IMF WORKING PAPER

WP/87/58

INTERNATIONAL MONETARY FUND

Research Department

Buy-backs and the Market Valuation of External Debt

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September 10, 1987

Abstract

This paper analyzes "buy-backs" and "debt-equity swaps" involving external debt of developing countries. It is argued that if such programs are expected to be successful in increasing the market value of remaining debt, they also lead to a roughly equivalent increase in prices at which a buy-back or debt-equity swap could be carried out.

JEL Classification Numbers:
4330, 4412

* The author thanks Eduardo Borensztein, Guillermo Calvo, Max Corden, David Folkerts-Landau, Richard Haas, Elhanan Helpman, Assaf Razin, Ken Rogoff and participants of a Research Department seminar for helpful comments.

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I. Introduction

This paper develops a framework for evaluating a range of "buy-back" proposals that might reduce market discounts currently observed for the external debts of many developing countries. The proposals considered would reduce the aggregate contractual value of a country's debt or would alter the debt-equity mix of existing contracts. It is argued that the benefits of such proposals include capital gains and losses for debtors and creditors as well as increases in domestic investment in debtor countries that would result from a narrowing of market discounts on internal and external debt. The cost of a "buy-back" is measured by the current expenditure necessary to induce holders of a country's debt to voluntarily sell or exchange the existing debt in circumstances where they are fully informed as to the new amount and form of debt that will exist following the buy-back.

Two important insights emerge from the analysis. First, proposals that are successful in increasing the market price of debt, and therefore improve the climate for investment, also generate roughly equal increases in prices at which private investors will voluntarily sell or exchange these debts as the proposal is implemented. If, for example, a third party offers to buy a part of existing debt and forgives some or all of this debt, the price paid to purchase the debt will be the price expected to prevail following the forgiveness. Thus, market prices prevailing before the announcement of such a program will understate the expenditure necessary in order to purchase a given contractual value of debt.

This may be a particularly important consideration in cases where initial market prices are very low. Although it seems plausible that very low-price debt can be purchased and forgiven at a low "cost" it is clear that, if successful, such a proposition implies a very large capital gain to any individual creditor that holds his initially low-valued investment until after the forgiveness. It is illustrated below that in such cases, the initial creditors stand to gain a large part of the benefits of such a program. In such cases it may be useful to consider conditional buy-back proposals for which claims that remain outstanding following forgiveness are in some way subordinated to new claims.

Another insight that emerges from the framework developed in this paper is that voluntary exchanges of existing contracts for new contracts with different attributes, such as "equity" content, will reflect the expected post-exchange values of alternative contracts. For example, if a third party offers to exchange equity for existing debt, a voluntary exchange will reflect the expected relative rights of debt and equity holders that will prevail following the exchange. An important determinant of this relative price would be the implicit or explicit subordination of the relative rights of holders of different types of financial contracts. It will generally be the case that increased values that might accrue to one type of contract will be matched by decreases in the values of other contracts. The effects of this change in relative values of existing credits to a given country may have little effect on the climate for investment in the debtor country.

In the next section it is argued that the aggregate value of external claims on a country depends upon the present value of expected resource transfers from that country. Section 3 shows how the cost of forgiveness of a share of the existing contractual claims might be calculated. The analysis utilizes a hypothetical auction that is designed to induce private investors to reveal the cost a third party would incur in raising market prices of debt that would remain following a partial forgiveness of existing debts. Section 4 analyzes debt-equity swaps and the final section discusses extensions of this line of research.

II. The Aggregate Value of External Debt

The argument developed in this section is that the aggregate market value of claims on a debtor country depends upon the expected present value of resource transfers from the country that will be available to creditors. The expected resource transfer is determined by a large number of factors, some of which are controlled by the debtor government and some of which are not. It is assumed that these factors are not affected by the proposals discussed in the following pages. This assumption is to some extent unrealistic. For example, a buy-back that succeeds in increasing the market value of existing debt should improve the growth prospects for the debtor and, in turn, the payments to nonresident creditors the country could be expected to make. A more complete investigation of such linkages is left to future research.

