**Evaluating Debt Repurchases: What are
the Alternatives to Investment?**
(forthcoming, Journal of International Economics)

Célia Costa Cabral
Faculdade de Economia
Universidade Nova de Lisboa

Working Paper n° 279
August, 1996

The analyses, opinions and findings of this paper represent the views of the author, they are not necessarily those of "Faculdade de Economia".

Evaluating Debt Repurchases: What are the Alternatives to Investment?*

(forthcoming, Journal of International Economics)

Celia C. Cabral

Universidade Nova de Lisboa
Faculdade de Economia

Abstract

A general model of debt repurchases is built which reconciles most points raised in the literature on buybacks. The inclusion of assets alternative to domestic investment is shown to be of crucial importance in the analysis and leads to the reversal of some previous results. It is shown that investment necessarily rises following a buyback, independently of the source of the funds used. The condition that determines whether or not buybacks are an attractive solution to the debtor is derived. It is shown to depend on the price at which debt can be bought and on an "interest differential effect".

JEL Classification Numbers: F20.

Keywords: Debt Overhang, Debt Buyback.

Célia C. Cabral
Faculdade de Economia, Universidade Nova de Lisboa
Travessa Estevão Pinto
1070 Lisboa
Portugal
Telephone: (+351 1) 69 36 24, ext. 1331
Fax: (+351 1) 388 60 73
E-mail: ccc@fe.unl.pt

*I am grateful to James E. Anderson and Robert Murphy for many helpful comments. I also gratefully acknowledge partial financial support for this research provided by an INVOTAN (NATO) Fellowship. I alone, of course, am accountable for the contents of this presentation.

1 Introduction

There seems to be general agreement that debt reduction would benefit both creditor and debtor nations. The arguments for debt reduction are clearly described by Krugman (1989):

When a country's obligations exceed the amount it is likely to be able to pay, these obligations act like a high marginal tax rate on the country: if it succeeds in doing better than expected, the main benefits will accrue, not to the country, but to its creditors. This fact discourages the country from doing well (...) the burden of the national debt will fall on domestic residents through taxation, and importantly through taxation of capital; so the overhang of debt acts as a deterrent to investment. (...) the higher is the external debt of a country, the larger the probability of nonpayment; and thus the greater the subjective discount on that debt. If debt is high enough, further increases in the level of debt may actually lead to a smaller expected value of payments.

This suggests that Highly Indebted Countries (HICs) are in many cases on the right-hand-side of the so called "Debt Laffer curve" and that Pareto-improving debt reduction schemes are desirable (see also Froot (1989)). Large debt levels have created disincentives on investment. Reducing debt levels would reduce these distortions, increase expected future payments and thus the value of remaining outstanding debt.

While it may be in the interest of creditors that debt is reduced, we are in the presence of a collective action problem: it is in no individual bank's interest to be the one to forgive part of its debt. In the absence of an international debt facility that would restructure and reduce HIC's debt, market-based schemes assume particular importance.

Three instruments have been proposed. Market debt repurchases are the simplest, followed by exit-bonds, which are a form of debt repurchase in which future resources are used currently to buy back debt. Debt-equity swaps, the third form, can be thought of as equivalent to the following two-step procedure: first, allowing foreign direct investment to take place in a conventional way at the current market exchange rate; second, using those proceeds to buy back the country's debt¹. In a buyback operation, a debtor buys its own debt in secondary markets, taking advantage of the discount it is sold at. The exchange of exit bonds or equity for debt combines this feature with the additional element of pricing the exit bond or equity share. There is a vast literature on the subject of debt repurchases and much controversy has surrounded this topic. Many arguments for and against buybacks have been raised by several authors.

The aim of this paper is twofold; the first objective is to build a general model of debt repurchases which incorporates the different arguments raised in the literature, and provides a framework which allows for the reconciliation of previous results. This model is then used to show how previous results are dependent upon particular assumptions made on the parameters of the model. The second objective is to show that the consideration of alternative assets in which the country can apply its initial endowment is not of negligible importance. Existing models of debt repurchase consider investment as the sole way of converting first-period endowment into second-period consumption. In reality, countries may have other options. The accumulation of foreign currency reserves is just one example. Other options may be available, as well. Capital flight may be considered as another example of such other options. If

¹This is true unless we are in the presence of a few particular cases, as noted by Williamson (1988): (1) in the case where the country is not allowed to buy back its own debt; (2) in the case where the inflow of foreign exchange would otherwise be pre-empted for debt service; (3) if the country wishes to subsidize at least some forms of inward investment.

the expected return on domestic investment is low, capital can be sent abroad and invested there, where it can easily earn the risk-free interest rate. The introduction of the possibility that a debtor country may hold other assets safer than domestic investment is precisely what leads to the main conclusions of this paper, and to the reversal of some previous results. It is shown that if a debtor country can hold part of its initial endowment in a safe asset, then: the source of the funds used for a buyback brings no qualitatively different results, as previously suggested; investment necessarily rises while present consumption does not have to fall following a buyback; there is no overinvestment in the "safer" sectors of the economy; and debt-equity swaps will be no more desirable than straight debt repurchases. Finally, the condition that determines whether or not a buyback will be in the interest of a debtor country is derived. It is shown to depend not only upon the (high) price paid in the secondary market, as has been extensively discussed in the literature as the main drawback on this kind of operation, but also upon an "interest differential effect". This effect reflects savings due to the difference between the interest rate paid on international loans and the interest rate earned by the best alternative asset holdings.

