, where C is the amount devoted directly to consumption (that is, allocated neither to investment nor buybacks). We assume that $0 < \sigma_1 < y_1, 0 < \sigma_2 < y_2$, and $0 \leq \sigma_3$. That is, when the country's investment income rises by a dollar, whether through higher investment or through good luck, creditors will be able to extract some, but not all, of that extra income, unless the country is already repaying its debt in full.[11]

The parameters of the σ function are likely to assume quite different values for sovereign and corporate debt. For a corporation $y_1 = \sigma_1$ and $y_2 = \sigma_2$: every extra dollar earned by a company provides (approximately) one dollar more for its creditors in the event of default. In the country case, an extra dollar of income benefits creditors by only a small fraction of that amount. However, we allow for the "corporate case" as a limiting special case of our analysis.

3. *Buyback Costs and Debt Valuation*

At stage two, the country will be able to repurchase $B(I,C,X;D)$ of face value claims for an expenditure of X where $X < B$ if the country's debt sells at a discount. Note that investors will be selling their debt after X is chosen but before stage three when the country allocates resources between I and C. However, as we will show, they will be able to deduce what the country will spend on I and C once X and B are determined.

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[10] This assumption is completely innocuous – one could alternatively consider all financial variables to be written as present values discounted to the same time.

[11] Income devoted directly to consumption may or may not be immune from creditors; if for example the country wishes to consume imports that can be seized or otherwise impeded by creditors then σ_3 may be positive. The rationale underlying the enforcement technology assumed here is based on the theoretical and empirical arguments presented in Bulow and Rogoff (1989a,b). Although foreign creditors cannot realistically invade a defaulting country and sieze its productive assets, they can hinder its trade in world goods and capital markets. Bulow and Rogoff (1989a) investigate the resulting dynamic bargaining game between debtors and creditors. To simplify the analysis here, we have boiled down the entire future into a single period. In Bulow and Rogoff (1989b) we show that LDC debt contracts must be primarily supported by the legal and political rights of creditors within their own countries, rather than by reputational factors.

At the end of stage two, once the buyback is completed, the market value of remaining debt is just the expected future payments to bondholders:

$$V(I,C,X;D) \equiv E\{min[D - B(I,C,X;D), \sigma(I,\theta,C)]\} \tag{1}$$

We can rewrite $V(I,C,X;D)$ as

$$V(I,C,X;D) \equiv \int_{\underline{\theta}}^{\hat{\theta}} \sigma(I,\theta,C) f(\theta) d\theta + [D - B(I,C,X;D)][1 - F(\hat{\theta})] \tag{2}$$

where $\hat{\theta}$ is given by

$$\sigma(I,\hat{\theta},C) = D - B(I,C,X;D) \tag{3}$$

That is, given I,C,X, and D, $\hat{\theta}$ is the critical value of θ such that the country will pay its debt in full if and only if $\theta \geq \hat{\theta}$. Given our assumptions, $\hat{\theta}$ is decreasing in C,I, and X and increasing in D.

To economize on notation, we will adopt the following conventions: $B(X) \equiv$ debt repurchased for an expenditure of X; $V(D-B) \equiv$ market value of remaining debt after repurchase of $B(X)$ face value of bonds.

C. *Equilibrium Condition for Buybacks*

The price the country must pay to repurchase its debt, $X/B(X)$, is governed by the following equilibrium condition:

$$\frac{X}{B(X)} = \frac{V(D-B)}{D - B(X)} \tag{4}$$

where $V(D-B)/[D-B(X)]$ is the market price of the country's debt after the repurchase. Condition (4) simply states that the marginal investor must be indifferent between tendering and not tendering his bonds.

D. *Marginal vs. Average Debt*

Two important concepts that will play a recurring role in our analysis are marginal and average debt. Marginal debt is defined as $\partial V(D-B)/\partial(D-B)$. It is the *cost to the country* of having one extra dollar of debt outstanding.[12] Differentiating equation (2) yields

$$\frac{\partial V(D-B)}{\partial(D-B)} = 1 - F(\hat{\theta}) \tag{5}$$

[12] The reason we are centrally concerned with $\frac{\partial V(D-B)}{\partial(D-B)}$ and not with $\frac{dV(D-B)}{d(D-B)}$ will become apparent after we prove proposition 1 below. The two can be different because a

The average value of debt is the total value of debt divided by the amount outstanding. If all debt is treated *pari passu* (equal sharing), as virtually all sovereign loans are, then the average value is simply the market price of a bond.[13] Again using equation (4) we find the average value of debt, $\frac{V(D-B)}{D-B(X)}$, to be always at least as large as the marginal value:

$$\frac{V(D-B)}{D-B(X)} = \frac{1}{D-B(X)} \int_{\underline{\theta}}^{\hat{\theta}} \sigma(I,\theta,C) f(\theta) d\theta + 1 - F(\hat{\theta}) \tag{6}$$

Figure 2 illustrates the difference between marginal and average debt.

[Insert Figure 2 Here]

In the Figure, drawn for given I, C, and X, the market value of debt is found by taking the returns to debtholders for each value of θ and weighting those returns by the density of that value. This is done by graphing realized returns against the cumulative density function of θ so that each range of values of θ for which there is, say, a .01 probability of realization, is allocated a width of .01 on the horizontal axis. The total value of debt, integrating across all states, is the sum of area i, representing the market value of a claim to creditors' income in defaulting states, and area ii, which represents the market value of a claim to creditors' income in full payment states. The average value of debt is just the total value divided by the face value $D - B(X)$.

The marginal value of debt, which is the increment to total value if $D - B(X)$ is increased by one dollar, is $1 - F(\hat{\theta})$. This equals the area of rectangle ii, which has area $[1 - F(\hat{\theta})] \cdot [D - B(X)]$, divided by $D - B(X)$. Therefore, the ratio of the marginal value of debt to the average value is

$$\frac{Marginal\ Value\ of\ Debt}{Average\ Value\ of\ Debt} = \frac{ii}{i+ii} = \frac{value\ of\ returns\ in\ full\ payment\ states}{value\ of\ returns\ in\ all\ states} \tag{7}$$

This ratio will turn out to be of critical importance in our comparison of investment and buybacks.