In the analysis that follows, expected future payment streams are translated into expected present values. For the usual reasons, payoffs that are expected to occur far in the future are worth less today as compared to equal payoffs that will be received sooner. Nevertheless, investors are assumed to arbitrage claims on payment streams with the same present value so that their expected yields are equalized. This requires that some market participants can borrow and lend at any maturity at market interest rates. It is not necessary that the debtor be able to borrow and lend at market interest rates.

Suppose we observe that a country's debt is selling at 50 percent of its contractual value and that its total debt is $100 billion. 1/ What value would the remaining debt carry if some part of the existing debt were forgiven? For example, if investors now value $100 billion of bonds at $50 billion, what value would they place on $75 billion worth of bonds remaining if $25 billion of the country's debt was forgiven? If we assume that the behavior of the debtor is unaffected by a partial forgiveness of

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1/ As argued in an earlier paper, there is probably little useful distinction between so-called internal and external debt at least in the context of this exercise. Thus the relevant stock of debt, $100 billion, in the above exercise should be thought of as the total government debt of the country concerned.

its legal obligations, the answer to this question depends entirely on why investors valued the original $100 billion face value bonds at $50 billion. 1/

A simple way to characterize investors' expectations is to envision a probability distribution for the present value of various possible payoffs by a country to all its creditors. In the first example developed below, it is assumed that all creditors hold identical bond contracts and that each creditor expects to receive the average payment on the country's aggregate contractual obligation. 2/ For example, if a uniform distribution for outcomes is assumed over aggregate payoffs with present values that range from zero to the entire contractual liability of $100 billion, each investor assumes that he will receive the same share of his contractual rights. Thus, the expected probability of receiving a payoff of $0.50 per dollar is equal to the expected probability of the country generating a payment stream to all creditors with a present value of $50 billion. The "payment stream" in the case of external debt can be thought of as net exports of goods and services.

III. Reductions in the Contractual Value of Debt

To explore the question of how a change in the contractual rights of creditors will alter the market value of credits, an auction can be imagined in which a benefactor would buy and forgive a portion of the existing debt. It is assumed that the funds made available by the benefactor would not otherwise be made available to the debtor country. The benefactor would then reissue a reduced stock of claims on the debtor country that would carry a lower contractual value. This procedure would, in most cases, generate conditions subsequent to the auction consistent with a reduced gap between the market value of the debt and its contractual value. The private sector's behavior with regard to an auction would depend upon expectations concerning the present value of the country's aggregate payments to creditors. For simplicity it is assumed in this analysis that these expectations are not changed by the auction. Thus, predicted changes in market prices reflect the fact that following the auction there will be a smaller value of contractual claims on expected payments.

1. Pricing for a uniform probability distribution

In order to focus on the implications of debt forgiveness, a very simple probability distribution for aggregate payments is assumed. In

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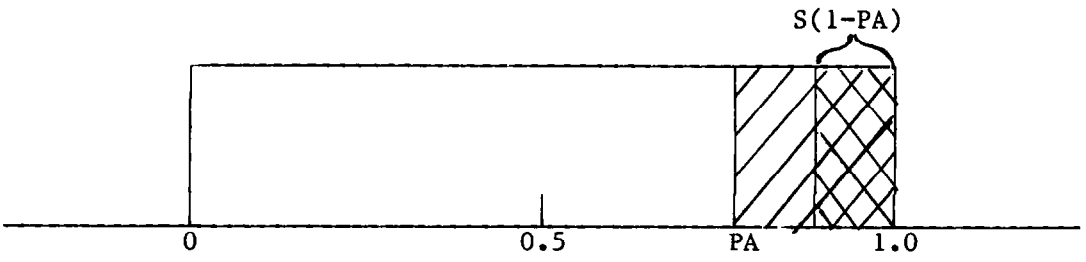
1/ For convenience it is assumed that the contractual value and the "face value" of the debt were identical when the debt was issued. This will not, in general, hold but does not affect the analysis as long as we interpret changes in the market discount as relative to the "at issue" discount.