In section 2, a brief review of the literature on buybacks is presented. In section 3 a general model of debt repurchases is built, and the condition that determines whether or not a buyback is in the interest of the debtor nation is derived. In section 4 it is shown how previous results in the literature can be obtained from the general model developed in this paper when particular assumptions are made on some of the parameters. In section 5 it is shown how the introduction of an alternative asset in the model can weaken or even reverse previous conclusions. Section 6 concludes.

2 The literature on debt buybacks

A great amount of controversy has surrounded the subject of debt buybacks, and many arguments have been raised in the literature for and against them. The four main points raised are:

(1) Secondary market prices are too high: In Bulow and Rogoff (1988) the argument used against debt buybacks is that the price which debtors must pay to buy back debt is too high. In order for creditors to be willing to sell, the price must be at least the "average" value of debt, while the reduction in debt payments is given by the "marginal" value of debt. Suppose a country's debt is D , and that with probability π it will fully repay its debt. Otherwise it will default. Suppose further that in case of default the creditor is able to extract some repayment $x \leq D$. The average value of debt is thus $\pi + (1 - \pi)x/D$. This represents how much on average creditors are expected to be paid on each unit of debt. The marginal value of debt represents the reduction in total debt payments if the face value of debt is reduced by one unit: $[\pi D + (1 - \pi)x] - [\pi(D - 1) + (1 - \pi)x] = \pi$. The average value of debt would thus be larger than the marginal value of debt (as long as $x > 0$). The difference between the two values $((1 - \pi)x/D)$ depends upon how much the creditor expects to be able to recover from the debtor country's disposable income in the event of default and upon how large the probability of default is. Bulow and Rogoff argue that the excess of the average value of debt over the marginal value of debt is likely to be great.

Their argument against buybacks is strengthened by the fact that the price that must be paid in order to induce creditors to sell is not the pre-buyback but the post-buyback (higher) average value of debt² (see

²In the absence of concerted action, in order for creditors to be willing to sell their claims, the price offered has to be high enough for creditors to be indifferent between selling or holding on to their claims. Therefore, the price at which a buyback could take place would have to be at least as high as the post-buyback expected market

also Dooley(1988)).

They further argue that since the creditors are better off with than without the buyback, which is "a purely financial transaction with no efficiency gains or losses", the debtor country must end up worse off. Debt buybacks would thus not be an attractive solution to a debtor country *per se* and they thus make no sense, unless the debtor also receives incremental new loans and donations to cover part of the debtor's losses, or else receives some other kind of substantial concession from the creditor. They argue that in a buyback operation the country is using funds that the creditor would otherwise be unable to apprehend, and that these funds could be used instead for consumption or investment.

(2) The insurance value of reserves : Another argument against buybacks is raised by Van Wijnbergen (1991). He argues that using reserves to buy back debt can only lead to a reduction in welfare, even if the secondary market price the country is able to buy its own debt at is as low as the marginal value of debt³, because reserves have an insurance value to the debtor country. This value is not captured by the secondary market price which only reflects intra-bank transactions⁴.

(3) The investment incentive constraint : The main argument in price of remaining debt. If the buyback took place at a lower price than this, we would again be in the presence of a free rider problem. All debt holders would want the buyback to take place since it is expected to raise the value of remaining debt. But no one wants to be the one selling since after the buyback the value of their claims would have increased. This is true unless the banks have different reservation prices.

³This would be the case where the creditors receive nothing in the states of default. Otherwise, the secondary market price (which reflects the average value of debt) would be larger than the marginal value.

⁴Van Wijnbergen's result is obtained under the assumption that reserves are a perfectly safe asset. It can easily be shown that the violation of this assumption will lead to the definition of conditions under which buybacks will not be welfare reducing.

favor of debt buybacks is the fact that high debt values introduce a disincentive to investment, since part of the fruits of investment would be used for debt repayment (domestic tax rates must be higher to meet the higher debt service). Investors perceive a reduction in debt levels as an increase in the expected return on investment projects. A reduction in debt levels therefore results in more investment taking place, and could actually increase future debt payments by highly indebted countries. This effect is formally built into an analytic framework for the first time in Froot (1989). Froot formulates a general model with investment incentives. This model is used to compare four different debt reduction schemes: pure debt forgiveness, debt buybacks out of internationally donated funds, debt buybacks out of first-period endowment and exit bonds (buybacks out of future cash flows). Results depend largely on the source of resources used to buyback debt since they have different opportunity costs. In all schemes, with the exception of buybacks out of first-period resources, funds become available in the same period in which they are used. However, if first-period endowment is used to buy back debt, this is not true. It results in an intertemporal substitution effect which contributes to the reduction of investment and can even offset the investment incentive effect. In this case investment would actually fall, if first-period utility is sufficiently concave.

Bulow and Rogoff (1991) construct a model that includes investment incentives and derive a necessary condition for a buyback to be in the interest of a debtor country. This condition is shown to depend on parameters which are independent of the responsiveness of investment to debt reduction. They thus argue that *it is true that buybacks can stimulate investment, but when they do, it is the creditors who reap the efficiency gains*, leading them to conclude that the inclusion of the investment incentive effect does not alter the conclusions of their fixed investment 1988 model.