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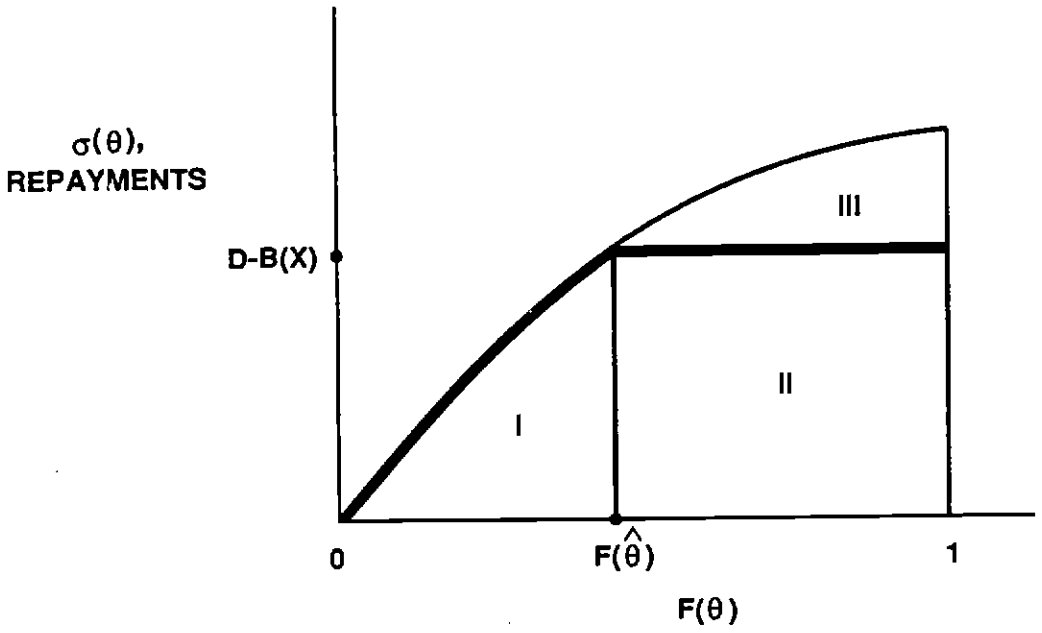
higher face value of debt could discourage investment. In the extreme, $\frac{dV(D-B)}{d(D-B)}$ could be negative; this would be the case if we were on the wrong side of the infamous Debt Laffer Curve (see, for example, Krugman (1989)). The difference between the country's gain from a one dollar reduction in the face value of its debt, $\frac{\partial V(D-B)}{\partial D-B}$, and the bondholder's loss, $\frac{dV(D-B)}{d(D-B)}$, is attributable to the efficiency consequences of changes in the country's allocation of resources.

[13] If some bonds receive priority over others then obviously the senior bonds will sell for more and the junior bonds for less. We briefly discuss seniority at the end of the paper.

FIGURE 2

AVERAGE vs MARGINAL DEBT

(I, C, X held constant)



DARK LINE REPRESENTS MIN (D-B(X), σ(θ))

1. Total Market Value of Debt = area I + area II

2. $$\text{Average Value of Debt} = \frac{\text{Total Market Value of Debt}}{\text{D-B(X)}} = \frac{\text{I + II}}{\text{D-B(X)}}$$

3. $$\text{Marginal Value of Debt} = \frac{\partial \text{ Total Market Value of Debt}}{\partial \text{ (D-B(X))}}$$

$$= 1\text{-}F(\hat{\theta}) = \frac{\text{II}}{\text{D-B(X)}}$$

4. $$\frac{\text{Marginal Value of Debt}}{\text{Average Value of Debt}} = \frac{\text{II}}{\text{I + II}}$$

III. The Country's Optimization Problem

The country wishes to maximize its expected consumption

$$W(I,C,X;D) \equiv C + E\{y(I,\theta)\} - V(I,C,X;D) \tag{8}$$

subject to

$$C + I + X = W_0 \tag{9}$$

$$\frac{\partial W}{\partial C} \leq \frac{\partial W}{\partial I} \;\; ; = 0 \text{ if } C > 0 \tag{10}$$

$$C, I, X \geq 0 \tag{11}$$

Equation (8) states that expected consumption equals resources devoted directly to consumption, C, plus expected gross investment returns, $E\{y(I,\theta)\}$, less expected bond repayments V. Equation (9) is the country's budget constraint, and equation (10) is a perfection constraint.[14] It says that after the buyback the country will split remaining resources between C and I to maximize W. The perfection constraint prevents the country from buying back its debt at a cheaper price by announcing that it is going to choose a very low level of investment; such an announcement is not credible.[15]

We define a solution to (8) as I^*, X^*, C^*. Since we are interested in when buybacks can be optimal, we concentrate on characterizing this solution when $X^* > 0$.

PROPOSITION 1: If $X^* > 0$, then

$$\frac{\partial W}{\partial X} = \frac{\partial W}{\partial I} \; .$$

PROOF: Assume $X^* > 0$.

Implicitly differentiating (8) yields

$$\frac{dW}{dX} = 0 = \frac{\partial W}{\partial X} + \frac{\partial W}{\partial C}\frac{\partial C}{\partial X} + \frac{\partial W}{\partial I}\frac{\partial I}{\partial X} \tag{12}$$

[14] Technically, constraint (10) would read $\frac{\partial W}{\partial C} = \frac{\partial W}{\partial I}$ if $I, C > 0$; $\frac{\partial W}{\partial C} \leq \frac{\partial W}{\partial I}$ if $C = 0$; $\frac{\partial W}{\partial I} \leq \frac{\partial W}{\partial C}$ if $I = 0$. However, it simplifies to (10) because the Inada condition guarantees that $I > 0$.

[15] If the country can precommit to an investment level, negotiations between creditors and debtors should yield efficient investment and eliminate debt overhang. In this case, the financial structure of the country does not affect its real decisions, as in the standard Miller-Modigliani world. See, for example, Fama and Miller (1972).

Applying the perfection constraint (10) implies

$$0 = \frac{\partial W}{\partial X} + \frac{\partial W}{\partial I}\left[\frac{\partial (C+I)}{\partial X}\right] \tag{13}$$

The budget constraint (9) implies $\partial(C+I)/\partial X = -1$, and substituting into (13) yields

$$\frac{\partial W}{\partial X} = \frac{\partial W}{\partial I} .$$

Q.E.D.

