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EVALUATING DEBT REPURCHASES: WHAT ARE THE ALTERNATIVES TO INVESTMENT?

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Abstract

In this paper a general model of debt repurchases is built which reconciles most of the points raised in the literature on debt buybacks. It is shown that results previously found in the literature can be obtained from this general model and are strongly dependant on assumptions made on its parameters. The condition that determines whether or not buybacks are an attractive solution from the point of the debtor nations is derived. Additionally it is shown that if there are other assets safer than investment, a debt buyback will always lead to an increase in investment and a reduction in the holdings of such other assets. This result holds independently of the source of the resources used for the buyback, unlike previous suggestions. With a buyback out of current resources, optimal reserves levels fall by more than what is used for the buyback, releasing extra resources for investment purposes, while current consumption does not fall. (JEL F34)

Key Words:
Debt Overhang; Debt Repurchases; Investment Incentives.

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1 Introduction

There seems to be general agreement on that debt reduction would benefit both creditor and debtor nations. In the absence of an international debt facility that would restructure the highly indebted country's debt, market-based schemes assume particular importance. Such schemes include straight debt repurchases, exit-bonds (which are a form of debt repurchases in which future resources are used currently to buyback debt), and debt-equity swaps (these can be thought of as equivalent to the following two-step procedure: first, allowing private direct investment investment to take place at the market exchange rate in a conventional way; second, using those proceeds to buy back the coutry's debt [1]). In a buyback operation, a debtor buys its own debt in secondary markets, taking advantage of the discount it is sold at. 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 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 the different results that can be found. This model is then used to show how each previous result is dependent on particular assumptions made on the parameters of the model. It also points out that the consideration of alternative assets in which the country can apply its initial endowment is not of negligeable importance. The introduction of the possibility that a debtor country may hold other assets safer than 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 holds part of its initial endowment in a safe asset, then: (i) The source of the funds used for a buyback brings no qualitatively different results, as has previously been suggested. (ii) Investment necessarily rises following a buyback. (iii) present consumption does not have to fall following a buyback. Finally, the condition that determines whether or not a buyback will be in the interest of a debtor country is derived.

In section 2 a review of the debt overhang problem is conducted. For readers already familiar with the problem it is recommended to proceed directly to section 3. In section 3, a brief review of the literature on buybacks is presented. In section 4 a general model of debt repurchases is built, and the condition that determines whether or not a buyback is in the interest of

[1] this 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 buyback its own debt (2) in the case where the inflow of foreign exchange would otherwise be preempted for debt service (3) if the country wishes to subsidize at least some forms of inward investment.

the debtor nation is derived. In section 5 it is shown that some of the conclusions previously found in the literature can be weakened or even reversed under the more general conditions of the model developed in section 4. It is shown that, if the debtor country has the choice of holding a safe asset, then the source of the resources a country uses to buy back its own debt brings no qualitatively different results, as had been previously suggested. Investment will necessarily rise, irrespective of the resources used being current resources or future resources (exit bonds). Current consumption will not fall as a result either, as has been often said. If the debtor country holds any asset less risky than investment, it will choose to hold less of that asset and invest more once debt levels are reduced. If the country holds a completely risk-free asset then optimal holdings of that asset fall by the amount used for the buyback plus the amount used for the additional investment that would result. But current consumption remains uncanged. Section 6 concludes.

2 The debt overhang problem

In the early 80s, a series of negative shocks in the international economy. In 1982 Mexico declared that it could no longer continue to service its international credit obligations. For the first time, the possibility that some of the world's largest debtors might default on their international loans arised.

It was at first believed that the debt servicing problems that had then begun to surface were due to short-term liquidity problems and that as soon as economic recovery in many of the problem debtors resumed, debt servicing would continue. Therefore, with appropriate debt rescheduling negotiations, debt payments could be eased in the present, while the "liquidity crisis" lasted, but debt payments would resume in the future. This view reflected the belief that most countries will be solvent in the long run and that the problem was one of iliquidity. If the surplus available for debt service (the balance of goods, services and transfers plus inflows of direct and official investment minus the service of senior debt) grows faster than the rate of interest then a country can service its debt provided that it is given some liquidity relief. Many of the supporters of this view argue that if repayment has continued to take place in any scale at all, it is because debtors wish to continue to "play by the rules" so that they can regain access to international credit markets in the future. If only partial repayment takes place, this looks just as bad in the debtor's "record" as default. Any debt reduction schemes would make it more difficult for debtors to borrow in the future therefore erasing the benefits debtors have been hoping for with the repayment effort maintained until now. By very simply pushing the burden of the debt into the future, one would allow countries who want to continue to play by the

rules to be able to do so given the liquidity difficulties they face in the short-run, without jeopardizing their reputation in international credit markets. [2].