(4) The intersector investment distortion effect : Using a two-sector model, where only one of the sectors is exposed to output expropriation in case of default⁵, Goldberg and Spiegel (1992) show that a large debt overhang distorts the allocation of investment between the two sectors. Less than otherwise optimal investment would result in the "seizable" sector, and more than otherwise optimal investment would result in the "safe" sector. A debt buyback would then serve to alter this allocation of investment, producing efficiency gains. In this case, a capital gain would accrue to the owners of old equity in the "safe" sector. The presence of this capital gain leads them to conclude that debt/("safe" sector) equity swaps may be desirable even when straight buybacks are not. It also raises distributional considerations. If there is some factor which is complementary to investment, such as labor, it would benefit from the presence of the distorted investment allocation in the safe sector. It follows that when debt levels are reduced, they lose part of those benefits. Clearly then, in the absence of a redistribution of wealth, pure debt forgiveness is in the interest of some agents but not in the interest of others. They argue that *such distributional considerations may hinder the realization of debt reduction schemes which increase national wealth as a whole.*

3 A general model of debt buybacks

In subsection 3.1 the general model is set up. In subsection 3.2 the model is then used to see if added welfare is possible through a debt buyback.

⁵the "safe sector" would comprise domestic goods production, cottage industries, etc.

3.1 The model

A two-period model is used. The debtor country derives utility from consumption in periods 1 and 2. The utility function is assumed to be additively time separable and to increase in consumption at a decreasing rate (i.e. $U'_i > 0$, $U''_i < 0$, $i = 1, 2$). The debtor's discount factor is $\beta < 1$. The country's endowment is Y_1 . The level of inherited debt in period 1 is $D/(1 + r^*)$, where r^* is the periodic external interest rate (thus D units of debt are due to be paid in period 2). It is assumed that a central planner allocates the country's initial endowment Y_1 between current consumption and two available assets. The objective of the central planner is to maximize the representative agent's expected utility. The two assets, which are the only ways of converting first-period endowment into second-period consumption, are: physical capital (I units will be invested) and a financial asset (R units will be allocated to the financial asset). Investment yields a return of $f(I) + \varepsilon$ units of output in period 2, with $f'(I) > 0$, $f''(I) < 0$; ε is a random variable defined in the interval $[\underline{\varepsilon}, \bar{\varepsilon}]$ which follows a density function defined by $g(\varepsilon)$. The financial asset R earns the world risk-free interest rate r_f in period 2. This asset is meant to represent an alternative way of converting first-period endowment into second-period resources. In the literature on debt buybacks investment is the sole way of doing this. However, we know that countries have other alternatives. An illustration can be provided by the phenomenon of capital flight in HICs as an example of an asset such as R , as capital invested abroad can easily earn the risk free interest rate. Yet another alternative could be to hold foreign currency reserves which would also earn the risk free interest rate. In this case asset R would stand for foreign currency reserves. Without loss of generality, throughout the paper we will refer to this asset as reserves, keeping in mind that asset R could stand for any other financial asset available to the debtor country.

In period 2 the central planner observes the realization of the random variable ε and decides either to make payment on the outstanding obligations D and let agents consume whatever second-period income remains, or to default, knowing that this decision involves some losses imposed by creditors. These losses can be viewed as losses of gains from trade, losses associated with the exclusion of international financial markets, the loss of trade credits, etc. We will assume that they are proportional to the country's output and reserves levels (a fraction q_i of output q_r of reserves, for example)⁶. In deciding whether or not to default, the central planner compares utility under default and no default conditions, and since its objective is to maximize utility, it will choose the alternative that will provide higher utility⁷. Therefore, for the observed realization of ε , repayment will take place if second-period disposable income net of debt repayment is less than net of default losses (resulting from creditor retaliation):

$$f(I) + \varepsilon + (1 + r_f)R - D < (1 - q_i)(f(I) + \varepsilon) + (1 - q_r)(1 + r_f)R$$

From this condition, one can derive the "critical" value for ε , $\varepsilon = \varepsilon_0$ which makes the debtor country indifferent between repayment of debt and default:

$$\varepsilon_0 = \frac{D}{q_i} - \frac{q_r}{q_i}(1 + r_f)R - f(I). \quad (1)$$

When ε assumes a value larger than ε_0 , repayment will result; otherwise the country chooses to default. The probability of repayment (π) is then

⁶Losses associated with the deterioration of the terms of trade, for example, can be shown to result in a percentage reduction in output levels. Making the default loss dependent upon the level of reserves can be rationalized as follows: creditors might take tougher action against countries that hold high foreign currency reserve levels and yet default on their loans. How "tough" creditors are could be viewed as associated not only with the country's output level but with the country's disposable income instead.