This proof shows that if buybacks are profitable then, in equilibrium, an extra dollar spent on buybacks has the same benefit to the country as a dollar's worth of extra investment. Buybacks that are unprofitable on their own cannot be made viable by their effects on the country's investment incentives.

IV. Analysis of Buybacks: A Special Case

Armed with proposition 1, we can readily determine whether, for any given production and enforcement technology, buybacks can be profitable. Before proceeding to a general analysis we look at perhaps the most natural "special case", where

$$y(I,\theta) = \theta g(I) \tag{14}$$

and

$$\sigma(I,\theta,C) = q_1 C + q_2 \theta g(I) \tag{15}$$

$$0 \leq q_1 < 1,\ 0 \leq q_2 < 1 .$$

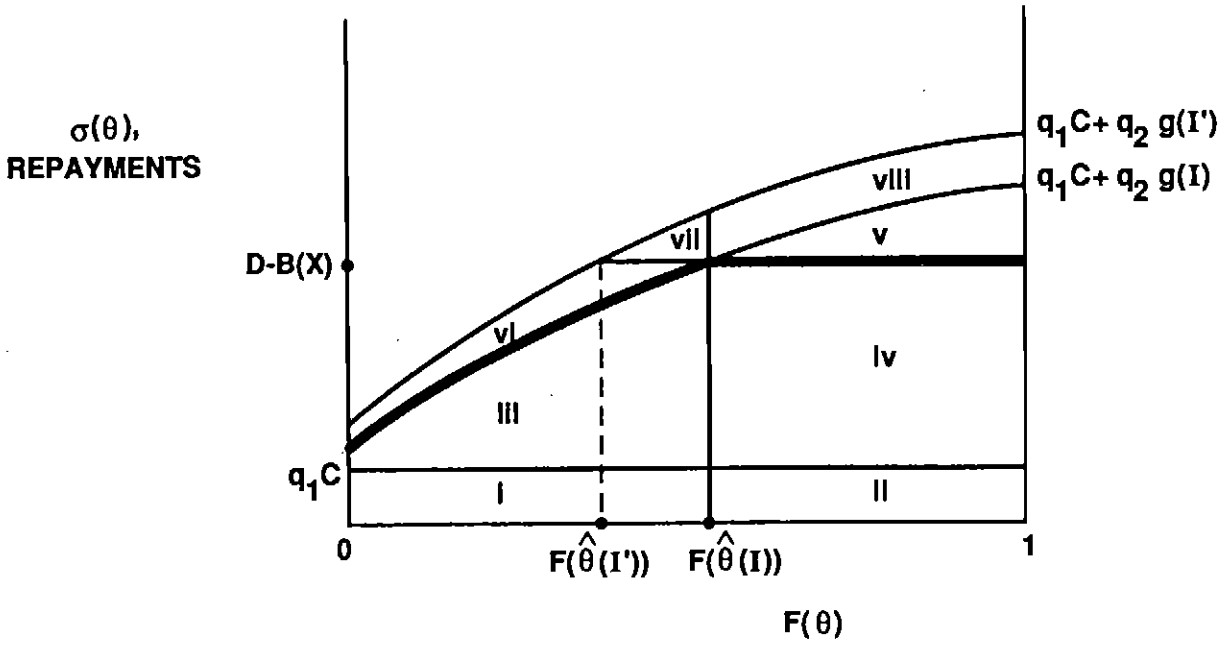
To economize on notation, we also assume $\underline{\theta} \geq 0$ and normalize so that $E(\theta) = \int_{\underline{\theta}}^{\overline{\theta}} \theta f(\theta) d\theta = 1$.

Under the investment technology of (14), the country's relative returns on investment in different states of nature are unaffected by the level of investment. Roughly speaking, the returns on marginal investment are taken to share the same risk characteristics as returns on other investment. With the linear expropriation technology, $\hat{\theta}$ can be calculated from equation (3) to be $\hat{\theta} = [D - B(X) - q_1 C]/[q_2 g(I)]$. Figure 3 illustrates these assumptions.

[Insert Figure 3 Here]

FIGURE 3

SPECIAL INVESTMENT AND SEIZURE ASSUMPTIONS



In Figure 3, at investment level I, the value of bondholders' claims is the sum of areas $i + ii + iii + iv$. When investment is increased from I to I', returns in all risky states are increased proportionately. Therefore, the ratio of area $vi + vii$ to iii is the same as the ratio of $viii$ to $iv + v$. The value of bondholders' claims would rise to $i + ii + iii + iv + vi$.

Note that $\partial g/\partial I \equiv g'(I)$ is the expected present value of returns from a marginal investment, since $E(\theta) = 1$. Therefore, marginal investment has a positive net present value if and only if $g'(I) > 1$.

Proposition 2 below states that if a country has any unused non-negative net present value investment, then it will not benefit from devoting any of its resources to buybacks.

PROPOSITION 2: If $g'(I) \geq 1$, then $X^* = 0$.

PROOF: See Appendix.