2/ For convenience it is assumed that all the bonds have the same infinite maturity and are indexed to market interest rates.

particular, it is assumed that the present values of all payoffs, between zero and $100 billion inclusive, are believed to be uniformly likely to occur. Thus, the mean expected payoff is $50 billion and each dollar's worth of contractual value sells for $0.50. 1/

The benefactor offers to buy existing debt in a single auction and promises to forgive the difference between the auction price, PA, at which the benefactor purchases bonds and the contractual value of the bonds purchased. 2/ The effects of such an auction can be illustrated for the uniform distribution ranging from 0 to 1 shown in Figure 1.

Figure 1



If the authorities purchase all of the outstanding debt, the amount forgiven per dollar would be (1-PA), the shaded area in Figure 1. The probability that new contracts would be paid off at contractual value (that is where PA equals one on the new contracts) is assumed to be the probability of all outcomes equal to or greater than PA for the old contracts. Since the auction price PA will be equal to one for the new contracts, the value of the new contracts is in part due to the probability of complete payoff which must be (1-PA) *1 or simply (1-PA). 3/

1/ The assumption that market prices reflect the mean of the probability distribution of the present value of expected payment streams is maintained throughout the analysis.

2/ The benefactor can either hold the new bonds or sell them in the market. As long as the rights of the benefactor and other investors are identical, this would not affect market prices. In practice, the rights of the benefactor or his preferences for enforcing those rights may be different. Thus, the "cleanest" assumption would be that the benefactor sells the new bonds back to private investors.

3/ Note that the value of this part of the new contract as a percentage of the auction price would be (1-PA)/PA. This, however, is not of interest because the objective is to calculate the market discount on the new contractual value of debt.

There will remain, however, some chance that the new contracts will not be completely paid off. This is assumed to be the probability of events to the left of PA for the original contracts. The mean of this probability density, the unshaded area in Figure 1, is 1/2 PA. The market price of the new contracts must therefore be:

$$PM = 1/2\ PA + 1-PA$$

$$PM = 1 - 1/2\ PA$$

Competitive bids at the auction will ensure that the auction price is equal to the expected market price following the auction. If, for example, the auction price was higher than the market price subsequent to the auction, successful sellers at the auction would realize an immediate capital gain. Conversely, if the auction price were lower than the subsequent market price, successful sellers at the auction would experience an immediate capital loss. Assuming no collusion among bidders, 1/ any expected gain would be eliminated as bidders competed against one another. It follows that the equilibrium auction price, PA, is that which sets the auction price equal to the subsequent market price, PM. For a uniform distribution where the benefactor buys and resells all the outstanding debt this would simply be:

$$PM = PA = \$0.66$$

Although more realistic examples of auctions and probability distributions are considered below, all the important aspects of a forgiveness proposal are captured in this simple example. 2/ The benefactor incurs a cost of about $22.2 billion in lowering the market discount on existing debt from 50 percent to 33 1/3 percent. The "investment" benefit of this reduction in market discounts would be the present value of future investment that would be undertaken at this discount that would not be undertaken at the initial 50 percent discount. This calculation would, of course, require an empirical estimate of the investment schedule in the debtor country.

The initial creditors enjoy a rise in the market value of their debt of $16.6 billion since the market value of their bonds rose from $50 billion to $66.6 billion when the auction was announced. 3/

1/ This is an important assumption. In practice, creditors may try to enforce noncompetitive bids by insisting that sales be allocated according to ownership shares rather than according to amounts offered for sale. Under these conditions the auction becomes a bilateral monopoly problem. In general, the sale price will be higher in this case and need not be equal to the expected post-forgiveness price.

2/ Any auction rule that generates the same amount of forgiveness would generate the same auction and post-auction price. The convention assumed here is therefore not crucial to the results.

3/ In selling their holdings the initial creditors would realize an accounting loss of $33.4 billion assuming that the initial accounting loss of $50 billion had not been realized.

The debtor country gains the rights to payoffs above $66.6 billion that would have gone without forgiveness to external creditors. In this example, the expected present value of these outcomes would be about $5.6 billion.