⁷As shown in Bulow and Rogoff (1988) and Rosenthal (1991) a sovereign desire for future access to international credit markets, which it retains by paying its international debts, does not constitute by itself enough of an incentive for full repayment.

defined as:

$$\pi = \int_{\varepsilon_0}^{\varepsilon} g(\varepsilon) d\varepsilon. \quad (2)$$

The country's objective is to maximize expected utility, with respect to reserves holdings and investment, given the initial endowment Y_1 :

$$\begin{aligned} V(Y_1) = \max_{\{R, I\}} E[U] = & U(Y_1 - R - I) + \\ & \beta \int_{\varepsilon}^{\varepsilon_0} U[(1 - q_i)(f(I) + \varepsilon) + (1 - q_r)(1 + r_f)R] g(\varepsilon) d\varepsilon \\ & + \beta \int_{\varepsilon_0}^{\varepsilon} U[f(I) + \varepsilon + (1 + r_f)R - D] g(\varepsilon) d\varepsilon. \end{aligned} \quad (3)$$

The first order conditions for this maximization problem are:

$$\frac{dE[U]}{dR} = -U'_1 + \beta \left\{ \int_{\varepsilon}^{\varepsilon_0} U'_2(1 - q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} U'_2g(\varepsilon)d\varepsilon \right\} (1 + r_f) = 0, \quad (4)$$

$$\frac{dE[U]}{dI} = -U'_1 + \beta \left\{ \int_{\varepsilon}^{\varepsilon_0} U'_2(1 - q_i)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} U'_2g(\varepsilon)d\varepsilon \right\} f'(I) = 0. \quad (5)$$

These expressions can be combined to obtain:

$$\begin{aligned} f'(I) \left\{ \int_{\varepsilon}^{\varepsilon_0} U'_2(1 - q_i)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} U'_2g(\varepsilon)d\varepsilon \right\} = \\ (1 + r_f) \left\{ \int_{\varepsilon}^{\varepsilon_0} U'_2(1 - q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} U'_2g(\varepsilon)d\varepsilon \right\}. \end{aligned} \quad (6)$$

The expected rate of return net of default penalties will be the same for both assets. This expression can be rewritten further as

$$f'(I) = (1 + r_f) \frac{\int_{\varepsilon}^{\varepsilon_0} U'_2(1 - q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} U'_2g(\varepsilon)d\varepsilon}{\int_{\varepsilon}^{\varepsilon_0} U'_2(1 - q_i)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} U'_2g(\varepsilon)d\varepsilon}. \quad (6')$$

Optimal investment is thus determined by the risk-free rate of return (r_f , the return on reserves), the percentage reduction in output and in reserves that results in case of default (q_i and q_r respectively), and on the probability of default itself (i.e. on ε_0). Investment will be lower the higher the risk-free interest rate r_f , the higher the percentage reduction in output that results in case of default (q_i), the lower the percentage loss in reserves (q_r) and the higher the probability of default (the higher ε_0).

The presence of the investment distortion effect can be easily seen here, since $f'(I) > (1 + r_f)$ will hold true as long as $q_i > q_r$, i.e. as long as the other asset which the debtor country holds (in this case reserves) is "safer" than investment. A reduction in the level of debt results in a lower probability of default (since ε_0 will fall, as can be seen from definition (1)). From the examination of (6') it then becomes clear that investment levels will necessarily rise if debt is reduced.

3.2 Will a debt buyback be welfare improving?

Can a buyback be welfare improving for the debtor country? Under what conditions? Suppose the buyback reduces second-period debt by X units (remaining debt due in period 2 would then be $D - X$) and that the price the country must pay for the buyback in period 1 is P . We will look at the sign of $\frac{dV(X)}{dX}$ evaluated at $X = 0$ (i.e. at the current debt level), where $V(X)$ measures expected utility as a function of the buyback X .

$$\begin{aligned} V(X) = & \max_{\{I, R\}} \left\{ U(Y_1 - I - R - P \frac{X}{1 + r^*}) \right. \\ & + \beta \int_{\underline{\varepsilon}}^{\varepsilon'_0} U[(1 - q_i)(f(I) + \varepsilon) + (1 - q_r)(1 + r_f)R] g(\varepsilon) d\varepsilon \\ & \left. + \int_{\varepsilon'_0}^{\bar{\varepsilon}} U[f(I) + \varepsilon + (1 + r_f)R - D + X] g(\varepsilon) d\varepsilon \right\}, \end{aligned} \quad (7)$$

where

$$\varepsilon'_0 = \frac{D - X}{q_i} - \frac{q_r}{q_i} (1 + r_f)R - f(I) \quad (8)$$

represents the post-buyback critical value for the random shock variable (which defines the new probability of repayment π'). A debt buyback will be welfare improving if

$$\frac{dV(X)}{dX} \Big|_{X=0} = -U'_1 \frac{P}{1 + r^*} + \beta \int_{\varepsilon'_0}^{\bar{\varepsilon}} U'_2 g(\varepsilon) d\varepsilon \geq 0. \quad (9)$$

Using (4), this condition becomes

$$P \leq \frac{\int_{\varepsilon'_0}^{\bar{\varepsilon}} U'_2 g(\varepsilon) d\varepsilon}{\int_{\underline{\varepsilon}}^{\varepsilon'_0} U'_2 (1 - q_r) g(\varepsilon) d\varepsilon + \int_{\varepsilon'_0}^{\bar{\varepsilon}} U'_2 g(\varepsilon) d\varepsilon} \frac{1 + r^*}{1 + r_f}. \quad (10)$$

If the buyback is done out of internationally donated funds, from the debtor country's point of view that is equivalent to simple debt forgiveness: in terms of our model, the country would simply view P as $P = 0$ in the model formulated above. Therefore the buyback would necessarily be welfare improving and higher levels of first-period consumption and investment would result.