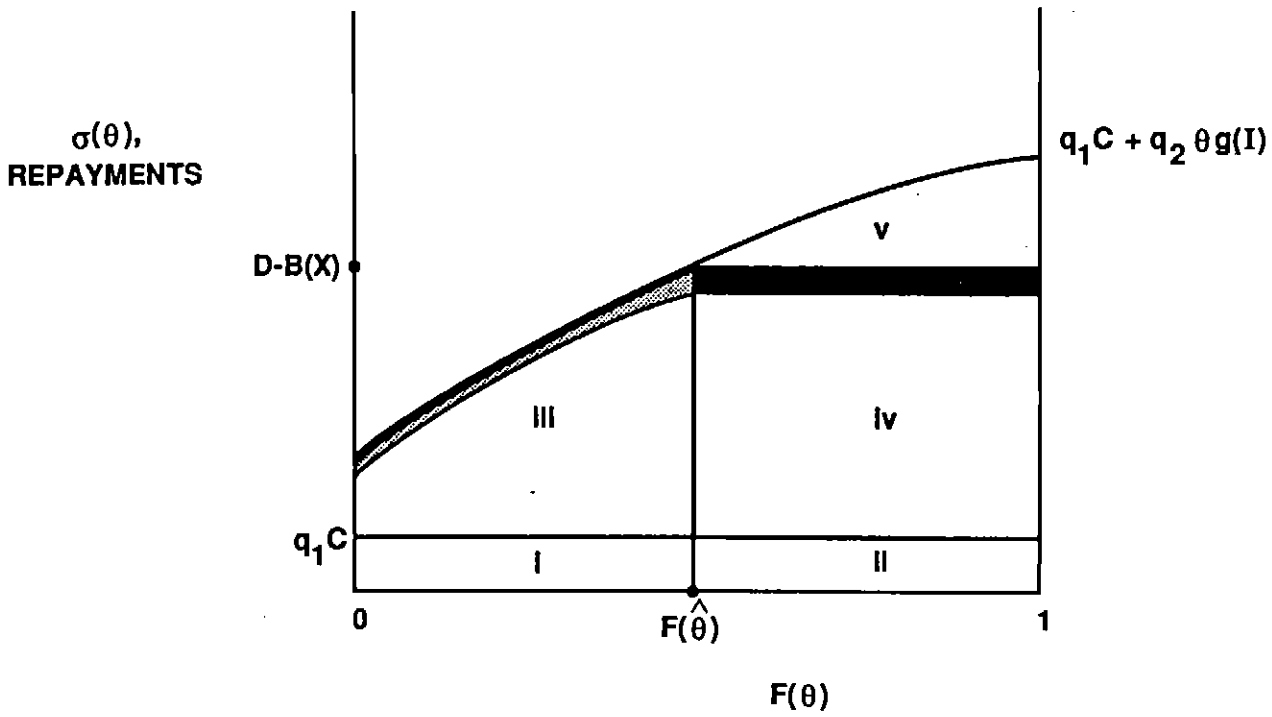
A diagramatic exposition of propostion 2 follows. Consider the best case for buybacks, where the investment alternative has zero NPV. Then there are no efficiency consequences of increasing or decreasing buyback levels and the gain to the country of spending another dollar on buybacks is exactly equal to the change in expected payments to bondholders.

First consider an extra dollar found and spent on a buyback. In Figure 4 bondholders own a claim worth areas $i + iii + ii + iv$. An expenditure of one dollar on a buyback will induce an individual bondholder to relinquish a claim equal to the entire shaded area in Figure 4. This area represents his share of total payoffs in both defaulting states and non-defaulting states, and must equal one dollar. However, the benefit to the country is only the black part of the shaded area. The problem is that an individual bondholder has no incentive to recognize that when he relinquishes his debt, other creditors benefit whenever $\theta < \hat{\theta}$. In defaulting states, the buyback only helps other bondholders by allowing them to split the same default pie among less creditors. Since the total shaded area is in direct proportion to $i + iii + ii + iv$ and the black shaded area is in proportion to $ii + iv$, the gain to the country from a dollar's increase in buybacks is $\frac{ii+iv}{i+iii+ii+iv}$ or, by equation (7), the ratio of the value of marginal to the value of average debt.

[Insert Figure 4 here]

FIGURE 4

GAINS FROM A BUYBACK



Now consider a marginal investment in the case where $q_2 = 1$; that is, where 100 percent of investment returns can be seized in the event of a default. This is, of course, the *least* favorable case for investment relative to buybacks. If the marginal investment has a zero net present value, then the entire shaded area in Figure 5 is one dollar. The proportion of that dollar going to the country is $\frac{iv+v}{iii+iv+v} > \frac{ii+iv+v}{iii+iv+v+i+ii} > \frac{ii+iv}{ii+iv+i+iii}$, so the country keeps more from investment than from a buyback even if $q_2 = 1$. If $q_2 < 1$, the country keeps $1 - q_2$ off the top and $\frac{iv+v}{iv+v+iii}$ of the remaining q_2. It gets even more if $g' > 1$. Therefore, the country is always better off reducing buybacks. While creditors do collect a "tax" on the country's marginal investment, as in the debt overhang theory, the debt overhang "tax rate" is always *lower* than the implicit tax on buybacks.

[Insert Figure 5 here]

V. The General Case

While section IV indicates that buybacks will never be profitable under certain assumptions, it is possible by looking at the general case to derive conditions under which these repurchases would make sense. However, we will argue at the end of this section that these conditions are quite unrealistic.

For buybacks to be profitable, we must have $\partial W/\partial X \geq \partial W/\partial I$ at the optimum. It is straightforward to show that even in the general case $\partial W/\partial X \leq \frac{marginal\ value\ of\ debt}{average\ value\ of\ debt}$. The proof is exactly that given in the appendix, which only makes use of the special investment technology in section IV to calculate $\partial W/\partial I$.

The general formula for $\partial W/\partial I$ is

$$\frac{\partial W}{\partial I} = \int_{\underline{\theta}}^{\overline{\theta}} y_1(I,\theta) f(\theta) d\theta - \int_{\underline{\theta}}^{\hat{\theta}} \sigma_1(I,\theta,C) f(\theta) d\theta \tag{16}$$