But several years after the first problems began to surface the economic conditions continue to deteriorate; debt/export ratios, whose high values were associated with the triggering of the debt crisis, have remained high; commodity prices have also remained low for longer than it had been anticipated and world interest rates have remained steadily high. The high debt servicing burden that has resulted from these now long lasting adverse conditions has continued to divert savings from needed investment.

The large debt overhang not only creates adverse economic incentives but also adverse political incentives that work against any prospects of continued future servicing by most debtor nations. Prospects of solving the debt crisis seem gloomier now than ever, as it is clearly shown by the large discounts that claims to Latin American debt are traded at in secondary markets. They reflect the growing fear that creditors might never be repaid.

The long maintained view that debt servicing would be able to continue in the "medium-run" has now been subject to much criticism. Other proposals on the resolution of the current crisis are centered around debt reduction schemes. In 1989 Secretary Brady officially advocated for the first time debt forgiveness as a way os easing the debt urden in the LDCs and restoring their economic growth. The idea is that debt levels are too high to service with current resources and that therefore they should be reduced. High debt levels act as a tax on investment, thus penalizing economic growth. Debt reduction would ease the debt servicing burden in the short-run without however increasing payments due in the future, unlike the currently followed "debt financing" approach. The arguments for debt reduction are clearly described by Krugman (1988):

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 at two levels. First, the government of a country will be less likely to take

[2]With the concern of relating debt servicing payments to the "ability to pay" of these economies, other ideas developed. One proposal was that debt service payments should be limited to a certain percentage of exports, in order to guarantee that enough resources are available for the much needed investment in these economies. These proposals have been criticized (see Bergsten, Cline and Williamson, 1985) with the argument that this would constitute a strong disincentive to the development of export industries, and create a distortion that would act like an tax on exports.

painful or politically unpalatable measures to improve economic performance if the benefits are likely to go to foreign creditors in any case. Second, 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

The idea that creditors may sometimes increase expected payment by forgiving part of a country's debt is similar to that of the tax Laffer curve and has been consequently been called the Debt Relief Laffer Curve [3]. Debt reduction should contribute to more investment incentives and lead to economic reform. If debt reduction warrants enough growth, the secondary market value of debt will increase. It is then possible that this gain would make up for any losses incurred by banks in the debt reduction process. The better the economic performance of the debtors the smaller the expected losses for creditor banks, if any [4].

There are several different ways in which a reduction in debt levels can be achieved: Considerable attention has been given to various proposals for an international debt facility, an agency that would restructure highly indebted country's debt. Its purpose would be to provide debt relief to debtor countries through debt reduction schemes, while assuring that debtors benefiting from this type of action would pursue an internationally supervised program of economic reform.

While the creation of the International Debt Facility is widely discussed and debated [5], few debt reduction schemes have been put in practice. The

[3]Sachs (1988) originally referred to this effect as the "Debt Laffer curve". Schwartz and Zurita (1992) provide an example in which they construct such a curve, and how it can be used to determine the optimal debt level to be reached (through negociation)

[4]Concerns about the secondary market value of debt should not be viewed as all that critical. As noted by Sachs (1988), even in the event that losses would result to creditor banks on their international loans value, this does not necessarily mean that the market value of lending banks would have to fall. Bank's share prices are already discounted given the current expectations of future losses on these loans. Large amounts of reserves have also been set aside for the eventuality of large-scale defaults by debtor nations.