Condition (10) can be rewritten in the following way:

$$\int_{\varepsilon_0}^{\varepsilon} U'_2 g(\varepsilon) d\varepsilon (1 + r^*) 1/P \geq (1 + r_f) \int_{\underline{\varepsilon}}^{\varepsilon} U'_2 g(\varepsilon) d\varepsilon - \int_{\underline{\varepsilon}}^{\varepsilon_0} U'_2 g(\varepsilon) d\varepsilon q_r (1 + r_f). \quad (10')$$

It can then be seen that using one unit of resources to buy back $1/P$ units of debt will be welfare improving as long as the marginal utility of future savings on repayments of that debt plus interest (measured by $(1 + r^*)1/P$) is larger than the marginal utility of foregone future income, had that unit of resources been allocated in its best alternative use: asset R (this would have yielded $(1 + r_f)$ in the repayment states and $(1 + r_f)(1 - q_r)$ in the default states). Determinant in this condition is the net interest rate differential effect. This effect is determined by the difference between the external interest rate r^* and the net of default penalties return on reserves. This return will be lower than the risk free interest rate if $q_r > 0$.

In order to judge on the attractiveness of the buyback, one must still define what determines the price P at which debt will be repurchased. As has been previously stated (Dooley (1988), Bulow and Rogoff (1988)), (P) has to be (at least) equal to the post-buyback market price of debt. Further assumptions will be needed: Let us assume that if default occurs in the second period, the creditor is able to "apprehend" a fraction q'_i of output and a fraction q'_r of reserves. This fraction q'_i has to be smaller than or equal to q_i ⁸. Similarly, $q_r \geq q'_r$. The average value of each unit

⁸i.e the losses to the debtor in terms of output are larger than what the creditor

of debt is the expected value of repayment plus the expected value of apprehended output and reserves in the states of default, divided by the total amount of outstanding debt ($D - X$). Let $v(D)$ denote the average value of debt in $t=2$.

$$v(D - X) = \frac{\int_{\varepsilon}^{\varepsilon_0} [q'_i(f(I) + \varepsilon) + q'_r(1 + r_f)R]g(\varepsilon)d\varepsilon + \pi'(D - X)}{D - X}, \quad (11)$$

which can be rewritten as:

$$v(D - X) = \frac{\alpha}{D - X} + \pi', \quad (12)$$

where α represents the expected value of apprehended output in the default states⁹:

$$\alpha = \int_{\varepsilon}^{\varepsilon_0} [q'_i(f(I) + \varepsilon) + q'_r(1 + r_f)R]g(\varepsilon)d\varepsilon. \quad (13)$$

The average value of debt in $t = 1$ will thus be $v(D - X)/(1 + r_f)$. This is the price the country will have to pay to buy back its own debt.

From (10), we can then say that the buyback will be welfare improving if

$$\pi' + \frac{\alpha}{D - X} < \frac{\int_{\varepsilon_0}^{\varepsilon} U'_2 g(\varepsilon)d\varepsilon}{\int_{\varepsilon_0}^{\varepsilon} U'_2 (1 - q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} U'_2 g(\varepsilon)d\varepsilon} (1 + r^*). \quad (14)$$

The attractiveness of the buyback from the point of view of the debtor country depends largely upon the value of the parameters in the model; although defining reasonable estimates for these parameters is mainly an empirical question, equation (14) allows us, nevertheless, to trace out which are critical for the evaluation of such an operation.

Simple illustrations can be obtained from the examination of equation (14). Suppose for simplicity that $U'_2 = 1$ (utility is linear in second-period consumption). A crucial parameter is q_r . It is of interest to see receives if there are some inefficiency losses, or they would be equal if there are no such losses; but clearly under no circumstances can the creditor physically apprehend more than what is lost by the debtor in case of default.

⁹ $\frac{\alpha}{D-X}$ represents the difference between the average and the marginal value of debt.

what happens in the two extreme cases. Suppose $q_r = 1$. The right hand side of (14) will become $(1 + r^*)$. Since the left hand side (the price) is less than one, the inequality will hold. Suppose instead that $q_r = 0$ (asset R is "safe"): condition (14) becomes $(\pi' r^*) > (\frac{\alpha}{D-X})$. Welfare can increase if interest payments saved in the repayment states ($\pi' r^*$) are larger than the "excess price" paid on debt repurchased: the difference between the average and the marginal value of debt ($\frac{\alpha}{D-X}$). The crucial parameters are thus α (how much creditors will physically apprehend in case of default) and q_r (which measures how safe asset R is).

4 Reconciling the results in the literature

In this section we will see how the formulation of specific assumptions on the parameters of the general model set up in section 3 can lead to the different results which can be found throughout the literature.

One of the cases studied by Bulow and Rogoff (1988) is the one in which, in the event of default, the creditor is able to "apprehend" a fraction q of the defaulting country's disposable income (output and reserves). In terms of our general model this means setting $q_i = q_r = q$. It becomes clear, from examination of (6) that if such an assumption is made, optimal investment will be determined by $f'(I) = (1 + r_f)$. Therefore, no investment incentive effects would be present. The fact that any possible incentive effects due to a buyback are ignored is clearly shown when they argue: *the repurchase is a purely financial transaction with no efficiency gains (...)*

The authors also point out that the larger q , the more likely it will be that the buyback will be welfare improving. They state that if we had $q = 1$ (which they call the "corporation case") it would be an attractive operation. In fact, examination of condition (10) confirms this result.

If $q = 1$ this condition reduces to $P < \frac{1+r^*}{1+r_f}$, and a debt buyback will always be welfare improving since $P < 1$ and $r^* \geq r_f$ (i.e., the external interest rate is always greater than or equal to the risk free rate of return). Therefore, the larger the value of q , the more attractive the buyback will be to the debtor.