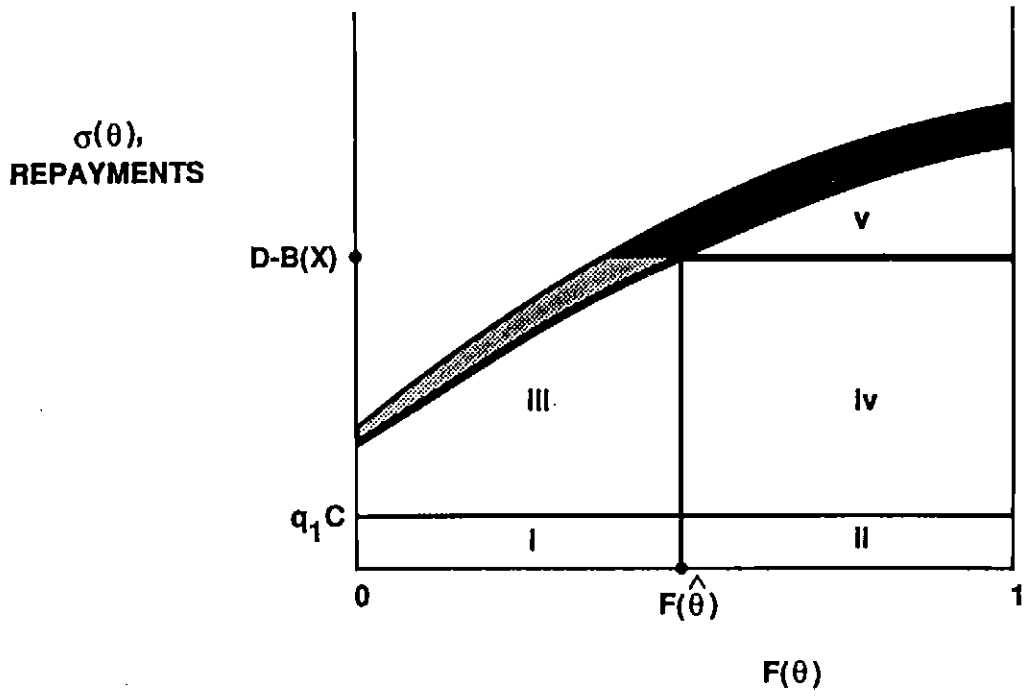
which can be interpreted as the expected marginal return on investment less the expected incremental payments to bondholders.

We define

$$\overline{q} \equiv \frac{\int_{\underline{\theta}}^{\hat{\theta}} \sigma_1(I,\theta,C) f(\theta) d\theta}{\int_{\underline{\theta}}^{\hat{\theta}} y_1(I,\theta) f(\theta) d\theta} \tag{17}$$

FIGURE 5

GAINS FROM INVESTMENT



and

$$G(\hat{\theta}) \equiv \frac{\int_{\underline{\theta}}^{\hat{\theta}} y_1(I,\theta) f(\theta) d\theta}{\int_{\underline{\theta}}^{\bar{\theta}} y_1(I,\theta) f(\theta) d\theta} \tag{18}$$

where $\overline{q}$ is the fraction of incremental defaulting state returns that go to bondholders, and $G(\hat{\theta})$ is the fraction of returns to marginal investment earned in defaulting states. Then, using (17) and (18), (16) can be rewritten as

$$\frac{\partial W}{\partial I} = E(y_1)[1 - G(\hat{\theta}) \cdot \overline{q}] \tag{19}$$

For buybacks to be a good idea, (19) must be less than or equal to the ratio of marginal value of debt to average value of debt, which by equations (5) and (6) is given by

$$\frac{\textit{marginal value of debt}}{\textit{average value of debt}} = \frac{1 - F(\hat{\theta})}{\frac{\int_{\underline{\theta}}^{\hat{\theta}} \sigma(I,\theta,C) f(\theta) d\theta}{D - B(X)} + 1 - F(\hat{\theta})} \geq \frac{\partial W}{\partial X} \tag{20}$$

We can place a lower bound on $\partial W/\partial I$ by setting $E(y_1) = 1$ and $G(\hat{\theta}) = 1$ in equation (16). $E(y_1) = 1$ implies that the country only has a zero NPV project available. If debt overhang really depresses investment to inefficiently low levels, then $E(y_1) > 1$. $G(\hat{\theta}) = 1$ implies that *all* marginal investment returns are earned in defaulting states, and that investment yields nothing when the country does well enough to not default. Setting $E(y_1) = 1$ and $G(\hat{\theta}) = 1$ we find, by comparing (19) and (20), that buybacks are at least as good for the country as investment only if

$$\overline{q} \geq 1 - \frac{\textit{marginal value of debt}}{\textit{average value of debt}} \tag{21}$$

Furthermore, under the more reasonable assumption that there exist zero NPV marginal investments that have at least as high an average return in good (i.e. non-defaulting) states of nature as in defaulting states – holding U.S. Treasury bills would be an example of such an investment opportunity – then $G(\hat{\theta}) \leq F(\hat{\theta})$ and (21) becomes

$$\overline{q} \geq \frac{1 - \frac{\textit{marginal value of debt}}{\textit{average value of debt}}}{1 - \textit{marginal value of debt}} \tag{22}$$

The empirical implausibility of (21) and (22) can be easily demonstrated. The seventeen HICs listed in the World Bank tables of troubled debtors (see footnote 1) owe less than four

TABLE 1

DEBT AS A PERCENTAGE OF FUTURE NET INCOME

Country	Private Debt, Book Value 12/31/87 ($ millions)	Private Debt, Market Value 12/31/87 ($ millions)	Market Value of Debt As Percent of Present Value of Future Income 12/31/87
Argentina	40,327	13,950	1.21%
Bolivia	1,083	153	0.25%
Brazil	66,452	31,763	0.67%
Chile	11,579	7,186	2.80%
Colombia	5,566	3,857	0.76%
Costa Rica	1,631	253	0.41%
Cote D'Ivoire	3,720	1,593	1.13%
Ecuador	5,866	2,394	1.64%
Jamaica	575	295	0.78%
Mexico	66,831	33,548	1.61%
Morocco	4,916	2,666	1.14%
Nigeria	14,091	5,949	1.69%
Peru	6,083	860	0.13%
Phillipines	11,884	6,230	1.20%
Uruguay	2,398	1,422	1.30%
Venezuela	24,116	13,952	2.41%
Yugoslavia	7,605	3,726	0.41%
17 HICs	**274,723**	**129,797**	**1.03%**

Source: World Debt Tables, 1988-89 edition; Salomon Brothers.
Private Debt is debt owed to private creditors.

Country is assumed to need to invest 25 percent of GNP each year to maintain a growth rate 5 points below the discount rate on its future income. Supplier debt is assumed to be worth the minimum of 100 cents on the dollar and five times the value of financial market debt.

months' GNP to their commercial bank creditors. Since the market value of this debt is well under half of face value, the expected present value of future repayments is less than two months' income. The implication is that $\overline{q}$, which is a measure of the fraction of a country's income that can be seized for debt repayment, is very small – at the very most .05.[16]

Another pespective on the size of $\overline{q}$ is given in Table 1. The table shows that for 17 HICs debt represents an average of approximately one percent of future income, even assuming that the country's growth rate will be five percentage points below its risk-adjusted discount rate and deducting 25 percent of GNP each year for investment to maintain this modest growth. (We do not mean to imply by these calculations that HICs' debt is not quite burdensome, only that q is low).