Thus, the $22.6 billion expenditure by the benefactor has three effects. First, the market discount is reduced from 50 percent to 33 1/3 percent. Second, the creditors realize an economic gain of $16.6 billion. Third, the debtor realizes an expected gain with a present value of about $5.6 billion. It should be noted that the initial creditors gain even though their collective rights to some relatively good outcomes have been transferred to the debtor country. This negative "income effect", from the point of view of creditors, is more than offset in this example by a "substitution effect" that results from the lower value of contractual debt following forgiveness. That is, the lower expected present value of payments by the debtor country will satisfy a larger share of credits following forgiveness.

This simple example of a buy-back proposal serves to highlight several important results that might be expected from such proposals. The relative strength (and for debt-equity swaps discussed in the next section even the signs) of these effects, however, are not invariant to assumptions about the probability distribution for payoffs. In the following discussion, these difficulties are explored further. In particular, it is argued that the "income effect" that was positive for the debtor in this example and negative for creditors as a group may not play an important role in some cases.

2. Partial buy-backs

It may not be realistic for the benefactor to offer to purchase all outstanding debt since this implies that all bids will be accepted regardless of cost. If the benefactor offers to buy less than the total outstanding debt, the reasoning is slightly more complicated but the basic results hold. In this case, the securities not purchased at the auction will also increase in value following the auction, although their contractual value will remain unchanged. In this case, the benefactor would buy some share, S, of the existing debt, forgive S(1-PA) per dollar purchased, and sell the new securities to the market. Returning again to Figure 1, the contractual value per dollar of outstanding debt forgiven by the benefactor would be S(1-PA). Thus, by analogous reasoning the market value of all debt following the auction would be:

$$PM = 1/2\ (1-S(1-PA)) + S(1-PA)$$

And the equilibrium auction price is found by setting PA = PM so that

$$PM = PA = \frac{1+S}{2+S}\ .$$

If, for example, the benefactor agreed to buy one-half of the $100 billion described in Figure 1 the equilibrium auction price would be:

PM = PA = $0.60.

The cost to the benefactor of "improving" the discount on debt outstanding following the auction from 50 percent to 40 percent is $12.0 billion. Corresponding to this the creditors realize a capital gain of $10 billion while the debtor realizes an expected gain of $2 billion. It should be noted that the capital gain to creditors accrues both to those who participate in the auction and to those who choose not to participate.

An accounting loss may be realized by the initial creditors that participate in the auction although the rise in the post-auction market price would provide an economic benefit to initial creditors regardless of their participation in the auction. If the initial creditors have to be paid to realize the accounting loss, then we should expect an auction price above the expected subsequent market price in order to compensate for this. This might be important in cases where initial investors' relationships with regulators or their own creditors depend upon accounting as well as market prices.

3. Pricing for a normal probability distribution

If the appropriate probability distribution over payoffs on existing debt was normal rather than uniform, there would be less value associated with payoffs near the extremes of 0 and 1. To illustrate this, consider a normal distribution, F(x), of expected present values of resource transfers, x, that has a mean of 0.5 and 98 percent of the probability density between 0 and 1.0. As described above, the benefactor might purchase all of the outstanding debt at PA and forgive (1-PA) of the debt. In this case the probability that repayment will exceed the reduced face value of debt is not (1-PA) as in the uniform distribution but 1 - F(PA), the shaded area in Figure 2. Moreover, the mean of the probability density of the remaining contractual value is not 1/2 PA but the price corresponding to the mean of the truncated probability density

Figure 2

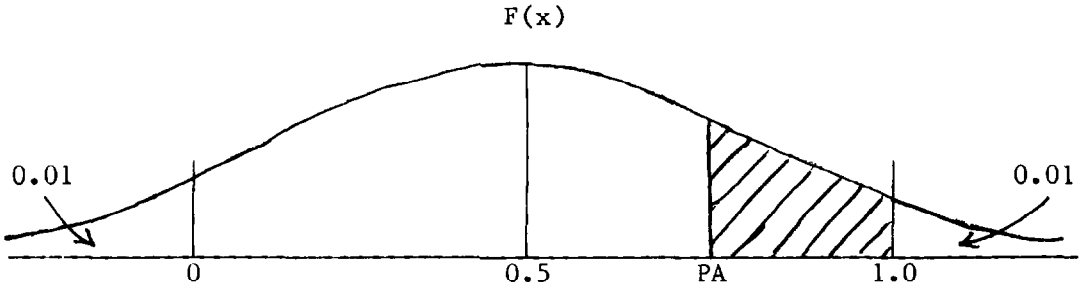


Figure 3

from 0 to PA. If y is defined as the payoff per dollar of the new contractual value following the auction then:

$$y = 1.0 \quad \text{if } x \geq PA$$

$$y = x/PA \quad \text{if } x < PA$$

The probability that $x < PA$ is $F(PA)$. The probability that $x \geq PA$ is $1 - F(PA)$. Thus the expected value of y will be the post-auction market price. 1/

$$E(y) = PM = 1 - F(PA) + \frac{1}{PA} \int_0^{PA} xf(x)dx$$

Where $f(x)$ is the probability density function of a truncated normal and, as before, since in equilibrium PA = PM the solution can be solved numerically.

Suppose the auction price was \$0.66 as was the equilibrium value for the uniform distribution. In this case, the market price following the auction would be slightly higher than \$0.66 giving the sellers an expected loss in participating in the auction. Expected losses would induce sellers to drive the auction price up to about \$0.69 per dollar bid. At this auction price the post-auction market price would also be about \$0.69 per dollar of contractual value.

The cost to the benefactor of raising the market price of remaining debt from \$0.50 and \$0.69 would be about \$21.4 billion. Creditors receive a capital gain of \$19 billion while the debtor regains control over expected payments with a present value of about \$2.4 billion. It is interesting to note that the results were comparable to the uniform distribution discussed above. In fact, if we allow the variance of the normal distribution to become very large, the results converge to the uniform distribution. As the variance of a normal distribution becomes very small, it approaches the case in which there is a certain return of some present value on existing debt. We turn to this extreme in the next section.

4. Pricing for single value and nonsymmetric distribution

For simplicity it is assumed that all of the probablility mass is concentrated on one payoff corresponding to \$.50 per dollar of contractual

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1/ If the benefactor offered to purchase a share, S, of the outstanding debt the equilibrium auction price would be:

$$PA = PM = 1 - F(1 - S(1 - PA)) + \frac{1}{PA} \int_0^{(1-S(1-PA))} xf(x)dx$$

And if $S = 1/2$

$$PA = PM = 0.64$$

value. An auction along the lines discussed above would result in a post-auction market price which is simply $.50 times the ratio of the initial and post-auction contractual values

$$PM = .50 * \frac{100}{100 - (1-PA)100} = .50 * \frac{1}{PA}$$

In equilibrium therefore

$$PM = PA = \$0.706.$$

Thus the benefactor would incur a cost of $20.6 billion in raising the market price by 20.6 percentage points. Moreover, creditors would realize a capital gain that is exactly equal to the expenditure of the benefactor. This is because there is no "income" effect in this example. The assumption that there is no probability that payments will exceed the new contractual value of debt of $70.6 billion means that creditors, as a group, "lose" payoffs that have a zero chance of occurring. By the same logic, the debtor does not regain the rights to payoffs. Thus, in any circumstance where the post-forgiveness contractual value of debt exceeds all probable payoffs, the creditors gain because of the "substitution" effect while the debtor gains only to the extent that investment is higher due to the fall in market discounts.

A purchase with forgiveness seems particularly attractive in cases where initial market prices are relatively low. However, in such cases a large share of the benefits of forgiveness might accrue to the creditors. If, for example, the initial probability over outcomes was massed at $0.10, the equilibrium auction price would be about $0.316. In this case, the benefactor would incur a cost of $22 billion in raising the market price by 22 percentage points. However, there may be little or no increase in investment at a discount of 68 percent.

In this limiting case where the variance of expected returns is zero, the benefactor can obtain a percentage increase in the market price of existing debt only by incurring a cost equal to the equivalent share of the contractual value of outstanding debt. This simply reflects the fact that creditors remaining after the auction and forgiveness expect to share the same distribution of payments. It follows that in cases where the initial price is very low, an auction scheme that would reduce the market discount to a level that might be expected to encourage new investment would require the purchase of a sizable part of existing debt at a high cost.