[5]The U.S. Treasury has strongly opposed the creation of such an institution. Arguments used against it rest on the concern that it would cost the taxpayers too much money and that public funds would have to be used to bail out banks suffering large losses from this type of scheme. However, while this might be true if one assumes that all debt will eventually be repaid in the future under the current strategy, it is not necessarily so otherwise. With the current handling of the debt crisis situation, exposure of commercial banks has steadily declined while exposure of many international institutions and of export

main reason is certainly a collective action problem: individual banks don't want to participate in such schemes since remaining debt becomes safer and increases in value. It is in creditors interest that debt be reduced, but it is not in any individual's bank interest to forgive or sell at secondary market prices its own debt claims. It is financially more rewarding to hold on to them since they increase in value subsequently. If creditors have in the past been unable to overcome the free-rider problem that has crippled the new lending required to sustain continued investment (and debt servicing), certainly the same type of difficulty will also arise with debt reduction schemes and block any coordinated write-down of debt.

In the absence an international debt facility that would help override this problem, an alternative is market-based debt reduction schemes such as debt/equity swaps, buybacks and exit bonds. These schemes' voluntary base would allow the overcoming of the free-rider problem.

Debt/equity swaps have been implemented in a number of countries (including Argentina, Brazil, Chile, Costa Rica, Mexico and the Philippines). With a debt/equity swap, a foreign investor buys some of a country's debt on the secondary market and then trades it in at the central bank for local currency. This currency is then used for the purpose of investment [6].

Another form of market based debt reduction schemes is debt buybacks. In a buyback operation, the debtor country buys its own debt in the secondary market from its current holders, using either own resources or internationally donated funds [7].

Similar to debt buybacks there is the case of exit bonds. Exit bonds consist on swapping a certain amount of debt for bonds where there is some concession to the debtor in terms of the interest rate or of the value of the

credit agencies has increased. Therefore, tax dollars are already being used to support interest payments to commercial banks. With a debt reduction plan, initial book losses would be absorbed by commercial banks rather than taxpayers.

[6] As noted by Bulow & Rogoff (1988) equivalent to a debt-equity swap is the following two-step operation: first, allowing direct private investment to take place in the economy at the market exchange rate in a conventional way. Second, using those proceeds to buyback the country's debt.

[7] In the absence of concerted action, in order for creditors to be willing to sell their claims the price offered has to be high enough so that creditors will 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 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.

bond issue [8]. Exit bonds can be thus described as a buyback operation using "future" resources.

3 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 main of these points will next be reviewed:

(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 exctract 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. The difference between the two values depends on how much the creditor expects to be able to recover from the debtor country's disposable income in the event of default and on how large the probability of default is. They 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-buybach (higher) average value of debt [9] (See also

[8] In order for creditors to agree to these concessions these bonds have to be "safer" than the original debt, so that some sort of guarantees on the principal or on interest may be required. Alternatively, the principal or interest on the bonds could be made senior to those on existing loans. Partial or total collateralization could also be a solution. Collateralization using reserves seems pointless since reserves could be used as or more efficiently in a buyback program. Seniority does not seem to be a viable solution either since the required waiver of the nonsubordination clause would need the unanimous consent of all lending banks, which is highly unlikely. Therefore the only other possibility is that of guarantees which would have to be provided by an institution such as the World Bank, who has the legal power, capital, experience and capacity to do so.

[9] In the absence of concerted action, in order for creditors to be willing to sell their

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 don't make sense, unless the debtor also receives incremental new loans and donations to cover part of their losses, or else receive some other kind of substantial concessions 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 otherwise be used 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 debt [10], 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 transactions [11].

(3) *The investment incentive constraint* : The main argument in 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. Investors perceive a reduction in debt levels as an increase in the expected return in 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. Krugman (1988) provides a clear description of this effect, which is later formally built into an analytic framework and modelled 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 inter-

claims the price offered has to be high enough so that creditors will 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 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.

[10] This would be the case where the creditors would 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.

[11] Van 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.

nationally 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 endowments are used to buyback debt, this is not true. It results in an intertemporal substitution effect which contributes to reduce 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 not to depend on parameters which are independent on 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 investment incentive effect does not alter the conclusions of their fixed investment 1988 model.

(4) *The intersector investment distorsion effect* : Using a two-sector model, where only one of the sectors is exposed to output expropriation in case of default [12], Goldberg and Spiegel (1992) show that a large debt overhang distorts the allocation of investment between the two sectors. A debt buyback would then serve to alter this allocation of investment producing efficiency gains. In this case, it also follows that 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 factors complementary to investment, such as labor, would benefit from the presence of the distorted investment allocation in the safe sector. It follows that when debt levels are reduced, they loose 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.*

[12] the "safe sector" would comprise domestic goods production, cottage industries, etc.