[Insert Table 1 Here]

Table 1 only includes private debt and not debt to official creditors, because we regard debt to official creditors as more of a measure of the present value of past foreign aid than of future repayments. As table 2 shows, except in unusual circumstances (such as in 1987 when Brazil was punished for its debt moratorium and the United States was delaying approval of increased World Bank "lending"), private lenders have accounted for well over 100 percent of HICs' net repayment burden.

[Insert Table 2 Here]

However, even if $\overline{q}$ were as high as .25, (21) and (22) can only hold if the value of marginal debt is very close to the value of average debt. For example, (21) implies that if $\overline{q} = .25$ and a country's debt is selling for 50 cents on the dollar then there must be at least a 37.5 percent chance of full repayment and at most an expected repayment of 20 cents on the dollar conditional on default. For (22) to hold, the probability of full repayment would have to rise to 42.9 percent and the expected payments in defaulting states could be at most 12.5 percent of par. This essentially "all or nothing" distribution of expected repayments seems inconsistent with the consensus view that HICs will repay some but not all of their debts. Allowing for a more realistic, lower value of $\overline{q}$ and positive NPV projects can make profitable buybacks totally impossible.

[16] Throughout the current debt crisis no country has made net transfers of more than five percent of GNP or twenty-five percent of export revenues over any extended period.

TABLE 2

DESTINATION OF CAPITAL OUTFLOWS, 1983-87

1983-87 Total	Net Capital Outflows to Private Creditors ($ millions)	Total Net Outflows ($ millions)	Private as Percent Of Total Outflows
Country			
Argentina	6,519	5,992	109
Bolivia	248	97	256
Brazil	13,704	14,258	96
Chile	994	4	N.M.
Colombia	(32)	(1,124)	N.M.
Costa Rica	828	712	116
Cote D'Ivoire	1,650	1,105	149
Ecuador	943	330	286
Jamaica	309	115	269
Mexico	23,745	22,842	104
Morocco	717	(396)	N.M.
Nigeria	3,609	2,726	132
Peru	(1,248)	(1,876)	N.M.
Phillipines	829	37	N.M.
Uruguay	508	502	101
Venezuela	10,253	10,524	97
Yugoslavia	2,531	4,419	57
Year	**17 HICs**		
1983	2,861	175	N.M.
1984	10,950	8,324	132
1985	18,670	18,037	104
1986	19,428	18,574	105
1987	14,198	15,159	94
1983-87	**66,107**	**60,269**	**110**

N.M. stands for not meaningful.

Source: World Debt Tables, 1988-89 edition.

Note: Private debt accounts for roughly 75 percent of the book value of HIC debt.

What is the difference between the general case and the special case of section IV?

First, the general analysis allows the "tax rate" on investment to be increasing in income. A rising marginal tax rate raises the value of marginal debt relative to average debt and makes profitable buybacks theoretically feasible.

Second, in the general case we are allowing for new investment which is "less risky" than old. The bound in (22) assumes that marginal investment returns are completely uncorrelated with inframarginal returns, as in the case of a riskless asset. In this case, marginal investment returns are more concentrated in defaulting states of nature than are average investment returns. The bound in (21) goes further, allowing new investment to be so highly *negatively* correlated with old investment that the new investment yields positive returns only when θ is *less* than $\hat{\theta}$.

VI. Risk Aversion

How does our analysis differ when the country is risk averse? [17] Buybacks provide no returns to debtors in defaulting states, and may yield less than investment for the highest values of θ. However, buybacks may have higher *ex post* returns in some intermediate non-defaulting states. (This is necessarily the case when buybacks and investment yield the same expected returns.) Therefore the effects of risk aversion are ambiguous. Clearly, however, if the country's utility function is sufficiently concave, then risk aversion works against buybacks.

Note that for buybacks to have at least as large an *expected* return as investment, marginal investment returns must be skewed towards bad states of nature, and there must be rising marginal tax (seizure) rates. Both of these factors make investment relatively more attractive with risk aversion. For example, when marginal tax rates are either constant or increasing, holding riskless cash reserves becomes unambiguously more attractive relative to buybacks in the presence of risk aversion.

[17] It is plausible to treat the country as risk averse and foreign investors as risk neutral, if the θ shock is diversifiable in world capital markets.

VII. Seniority

Some recent plans for resolving the HICs' debt problems involve creating new classes of senior debt to enhance buybacks. A number of Mexico's recent efforts have included ingenious schemes for doing just that.[18] Stripped of their fancy financial engineering gimmickry, such deals are the equivalent of this: For every dollar of old equal priority debt, each bondholder is given $\$\alpha$ of "senior" debt and $\$1 - \alpha$ of "junior" debt. After the exchange, each investor owns a claim worth exactly as much as what they held before the exchange. However, the junior debt has a lower market value than the senior debt. Thus, after the exchange, the country can repurchase junior debt at a lower price than it would have had to pay for equal priority debt prior to the exchange. Since the country doesn't care whether the debt it retires is junior or senior, its payments being a function only of the amount of debt outstanding and not the distribution of seniority rights among creditors, this type of scheme would appear to improve the scope for buybacks.

However, as the Mexico case has shown it is not easy to institute strong, credible seniority provisions for sovereign debt. As the corporate finance literature shows, without minimum collateral requirements it is difficult to have meaningful seniority clauses; if a "junior debt" payment is due when money is available but before a "senior debt" payment must be met, the junior debt really gets priority. However, the very essence of sovereign debt is that there is no collateral. The seniority issue is very complex theoretically. In practice, most sovereign debt with the exception of trade credits is treated as equal priority.

VIII. Corporate vs. Sovereign Debt

The analysis above can be thought of as a general model of buybacks. One special case worth mentioning is the "corporate" case, where one can think of C as dividends paid and where $\sigma(I, \theta, C) = y(I, \theta)$. That is, creditors get all assets in the event of default. This is essentially the case of $q = \overline{q} = 1$ in sections IV–V. Buybacks of equal priority debt help bondholders if they replace riskless marginal investments, but hurt bondholders if they replace investments with risk characteristics similar to the corporation's other investments. However, if debt is finely enough graded by seniority then it can be shown that a repurchase of the most junior debt is, from bondholders' perspective, equivalent to the debtor's throwing

[18] See Bulow and Rogoff (1988).

its money out – or paying a dividend. [19] Such a buyback would always be preferable for the borrower to a zero net present value investment.