5. Pricing for bimodal distributions

Another interesting distribution is an "all or nothing" possibility represented by a 0.5 probability that all creditors receive full payment and a 0.5 probability that creditors receive nothing. Such a distribution might be relevant in cases when a single important change in the economic environment would either render the country unable to make any payments

or make the existing debt small relative to the country's capacity to pay. The equilibrium condition for this auction would be:

$$PA = PM = 0.5 * 0 + 0.5 * 1.0$$

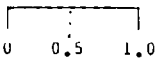
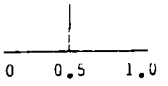
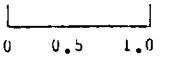
$$= 0.5$$

In this case the market value debt will always remain at $0.50 regardless of the amount purchased by the benefactor. The benefactor would incur a cost of $25 billion but would not succeed in narrowing the market discount. Therefore, the investment effect would be zero. The creditors in this case receive no capital gain while the debtor receives a capital gain of $25 billion.

6. Comparison of results

The results of this section are summarized in Table 1. It is clear that the distribution of benefits of a buy-back scheme depends upon the nature of the probablility distribution over outcomes. In any case, however, the debtor stands to gain either from an improvement in the climate for investment or from an expected capital gain through debt reduction. Creditors gain to the extent that market prices rise as a result of the buy-back.

Table 1. Reductions in Contractual Value

				
Distribution	Uniform	Normal	Single Value	Bimodal
Cost to benefactor	$22.2	$21.4	$20.6	$25.0
Investment effect (percent rise in market prices)	+16.6	+19.0	+20.6	--
Expected gain for debtor	$5.6	$2.4	—	$25.0
Realized gain for creditors	$16.6	$19.0	$20.6	--

One way to alter the distribution of benefits for any of these distributions is to break the equality between the auction price and the expected post-auction market price. For example, the debtor country might specify that debt not purchased at the auction would not be fully honored. While this might be considered a partial default on the part of the debtor country, donor countries might reduce the expected cost of such an action to the debtor by refusing to assist creditors in enforcing payments for debt not purchased at the auction.

The difficulty in analyzing such schemes is that the probability distribution over payoffs is obviously changed by default or subordination of debt not bought at the auction. Default or subordination might succeed in reducing the market discounts with or without a buy-back. An extreme example of this would be the case where the debtor defaults completely on all debt not purchased in the buy-back. If credible, this would allow all initial debt to be purchased at any positive price the debtor offers since the expected post-auction price of existing debt would be zero. It seems to follow that a buy-back under these conditions is analytically equivalent to a unilateral default on the part of the debtor combined with some compensation as provided by the buy-back.

IV. Pricing for Different Types of Financial Contracts

In this section the assumption that all creditors receive the average payment is relaxed. As before, it is assumed that the aggregate value of financial claims on a country's resource transfers will reflect the present value of a range of possibilities for expected payment streams. However, given this aggregate value, the value of each different type of claim on the expected resource transfers will depend on the "place in line" for payment granted to different types of creditors. For this reason individual creditors will be very interested in their rights relative to other creditors. It follows that creditors would welcome porposals that might move them up in line a place or two. However, such proposals may not affect the market valuation of a debtor's aggregate obligations.

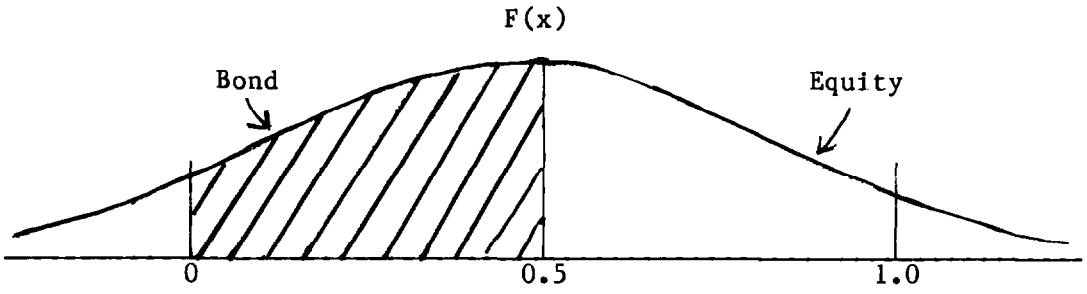
It has been suggested, for example, that equity could be substituted for debt in order to improve a country's financial position. One way to analyze such an idea is to imagine that a benefactor offered to purchase debt at the market discount and then reissue equity claims on the debtor country. The cost of such an auction would be the difference between the auction price of the bonds and the post-auction market price of the equities sold.