4 A general model of debt buybacks

A model is set up in subsection 4.1 in which a central planner allocates initial country endowment between two assets: one is investment and the other is any other asset. For simplicity, and without loss of generality, we will assume that this asset is international currency reserves. The central planner is assumed to maximize expected utility of the representative agent. In subsection 4.2 this model is used to see if added welfare is possible through a debt buyback.

4.1 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 is $D/(1 + r^*)$, where r^* is the periodic external interest rate. D units of debt are due to be paid in period 2. In period one, the initial endowment Y_1 is allocated between present consumption (C), investment (I) and holdings of foreign currency reserves (R). 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 $g(\varepsilon)$. Reserves earn the risk free interest rate r_f. In period 2, the country observes the realization of the random variable ε and decides either to make payment on the outstanding obligations D and 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 proportional to the country's output and reserves levels (a fraction q_i of output q_r of reserves, for example) [13]. In deciding whether or not to default, the debtor country 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 utility [14]. Therefore,

[13] Losses associated with the deterioration of the terms of trade for example would result in a percentage reduction in output levels. Making the default loss dependent on 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.

[14] As 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

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:

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

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 defined as:

$$\pi = \int_{\varepsilon_0}^{\bar{\varepsilon}} g(\varepsilon)d\varepsilon \tag{2}$$

The country's objective is to maximize expected utility, with respect to reserves holdings and investment:

$$\max_{\{R;I\}} E[U] = U(Y_1 - R - I) + \beta \int_{\underline{\varepsilon}}^{\varepsilon_0} U[(1-q_i)(f(I)+\varepsilon) + (1-q_r)(1+r_f)R]g(\varepsilon)d\varepsilon$$

$$+\beta \int_{\varepsilon_0}^{\bar{\varepsilon}} U[f(I) + \varepsilon + (1 + r_f)R - D]g(\varepsilon)d\varepsilon \tag{3}$$

The first order conditions for this maximization problem are:

$$\frac{dE[U]}{dR} = -U_1' + \beta\{\int_{\underline{\varepsilon}}^{\varepsilon_0} U_2'(1 - q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon\}(1 + r_f) = 0 \tag{4}$$

$$\frac{dE[U]}{dI} = -U_1' + \beta\{\int_{\underline{\varepsilon}}^{\varepsilon_0} U_2'(1 - q_i)g(\varepsilon)d\varepsilon + \int_{\underline{\varepsilon}}^{\varepsilon_0} U_2' g(\varepsilon)d\varepsilon)\}f'(I) = 0 \tag{5}$$

These expressions can be combined to obtain:

$$f'(I) = (1 + r_f)\frac{\int_{\underline{\varepsilon}}^{\varepsilon_0} U_2'(1 - q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon}{\int_{\underline{\varepsilon}}^{\varepsilon_0} U_2'(1 - q_i)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon} \tag{6}$$

The expected rate of return on investment will equal the rate of return on the alternative asset: reserves. 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),

debts, does not constitute by itself enough of an incentive for full repayment.

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) and the lower the percentage loss in reserves (q_r).

A reduction in the level of debt results in a lower probability of default, resulting from a reduction in ε_0 as can be seen from definition (1). From examination of (6) it then becomes clear that investment levels will necessarily rise as long as $q_i > q_r$, i.e. as long as the other asset the debtor country holds (in this case reserves) is "safer" than investment.