IX. Why Do Countries Sometimes Buy Back Debt?

The main conclusion of our analysis is that if highly indebted countries have positive NPV investment projects, then they will not benefit from expending scarce resources on debt repurchases. Why then do HICs sometimes conduct such repurchases? [20] Sometimes, the buybacks are part of larger deals in which the country is given a sidepayment by its creditors. (The analysis here may be useful in evaluating how large these sidepayments need to be for the country to at least break even.) In other cases, the reason for a buyback may be that the country's best alternative investment project has negative net present value (in contrast to our maintained assumption). If alternative investment projects are poor enough, then it does not matter what percentage of their returns accrue to the country; buybacks are a more efficient use of its resources.

For some countries, this explanation is quite plausible. Many HICs are now faced with much higher world interest rates and lower export prices than during the seventies when they accumulated their debt. As Table 3 indicates, those who have held private investments in HICs have not prospered in the 1980s. Furthermore, the low current ratio of price to book value for the HICs' "submerging markets" relative to other markets implies that investment opportunities, holding political constraints constant, may be generally better elsewhere in the world. Finally, the fact that so little of the capital flight money that was removed in the late 70s and early 80s has returned implies that investors who know these markets well and have money have chosen not to invest. Of course, the assumption that countries' best alternative investment projects have negative NPV runs completely counter to the debt overhang theory which says that the countries have many high NPV projects available.

[Insert Table 3 Here]

Our analysis does assume symmetric information. Buybacks might make sense if the

[19] Were it possible to have a sufficiently comprehensive indexation and seniority structure (that is, if there were no enforcement problems), then restructurings of the country's debt would not even have distributional effects. See Fama and Miller (1972) for the original discussion of "me-first" rules in the context of corporate finance; see also Fama (1978).

[20] Repurchases were used extensively during the late 1930s and early 1940s, in the aftermath of the last great LDC debt crisis; see Eichengreen and Portes (1988a,b).

TABLE 3

RELATIVE STOCK MARKET PERFORMANCE, 1981-87

Group of Countries	Market Value 12/31/80 ($ millions)	Market Value 12/31/87 ($ millions)	Total Price Change 1981-87 (percent)	Compound Annual Growth 1981-87 (percent)	Ratio of Prices to Book Value 12/31/87
Eight HICs	**44,955**	**43,889**	**(2.4)**	**(0.3)**	**0.8**
Other Emerging Markets	38,483	143,297	272.4	20.7	2.3
Japan	370,200	2,802,956	657.1	33.5	4.0
United States	1,448,120	2,588,890	78.8	8.7	1.7
World	2,725,915	7,843,392	187.7	16.3	2.1

Source: International Finance Corporation, *Emerging Stock Markets Factbook* 1988.0

Eight HICs include Argentina, Brazil, Chile, Colombia, Mexico, Nigeria, Phillipines, and Venezuela.

Other emerging markets include Greece, India, Jordan, Korea, Malaysia, Pakistan, Portugal, Taiwan, Thailand, Turkey, and Zimbabwe. No data was available on price/book or price/earnings ratios for Portugal and Turkey.

debtor country's leaders have private information that its future output is going to be much higher than creditors expect. On the other hand, such experts such as Rudiger Dornbusch (1988) have suggested that if countries wait a few more years they may be able to repurchase their debt even more cheaply. As table 4 shows, at least for the last two years the Dornbusch strategy has been the right one.

[Insert Table 4 Here]

Another explanation for buybacks is that politically powerful special interest groups may benefit from certain debt-equity swap programs even though the country as a whole loses. For example, Brazil's foreign minister, Mailson de Nobrega, had to combat enormous pressure from major industrialists when he recently decided to veto a proposed debt-for-exports plan. [21]

Finally, an interesting alternative explanation for buybacks has recently been formalized by Rotemberg (1988). In his analysis, the deadweight costs to bargaining are lower the lower the size of the debt; thus there are efficiency gains to buybacks other than the investment incentives we have focussed on here. We note, however, that the typical LDC debt contract prohibits buybacks at discount and that debtor countries must negotiate for this right. When one takes into account the costs involved in bargaining over the size and terms of the buyback, there may not be any efficiency gain. Furthermore, because many debt reduction schemes, such as the Mexican buyback of early 1988, involve the creation of new classes of creditors with interests that conflict with those of both the countries and older creditors, it is likely that many proposed plans will actually increase future bargaining costs.[22] These issues merit further attention.

X. Conclusion

We have shown, in a reasonably general model, that if a highly indebted country has good investment projects available to it, then it will not benefit from using any of its resources to buy back debt at market prices. Debt buybacks and debt-equity swaps only make sense for the country if these programs are heavily subsidized by creditors. This result

[21] See Alan Riding, "Debt-for-Equity Swaps Draw Latin Criticisms", *New York Times*, January 2, 1989, p.34.

[22] For a favorable analysis of the Mexican buyback, see Jeffrey D. Sachs, "Mexico Plan a Model for Other Debtors", *Wall Street Journal*, January 19, 1988.

TABLE 4

PRICING OF HIC DEBT

Country	Debt Price 12/2/86 (Percentage of Face Value)	Debt Price 12/31/87 (Percentage of Face Value)	Debt Price 12/31/88 (Percentage of Face Value)	Percent Change in Debt Price 12/2/86 to 12/31/87	Percent Change in Debt Price 12/31/87 to 12/31/88
Argentina	66	34	21	(49)	(37)
Bolivia	7	11	10	57	(9)
Brazil	75	46	40	(38)	(13)
Chile	67	61	57	(9)	(7)
Colombia	86	65	58	(24)	(12)
Costa Rica	35	15	12	(57)	(20)
Cote D'Ivoire	76	40	13	(47)	(69)
Ecuador	65	37	23	(44)	(37)
Jamaica	45	33	40	(27)	21
Mexico	56	50	43	(11)	(14)
Morocco	68	52	23	(24)	(56)
Nigeria	36	29	20	(19)	(31)
Peru	18	7	5	(61)	(29)
Phillipines	72	50	49	(31)	(2)
Uruguay	65	59	60	(9)	1
Venezuela	74	57	41	(23)	(25)
Yugoslavia	78	49	45	(37)	(8)
17 HICs	65	46	37	(29)	(19)

Source: World Debt Tables, 1988-89 edition; Salomon Brothers.

holds for all buyback programs large and small, so long as they involve voluntary creditor participation and are not part of a larger deal including offsetting concessions from lenders.