The introduction of two types of financial claims on the debtor country requires an assumption concerning the relative rights of the holders of these instruments. If it is assumed that bond holders will always be first in line for payment, then, from the bond holders point of view, the substitution of equity for debt would be equivalent to a forgiveness of the outstanding debt purchased by the benefactor. For the normal distribution discussed above, this would mean that the post-auction value of the bonds would correspond to the mean of the shaded area of Figure 3, plus the probability of a payoff of 1.0 for all outcomes to the right of 0.5. 1/

$$P_B = 1 - F(S) + \frac{1}{s}\int_0^s x\, f(x)dx$$

1/ Note that the integral's value is indexed by s, rather than PA in the earlier examples, since it is assumed that in valuing remaining bonds (1-s) of the contractual value of the initial debt is forgiven.

Figure 3



If one half of the initial debt is purchased, the equilibrium price would be $0.84. Thus, the benefactor would purchase $50 billion in bonds at a 16 percent discount, a total expenditure of $42.0 billion. The benefactor would then sell equities to the market. The value of the equities would reflect the value of all outcomes that yield a payment after all bond holders are satisfied. Note that in this case the value of outcomes above one would also go to equity holders.

If one half of the outstanding bond debt is purchased by a benefactor and reissued as equity, the value of the newly issued equity would be 1/

$$P_E = \int_S^{\infty} (x-s)\, \bar{f}(x)dx$$

$$= \$8.7 \text{ billion}$$

Note that the price function differs from the bond pricing function because outcomes from 0 to S imply a zero price for the equity since for all outcomes when $x < S$ the payoff to equity holders would be zero. It should also be noted that, by assumption, there is very little probability weight above 1.0. For this reason, the value of the equity, $8.7 billion plus the value of the bonds, $42 billion, exceeds only slightly the market value of the original bond contracts. The benefactor would realize a total cost of $33 billion in narrowing the discount on debt from 50 percent to 16 percent. The lesson from this auction is that a conversion of debt into equity could lead to a substantial increase in the market value of remaining bonds but would do so at a considerable cost to the benefactor. Moreover, in this example the debtor has absorbed an expected income effect loss of $0.7 billion.

1/ $\bar{f}$ is the f density defined above, not truncated at 0 and 1 but defined from $-\infty$ to $+\infty$.

V. Limitations and Extensions

Several issues remain in an attempt to fully evaluate the proposals outlined in this paper. It has been shown that there is no typical distribution of benefits associated with buy-back proposals. Under plausible circumstances, both debtors and creditors could benefit substantially. However it is possible that almost all the benefits of a forgiveness scheme could go to the creditors in the form of a substitution effect, with little or no benefit to the debtor country in the form of "investment" or "income" effects.

Another difficult problem is identifying the relevant alternative uses of available funds. Suppose, for example, the benefactor gave the funds to the debtor country and the debtor used the funds for imports and real investment. Alternatively, the funds could be used to service the existing debt in the usual way or to accumulate reserve assets. These alternatives or combinations of alternatives might be preferable in individual circumstances. At this point, it seems reasonable to conclude that there is no general rule as to whether a buy-back with forgiveness is an optimal strategy for individual countries. Each case would have to be judged against alternative uses of available funds.

Another important issue is that the distribution of benefits of buy-backs can be changed fundamentally by adding elements of repudiation to a buy-back proposal since this would break the link between auction prices and expected market prices. While it may be possible to tilt benefits toward the debtor country through conditional buy-backs, this could result in sanctions against the debtor and prejudice future access to private credit markets.

Finally, it should be noted that the effects of any scheme on market discounts will reflect not only the initial offer by a benefactor, but also any information that might be inferred concerning future schemes. If, for example, investors believe that the benefactor will do what is necessary to maintain a given discount on a country's debt, the market discount will move to this level and the benefactors actions then become endogenous to the system.