4.2 Will a debt buyback be welfare improving?

Can a buyback be welfare improving from the debtor country's point of view? Under what conditions? Suppose the buyback reduces second period debt by X units (remaining debt will be D-X) and that the price the country must pay for the buyback 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 resulting from the lower debt level $D - X$.

$$V(X) = U(Y_1 - I - R - P\frac{X}{1+r^*})$$

$$+\beta \int_{\underline{\varepsilon}}^{\varepsilon_0'} U[(1-q_i)(f(I)+\varepsilon) + (1-q_r)(1+r_f)R]g(\varepsilon)d\varepsilon$$

$$+ \int_{\varepsilon_0'}^{\bar{\varepsilon}} U[f(I)+\varepsilon+(1+r_f)R - D + X]g(\varepsilon)d\varepsilon \qquad (7)$$

where

$$\varepsilon_0' = \frac{D-X}{q_i} - \frac{q_r}{q_i}(1+r_f)R - f(I) \qquad (8)$$

represents the post buyback critical value for the random shock variable (which defines the new probability of repayment π') and where I and R represent the new optimal levels of reserves and of investment given the resulting lower level of debt due in period 2. A debt buyback will be welfare improving if,

$$\frac{dV(X)}{dX}|_{X=0} = -U_1'\frac{P}{1+r^*} + \beta\int_{\varepsilon_0'}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon \geq 0 \qquad (9)$$

Using (4) this condition can be rewritten as

$$P \leq \frac{\int_{\varepsilon_0'}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon}{\int_{\underline{\varepsilon}}^{\varepsilon_0'} U_2'(1-q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0'}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon}\,\frac{1+r^*}{1+r_f} \qquad (10)$$

The price at which the buyback takes place (P) has to be (at least) equal to the post-buyback market price of debt. In order to determine how high P will be, one needs further assumptions: 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 [15]. Similarly, $q_r \geq q_r'$. The average value of each unit 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.

$$V(D-X) = \frac{\int_{\underline{\varepsilon}}^{\varepsilon_0'} [q_i'(f(I)+\varepsilon) + q_r'(1+r_f)R]g(\varepsilon)d\varepsilon + \pi'(D-X)}{D-X} \tag{11}$$

which can be rewritten as:

$$V(D-X) = \frac{\alpha}{D-X} + \pi' \tag{12}$$

where α represents the expected value of apprehended output in the default states [16]:

$$\alpha = \int_{\underline{\varepsilon}}^{\varepsilon_0'} [q_i'(f(I)+\varepsilon) + q_r'(1+r_f)R]g(\varepsilon)d\varepsilon \tag{13}$$

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

$$\pi' + \frac{\alpha}{D-X} < \frac{\int_{\varepsilon_0'}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon}{\int_{\underline{\varepsilon}}^{\varepsilon_0'} U_2'(1-q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0'}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon}(1+r^*) \tag{14}$$

This condition can be interpreted in the following way: Welfare will increase with a buyback if the marginal utility of the amount of savings in gross interest payments to creditors in the debt bought ($\int_{\varepsilon_0'}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon(1+r^*)$ is higher than the marginal utility of the lost profitability of the resources used to buy it back ($P(\int_{\underline{\varepsilon}}^{\varepsilon_0} U_2'(1-q_r)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\bar{\varepsilon}} U_2' g(\varepsilon)d\varepsilon)$). 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; namely it depends on how safe reserves are (q_r), on the difference between the average and the

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

[16] $\frac{\alpha}{D-X}$ represents difference between the average and the marginal value of debt

marginal value of debt $\alpha/(D-X)$ and on the concavity of the utility function (i.e. the degree of risk aversion) [17].

let us take for instance the case where $q_r = 0$ (reserves are perfectly "safe") and $U_2' = 1$ (utility is linear in second period consumption). Then, this expression becomes:

$$\pi' + \frac{\alpha}{D-X} \leq \pi'(1+r^*) \qquad \text{or} \qquad \frac{\alpha}{D-X} \leq \pi' r^*$$

Welfare can increase with a buyback that reduces second period debt by one unit if the interest saved in the repayment states is larger than (or equal to) the "excess payment" on debt repurchased (the difference between the average and the marginal value of debt).

5 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 4 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 where 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 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 buybackare ignored is clearly shown when they argue: *the repurchase is a purely financial transaction with no efficiency gains ...*

They 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 conditions reduces to $P < \frac{1+r^*}{1+r_f}$, and a debt buyback will always be welfare improving

[17] 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.

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, they 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 meansthat $q_i = q_i' = q$ 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 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's model, in case of default output is reduced by some percentage q_i and reserves are a perfectly safe asset. It can be shown that if the default penalty is in any way dependant 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 at all times even in the absence of investment incentive effects. It is easily shown that a debt buyback can be welfare improving under certain condition, and that results depend on the degree of risk aversion and on how safe reserves are, i.e. the parameter q_r.