The intuition of our result can be broken into three parts. First, if a corporate debtor has a choice between a zero net present value investment and a debt buyback, creditors will generally gain (and since there are no efficiency consequences, debtors will lose) from a repurchase because it gives the firm a lower debt-equity ratio. Second, if positive net present value projects are available then a buyback is an inefficient use of resources and even less attractive. Thus, "debt overhang", cited by many as a justification for buybacks, actually makes buybacks less attractive. Third, when a corporation repurchases debt it uses funds that would otherwise serve as collateral for creditors. When a country makes a repurchase, only a fraction of the resources would be expropriable by creditors in the event of default. Therefore, creditors gain more (and debtors less) from a sovereign buyback than from a corporate buyback.

Even if one assumes that the only alternative to a buyback for a country is to hold reserves – a circumstance in which a corporation would always prefer a market repurchase of risky debt – buybacks only make sense if creditors can sieze a large fraction of the country's income when a default occurs. But this seems at odds with the HICs' tendency to default when their debt grows to more than several months' income. Barring information asymmetries, unilateral buybacks make sense for a country only when its alternative investments are extremely poor.

APPENDIX

Remark: Rearranging (4) we have

$$B(X) = \frac{X[D - B(X)]}{V(D - B)}$$

$$\begin{aligned} B'(X) \equiv \frac{\partial B}{\partial X} &= \frac{D - B(X)}{V} - \frac{XB'(X)}{V} + \frac{X[D - B(X)]B'(X)\frac{\partial V}{\partial D}}{V^2} \\ &= \frac{D - B(X)}{V} - \frac{XB'(X)}{V}\left[1 - \frac{\partial V/\partial D}{V/(D - B)}\right] \\ &\leq \frac{D - B(X)}{V}, \end{aligned}$$

where we have made use of the relationships

$$\frac{\partial V}{\partial D} = \frac{-\partial V}{\partial B};\ 0 \leq \frac{-\partial V/\partial D}{V/(D - B)} \leq 1.$$

PROOF OF PROPOSITION 2:

By proposition 1, if $X^* > 0$, then $\partial W/\partial I = \partial W/\partial X$.

However,

$$\begin{aligned} \frac{\partial W}{\partial I} &= g'(I)[1 - q_2 \int_{\underline{\theta}}^{\hat{\theta}} \theta f(\theta)d\theta] \\ &= g'(I)[1 - q_2 + q_2 \int_{\hat{\theta}}^{\overline{\theta}} \theta f(\theta)d\theta] \\ &> \int_{\hat{\theta}}^{\overline{\theta}} \theta f(\theta)d\theta > 1 - F(\hat{\theta}) \end{aligned} \tag{A.1}$$

and

$$\frac{\partial W}{\partial X} = \frac{-\partial V}{\partial B(X)} \cdot \frac{\partial B(X)}{\partial X} < \frac{\partial V}{\partial D} \cdot \frac{D - B(X)}{V[D - B(X)]}$$

by the remark. But using equation (5),

$$\frac{\partial V}{\partial D} \cdot \frac{D - B(X)}{V[D - B(X)]} = \frac{[D - B(X)][1 - F(\hat{\theta})]}{V[D - B(X)]},$$

which by equations (2), (14), and (15) can be written as

$$\frac{[D - B(X)]\int_{\hat{\theta}}^{\overline{\theta}} f(\theta)d\theta}{\int_{\underline{\theta}}^{\hat{\theta}}[q_1 C + q_2 g(I)\theta]f(\theta)d\theta + [D - B(X)]\int_{\hat{\theta}}^{\overline{\theta}} f(\theta)d\theta} \tag{A.2}$$

$$= \frac{\int_{\hat{\theta}}^{\overline{\theta}}[q_1C + q_2g(I)\theta]f(\theta)d\theta - \int_{\hat{\theta}}^{\overline{\theta}}\{q_2g(I)\theta - [D - B(X) - q_1C]\}f(\theta)d\theta}{\int_{\underline{\theta}}^{\overline{\theta}}[q_1C + q_2g(I)\theta]f(\theta)d\theta - \int_{\hat{\theta}}^{\overline{\theta}}\{q_2g(I)\theta - [D - B(X) - q_1C]\}f(\theta)d\theta}$$

Dividing through by $q_2g(I)$ gives

$$\frac{\frac{q_1C}{q_2g(I)}[1 - F(\hat{\theta})] + \int_{\hat{\theta}}^{\overline{\theta}}\theta f(\theta)d\theta - \int_{\hat{\theta}}^{\overline{\theta}}\left[\theta - \frac{D-B(X)-q_1C}{q_2g(I)}\right]f(\theta)d\theta}{\frac{q_1C}{q_2g(I)} + 1 - \int_{\hat{\theta}}^{\overline{\theta}}\left[\theta - \frac{D-B(X)-q_1C}{q_2g(I)}\right]f(\theta)d\theta} \tag{A.3}$$

$$< \frac{\frac{q_1C}{q_2g(I)}[1 - F(\hat{\theta})] + \int_{\hat{\theta}}^{\overline{\theta}}\theta f(\theta)d\theta}{\frac{q_1C}{q_2g(I)} + 1} \tag{A.4}$$

$$< \int_{\hat{\theta}}^{\overline{\theta}}\theta f(\theta)d\theta \tag{A.5}$$

Therefore, $\partial W/\partial I > \int_{\hat{\theta}}^{\overline{\theta}}\theta f(\theta)d\theta > \partial W/\partial X$. But if $\partial W/\partial I > \partial W/\partial X$ then $X^* = 0$.

Q.E.D.

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