Additionally, Bulow and Rogoff assume that every dollar lost by debtors due to the imposition of default penalties would be a dollar gained by the creditors. In terms of the general model this means that $q_i = q'_i = q$ and $q_r = q'_r = q$. This is an extreme assumption which yields the largest possible difference between the marginal and the average value of debt. This can explain why Bulow and Rogoff argue that this difference would be so large. It sets the values of q'_i and q'_r at its upper bound and therefore results in the maximum possible value for α in our model (see expressions (12) and (13)). However, many of the losses that debtor countries are expected to suffer in the event of default might not represent a gain to creditors either. Examples of such losses would be losses of the gains from trade, losses of trade credits, etc. It seems that it would be more reasonable to assume $q_i > q'_i$ and $q_r > q'_r$, which would result in a weaker condition than the one they obtain.

In Van Wijnbergen(1990) it is assumed that if a country chooses to default, output is reduced by some percentage q_i while reserves are a perfectly safe asset. It can be shown that if the default penalty is in any way dependent on the foreign currency levels (e.g. if we assume $q_r \neq 0$), the result that welfare will necessarily decrease following a buyback operation with the use of foreign currency reserves, will no longer hold true at all times, even in the absence of investment incentive effects. It can easily be shown that a debt buyback can be welfare improving under certain conditions, and that the results depend upon the degree of risk aversion and upon how safe reserves are, i.e. the parameter q_r .

In Froot (1989), the "gunboat technology" assumption made (the

entire debtor's country output can be confiscated by creditors in case of default) is, in terms of the general model, equivalent to setting $q_i = q'_i = 1$. It is also assumed that the only asset the country can apply its first-period endowment to is investment. Reserves holdings are exogenous and utility is linear in second-period consumption. Remaining assumptions are similar to the ones in the general model described above. Under these assumptions the investment optimality condition (5) becomes $U'_1 = \beta\pi f'(I)$. This is precisely the condition obtained by Froot. A substantial qualitative difference between buybacks out of first-period endowment and buybacks out of future endowment (exit bonds) results, as explained in section 2.¹⁰ In the following section it will be seen how this result will be substantially altered if we allow the country to hold an alternative asset in which to allocate some of its first-period's endowment.

In Goldberg and Spiegel (1992), the country's first-period endowment is either consumed or invested in one of two productive activities. One of these productive activities is subject to creditor "apprehension" in the event that the country defaults on its loans (investment in this sector is denoted by I_s and $q_i = q_s$) and the other is "safe" from apprehension (I_n denotes investment in this sector and $q_n = 0$). There is no other way the country can transform first-period endowment into second-period consumption. Utility is linear in second period consumption ($U'_2 = 1$). If the general model is altered to include one more productive activity, and to exclude asset R, the optimality condition that would result would be precisely the one they obtain: $\pi f'(I_s) = f'(I_n)$. The large debt overhang introduces a distortion which results in less than otherwise optimal investment in the seizable sector and more than optimal investment in the non-seizable sector. It follows that if debt is reduced (through debt for-

¹⁰Using first-period endowment funds to buy back debt reduces first-period consumption, which works to increase U'_1 and lead to a decrease in the investment level (which could offset the increase in investment resulting from the reduction in the investment incentive distortion).

givenness or repurchases). investment increases in the seizable sector and falls in the non-seizable sector, thus increasing the marginal product of capital in the "safe sector" and creating capital gains in this sector. For this reason they conclude that *debt-equity swaps may be in the interest of debtors even when straight debt repurchases are not*. This result is expressed in Proposition 3 of their paper.

In the next section this conclusion is re-examined under the more general assumptions of the model set up in section 3.

5 The importance of alternative assets to investment

In this section it will be shown that the difference between buybacks out of current resources or future resources will no longer remain as strong (or it may even be absent altogether) as Froot has suggested, as long as the country has the choice of holding other (safer) assets. Foreign currency reserves can be an example of such an asset. It will also be shown that Goldberg and Spiegel's proposition 3 will no longer hold in the presence of such other assets.

Let us first consider the case where there is only one productive activity, and assume that the debtor country can also convert first-period endowment into second-period consumption by holding an asset R . Suppose that utility is linear in second-period consumption, and that in case of default, the creditor is able to apprehend all of the debtor's output. Assumptions made are the same as in Froot (1989) with the exception of the presence of the extra asset. Using (6) and setting $U'_2 = 1$, $q_i = 1$, the first order conditions are:

$$-U'_1 + \beta \left\{ \int_{\underline{\varepsilon}}^{\varepsilon_0} (1 - q_r)(1 + r_f)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\bar{\varepsilon}} (1 + r_f)g(\varepsilon)d\varepsilon \right\} = 0, \quad (15)$$

$$-U'_1 + B \int_{\varepsilon_0}^{\varepsilon} f'(I)g(\varepsilon)d\varepsilon = 0. \quad (16)$$

As pointed out by Froot, the second first-order condition shows that the discounted expected marginal return on investment will equal first period marginal utility. But from examination of (15) it can be seen that now it will also equal the expected return on reserves (net of default losses). This allows us to write

$$f'(I) = \frac{\int_{\varepsilon}^{\varepsilon_0} (1 - q_r)(1 + r_f)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} (1 + r_f)g(\varepsilon)d\varepsilon}{\int_{\varepsilon_0}^{\varepsilon} g(\varepsilon)d\varepsilon}. \quad (17)$$

Equation (17) demonstrates that optimal investment is determined by the condition that the expected return on investment equals the expected return on reserves. It also shows that if debt levels are reduced, as in the case of a buyback, investment will necessarily increase as long as asset R is safer than investment: $q_r < 1$. This result holds no matter what the source of the funds used for the buyback is. In Froot's model investment could fall if first-period endowment were to be used for the buyback. With the introduction of asset R in the model, that can no longer happen.