The "gunboat technology" assumption made by Froot (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 it's first period endowment on 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 (6) becomes:

$$U_1' = \beta \pi f'(I)$$

This is the precisely condition obtained by Froot. From it a substantial qualitative difference between buybacks out of first period endowment and buybacks out of future endowment results, as explained in section 3 [18]. In

[18] Using first period endowment funds to buyback 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).

the following section it will be seen how Froot's results can be substantially altered if we allow the country to hold an alternative asset in which to apply some of it's first period's endowments.

In Goldberg and Spiegel, the country's first period endowment is either consumed or invested in one of two prductive activities. One of this productive activities is subject to creditor "apprehension" in case 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 precisely be the one they obtain:

$$\pi f'(I_s) = f'(I_n)$$

The large debt overhang introduces a distorsion 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 forgiveness 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 we will reexamine this conclusion under the more general assumptions of our model.

6 The importance of alternative assets to investment

In this section I will show that the difference between buybacks out of current resources or future resources will no longer remain as strong (or it may even not be present at all) 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. I will also show 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, as in Froot, 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. These are the same assumptions 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:

$$-U_1' + \beta\{\int_{\underline{\varepsilon}}^{\varepsilon_0}(1-q_r)(1+r_f)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\bar{\varepsilon}}(1+r_f)g(\varepsilon)d\varepsilon\} = 0 \qquad (15)$$

$$-U_1' + \beta\int_{\varepsilon_0}^{\bar{\varepsilon}} f'(I)g(\varepsilon)d\varepsilon = 0 \qquad (16)$$

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 (17) it can be seen that now it will also equal the expected return on reserves (net of default losses). This allows us to write

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

Equiation (17) demonstrates that optimal investment is determined by the condition that the expected return on investment equal 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 was used for the buyback. We see that now that can no longer happen.

It can also be seen that investment response to a lower debt level depends on 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 constant) and investment necessarily rises. Thus the safer the alternative asset, the stronger the investment incentive effect will be. 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. It can easily be seen that first order 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 resources [19]. Here, because first period consumption is fixed, there is no intertemporal substitution effect; all adjustment is done through an adjustment 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:

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

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 does no longer change with the buyback, we can also write $dC_1 = 0$ which allows us to determine how much optimal reserves holdings change due to the buyback. Since

$dC_1 = dY_1 - dI - dR = 0$ for a buyback out of internationally donated funds

$dC_1 = dY_1 - dI - dR - [P/(1 + r*)]dD = 0$ for a buyback out of the country's resources one can then write:

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

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

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

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

[19]The 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. $q_r > 0$) would merely reduce the size of this effect but not make it vanish

more 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 country's resources produces a new level of reserves that is lower that 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, since first period consumption is to remain unchanged, as with the buyback some resources will be used, this tends to reduce first period consumption and reserves fall 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 (let us denote investment in this sector by I_n, $q_n = 0$:

$$f'(I_n) = \int_{\underline{\varepsilon}}^{\varepsilon_0} (1 - q_r)(1 + r_f)g(\varepsilon)d\varepsilon + \int_{\varepsilon_0}^{\bar{\varepsilon}} (1 + r_f)g(\varepsilon)d\varepsilon \qquad (21)$$

Suppose that $q_r = 0$ once more. 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 large debt overhang 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.

7 Conclusions

In order to judge on the attractiveness of debt buybacks one has to pay attention to all of the several aspects of the problem involved: on one hand one cannot ignore the investment incentive effects generated by such a buyback in modeling them; it cannot be forgotten that this was the original argument raised in favor of debt reduction schemes. On the other hand one has to be aware of arguments such as the insurance value of reserves used for a buyback and of the fact that the cost at which the buyback takes place might be higher than the reduction in debt's face value. This two latter arguments suggest that there are costs to the buyback that may or may not outweigh the benefits.

It has been shown that the attractiveness of buybacks depends largely upon the value of some of the parameters in the general model used. Of

particular importance is a more clear definition of what the creditor is able to apprehend in case of default: should this be modeled as a percentage of output, or a percentage of total disposable income? How safe are other assets held by debtor nations? The investment incentive effects are 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 its values would then allow 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.

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