It can also be seen that investment's response to a lower debt level depends upon how safe reserves are. If, for example, $q_r = 1$ (the case where reserves are subject to apprehension in the states of default) then there would be no investment incentive effects since the condition above would be reduced to $f'(I) = (1 + r_f)$. If, on the other hand, R is a perfectly safe asset ($q_r = 0$), the investment response will be at its maximum with $\pi f'(I) = (1 + r_f)$. Since a lower debt level increases the probability of repayment, it increases the expected marginal return on investment (while the return on reserves remains unaltered) and investment necessarily rises. The investment incentive effect will be larger, the safer the alternative asset is.

One final insight can be obtained from condition (17): if the debtor country has access to a perfectly safe asset ($q_r = 0$), then the expected

after-penalty marginal return on investment will equal the world risk-free interest rate. This result is an important one since this condition is the same one which would be obtained under capital market integration. In the absence of a safe asset this would not be the case.

From the first first-order condition one can also conclude that the presence of a perfectly "safe" asset would determine a fixed first-period marginal utility (and thus also first-period consumption) at a level determined by the risk-free interest rate and the discount rate. This condition (15) would become $U'_1 = \beta(1 + r_f)$. A buyback would no longer have the effect of reducing first-period consumption, and the intertemporal substitution effect present in Froot's model would therefore vanish. Then, only the investment incentive effect would be present, investment would increase with a buyback (with the increase in the probability of repayment), and there would therefore be no difference between the investment incentive effects with a buyback out of current or out of future resources¹¹. Here, because first-period consumption is fixed, there is no intertemporal substitution effect; all adjustment is done through changes in reserves levels.

If we totally differentiate the optimality condition $\pi f'(I) = (1 + r_f)$, and since $\frac{d\pi}{dD} = -g(\varepsilon'_0)$, we can then write:

$$dI = \frac{f'(I)}{f''(I)} \frac{g(\varepsilon_0)}{\pi} dD. \quad (18)$$

It can easily be seen that investment will necessarily rise with a buyback in this case ($dI > 0$), since there is a reduction in the debt level ($dD = -X < 0$) and since $f''(I) < 0$. Finally, since first-period consumption no longer changes with the buyback, we can also write $dC_1 = 0$, which allows us to determine the degree to which optimal reserves holdings

¹¹The presence of the "safe" asset eliminates the intertemporal substitution effect. Of course, the presence of an asset which is safer than investment but not perfectly safe (i.e. $0 < q_r < 1$) would merely reduce the size of this effect, but not make it vanish.

change due to the buyback. Since

$$dC_1 = \begin{cases} dY_1 - dI - dR = 0 & \text{for a buyback out of} \\ & \text{internationally donated} \\ & \text{funds} \\ dY_1 - dI - dR - [P/(1+r^*)]dD = 0 & \text{for a buyback out of} \\ & \text{the country's resources,} \end{cases}$$

one can then write:

$$dR = -\frac{f'(I)}{f''(I)} \frac{g(\varepsilon_0)}{\pi} dD, \quad (19)$$

if the buyback is done out of internationally donated funds (the same would result from pure debt forgiveness).

$$dR = -\left[\frac{f'(I)}{f''(I)} \frac{g(\varepsilon_0)}{\pi} + \frac{P}{1+r^*} \right] dD, \quad (20)$$

if the buyback is done out of the debtor country's resources.

In the case where the buyback is done out of internationally donated funds, reserves fall by the same amount of the resulting increase in investment (i.e. additional investment is done with funds that would otherwise be held as reserves, just because the investment incentive distortion is now smaller and investment now yields a higher return). However, reserves will fall by a greater amount with a buyback out of current resources than with a buyback out of internationally donated funds or debt forgiveness. The reduction in the level of debt due to the buyback out of the country's own resources produces a new level of reserves that is lower than the previously optimal level minus the resources needed for the buyback. This result comes from two different effects working in the determination of the optimal level of reserves: first, if first-period consumption is to remain unchanged, and since some resources will be used to buy back debt, this tends to reduce first-period consumption, and reserves fall in order to partially offset that effect. Second, the increase in investment also reduces first-period consumption, if not offset by a reduction in reserves holdings. Therefore, while first-period consumption does not fall, more funds are freed for investment.

If there is more than one productive activity, as in Goldberg and Spiegel, we will have an additional first order condition (following Goldberg and Spiegel's notation, investment in the safe sector is denoted by I_n , with $q_n = 0$):

$$f'(I_n) = \left\{ \int_{\underline{\varepsilon}}^{\varepsilon_0} (1 - q_r) g(\varepsilon) d\varepsilon + \int_{\varepsilon_0}^{\varepsilon} g(\varepsilon) d\varepsilon \right\} (1 + r_f). \quad (21)$$

Suppose once again that asset R is perfectly "safe" ($q_r = 0$). Then this expression becomes $f'(I_n) = (1 + r_f)$. Investment in the "safe sector" is now no longer affected by debt reduction, and the capital gain effect vanishes from the model. Now, the debt overhang effect only affects the seizable sector's optimal investment, just as in Froot's model, and no additional effects will be present. It follows that debt-equity swaps can be no more desirable than straight debt repurchases, thus denying Goldberg and Spiegel's proposition 3.

6 Conclusions

This paper presents a general model of debt repurchases that includes all the effects previously found in the literature on debt buybacks, such as investment incentives, the insurance value of reserves, and the "excess price" paid in secondary market repurchases. Additionally, it identifies an additional effect, the "interest differential effect": on one hand, the country has to pay a price which is higher than the marginal value of debt to buy back its own debt, which constitutes a drawback on this type of operation; on the other hand, the country saves on the difference between expected future interest rate payments on repurchased debt and the (lower) return it would have obtained had the funds used been allocated instead in asset R, the best available alternative. This difference constitutes a positive effect from the point of view of the debtor country.

This paper also shows that the consideration of assets, other than domestic physical capital, is not of negligible importance in the modeling

of debt repurchases. Not only does the accumulation of foreign currency reserves constitute an example of such alternatives, but the existence of capital flight from highly indebted countries serves as another example of a "safe" alternative to "risky" domestic investment. It is shown that the introduction of a safe asset in these models serves to reverse some previously stated results: (i) Following a buyback, investment necessarily rises independently of the source of the funds used, at odds with Froot's (1989) suggestion. (ii) There will be no overinvestment in the "safer" sectors of the economy, as had been described by Goldberg and Spiegel (1992), and therefore a buyback will produce no capital gains in those sectors. From this there immediately follow two results: first, debt/equity swaps can be no more attractive than straight debt buybacks since the capital gains effect vanishes; and second, we no longer have to worry about the distributional considerations that could hinder the realization of debt reduction schemes that would increase national wealth as a whole.

Finally, it is shown that the attractiveness of buybacks depends largely upon the value of the parameters used in the general model. Of particular importance is a clearer definition of what the creditor is able to physically apprehend in case of default: should this be modeled as a percentage of output, or as a percentage of total disposable income? How safe are other assets held by debtor nations? The investment incentive effect is largely dependent upon this. Also dependent on these parameters is the definition of the difference between the average and the marginal value of debt, so often argued to be a large drawback to this type of operation. Different beliefs on these values can lead to very different results. Therefore, particular attention should be given to them. Only defining reasonable estimates for these values would allow us to answer the question of whether or not buybacks are attractive solutions to the resolution of the debt crisis, and settle much of the controversy.

REFERENCES

- Bergsten, C., William R. Cline and John Williamson, 1985, Bank Lending to Developing Countries: The Policy Alternatives, Policy Analyses in International Economics. (Washington: Institute for International Economics).
- Brady, N. D., 1989, Remarks to the Brookings Institution and the Bretton Woods Committee Conference on Third World Debt, Washington, March 13.
- Bulow, Jeremy and Kenneth Rogoff, 1988, The Buyback Boondoggle, Brookings Papers on Economic Activity 2, 675-698.
- Bulow, Jeremy and Kenneth Rogoff, 1989, Sovereign Debt: Is to Forgive to Forget?, American Economic Review 79, 43-50.
- Bulow, Jeremy and Kenneth Rogoff, 1991, Sovereign Debt Repurchases: No Cure for Overhang, Quarterly Journal of Economics 106, 1219-1236.
- Dooley, Michael P., 1988, Buybacks and the Market Valuation of External Debt, International Monetary Fund Staff Papers 35, 215-229.
- Eaton, Jonathan, Mark Gersowitz, and Joseph E. Stiglitz, 1986, The Pure Theory of Country Risk, European Economic Review 30, June, 480-513.
- Froot, Kenneth A., 1989, Buybacks Exit Bonds and the Optimality of Debt and Liquidity Relief, International Economic Review 30(1), 49-70.
- Goldberg, Linda and Mark M. Spiegel, 1992, Debt write-downs and debt-equity swaps in a two-sector model, Journal of Interna-

tional Economics 33, 267-283.

Helpman, Elhanan, 1989, The Simple Analytics of Debt-Equity Swaps, National Bureau of Economic Research Working Paper 2771.

Krugman, Paul R., 1988. Financing versus Forgiving a Debt Overhang, National Bureau of Economic Research Working Paper 2486, January.

Krugman, Paul R., 1989, Market-Based Debt Reduction Schemes, in J. Frenkel, M. Dooley and P. Wickham, eds., Analytical Issues in Debt (International Monetary Fund, Washington D.C.), 258-278.

Rosenthal, Robert R., 1991, On the incentives associated with foreign debt, Journal of International Economics 30, 167-176.

Sachs, Jeffrey D., 1989, New Approaches to the Latin American Debt Crisis, Essays in International Finance, The International Finance Section, Princeton University.

Schartz, E.S. and S. Zurita. 1992, Sovereign Debt: Optimal Contract, Underinvestment, and Forgiveness, Journal of Finance 47(3); 981-1004.

van Wijnbergen, S., 1990. Cash Debt Buybacks and the Insurance Value of Reserves. Journal of International Economics 29(1-2), 123-131.

Williamson, John, 1988, Voluntary Approaches to Debt Relief, Policy Analyses in International Economics, Washington: Institute for International Economics.