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16

MARKET-BASED DEBT REDUCTION FOR DEVELOPING COUNTRIES

Principles and Prospects

STIJN CLAESSENS, ISHAC DIWAN,
KENNETH A. FROOT,
AND PAUL R. KRUGMAN

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Stijn Claessens and Ishac Diwan are economists in the Debt and International Finance Division, International Economics Department, World Bank. Kenneth Froot is an assistant professor of economics, and Paul Krugman a professor of economics, at the Massachusetts Institute of Technology.

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Introduction

Since Mexico introduced a debt-equity swap program in 1984, several other schemes for retiring problem-country debt on the secondary market have emerged. Some of the schemes sound simple, others very complex. Some propose that debt reduction be accomplished through cash buybacks, with the cash coming from a variety of places, including debtor resources, multilateral institutions, creditor governments, and even from the creditors themselves. Some schemes assume that the debtor can issue a new type of security in exchange for private bank debt. Senior debt claims and various indexed instruments including equity in specific debtor-owned enterprises have also been proposed. To complicate matters further, debt-reduction methods have not been limited to purely "voluntary" schemes. Since the announcement of the Brady plan by the U.S. Treasury in March 1989, many debt-reduction packages have included concerted, nonvoluntary aspects. In addition, agreements often allow banks to choose from a menu of options for debt reduction.

Despite the increasing volume of market-based debt-reduction transactions and the official support for them, there still is a surprising amount of confusion about how they work — and about whether debtors or their creditors can expect to gain from any or all of them. Practitioners, creditor banks, and policymakers all seem divided on the advisability of market-based arrangements, yet the logical bases for their arguments are not clear. The sense of disagreement has not been helped by the academic literature, which appears as polarized as any other.

This manual reviews and consolidates what economists understand about market-based schemes and concerted debt restructurings. Its purpose is to reach those who wish to come to an independent judgment on the value of different market-based transactions and different forms of debt restructurings. Some will wish to understand the abstract reasoning behind why such transactions or restructurings are useful or dangerous. Others will have a more practical purpose in trying to decide how to design a market-based debt-reduction plan or debt-reduction deal that meets their objectives. All readers will see, however, that one ought to be skeptical of overly general answers to the questions of market-based transactions and debt restructurings. Part of the reason for this is that the gains and losses depend on many factors, some of which are difficult and maybe impossible to quantify precisely.

The answers are also tentative because the definition of market-based schemes — that they be entered voluntarily by debtors and their individual creditors — is ambiguous. If, for example, the governments of creditor banks appear prepared to spend whatever amount of money is needed to resolve the debt problem, the terms of a "voluntary" program will be more generous to creditors. Alternatively, if creditor governments and international institutions refuse to make available taxpayer monies, yet at the same time appear un-

willing to tolerate internal instability within debtor countries, the terms of any "voluntary" exchange will be very different.

Reliance on market-based and concerted approaches, then, does not do away with the need to establish a status quo against which individual debtors and creditors evaluate various alternatives. Market-based and concerted schemes are not necessarily a panacea in an all-out effort to resolve the debt-servicing problems of indebted countries. Instead, such schemes should be understood as playing a more modest role: as one possible mechanism for implementing a negotiated agreement on how much debtors must pay. The real purpose of this manual is thus to look through the financial smoke and mirrors of such schemes and to present their underlying economics simply. Market-based schemes are not automatically desirable simply because the market is involved: they must be evaluated for their effect on efficiency and on the division of burdens between debtors and creditors. In many cases, concerted plans represent improvements over voluntary schemes and lead to dramatically different treatments of debtors and creditors.

This manual is structured as follows. Sections 1 and 2 discuss the evolution of debt-crisis management from a coordinated approach to today's greater emphasis on voluntarism. Section 3 then begins to analyze the basic building blocks of market-based transactions. In sections 4 through 8 we apply these fundamentals to the study of several distinct types of market-based schemes, each of which is a close cousin to schemes that have actually been implemented. The text presents simple examples designed to highlight the mechanics (in annex 1 we present a more mathematical model).[1] In section 9 we turn to an important empirical question: is debt reduction in the collective interest of creditors? There we present estimates and discuss some of the shortcomings of any extreme conclusions. In section 10 we present the case for concerted debt-reduction schemes over voluntary schemes. There we discuss the workings of the "menu approach" to debt reduction. In section 11 we look at the most important example of a concerted menu plan to date: Mexico, 1989. Finally, section 12 offers our conclusions and outlook.

1

Concerted versus market solutions

Much of the strategy for dealing with problem debtors over the past seven years has emphasized concerted, not voluntary, action. Ever since the onset of the debt crisis, creditor governments and international institutions have attempted to encourage negotiated agreements among all parties. For the first five years, there seemed to be an implicit understanding that a market-based approach — in which each participant pursues his or her self-interest — could be destructive. A lack of mutual cooperation could easily have led to wholesale default by debtors, failure of major money center banks, and instability in the world monetary system.[2]

While cooperation was not perfect, it was able to forestall a complete breakdown in the debt management process. Is the shift in emphasis from programs that are concerted to those with a large component of "voluntarism" a good one? To answer this, we need first to review the original arguments for cooperative solutions.

The rationale for concerted action

The defining feature of a problem debtor is its inability to borrow on a voluntary basis — its lack of normal access to international capital markets. The essence of the concerted lending strategy followed from mid-1982 until early 1989 was to substitute nonmarket sources of finance for the normal ones: to use a combination of official lending and involuntary lending from existing creditors to supply debtor nations with enough foreign exchange to service their debts. To some observers, this strategy has seemed absurd. After all, what sense does it make to lend still more to countries that already owe more than they are expected to repay? It is important as a starting point to understand the rationale for new lending to problem debtors.

This rationale is often stated in terms of the distinction between liquidity and solvency: a country is asserted to be worth lending to if it is solvent (is expected to be able to repay its debt eventually) but not liquid (lacks the cash to service its debt on a current basis). But this distinction is a misleading one for the debt crisis. If it were known that a country were solvent, it would be able to borrow voluntarily, and there would be no liquidity problem. The liquidity problem arises precisely because there is a possibility that the country will not be able to repay its debt fully — specifically, because there is a sufficiently large possibility of nonpayment that the expected present value of repayment is less than the debt already outstanding.

Why, then, should creditors lend still more to such a country? The reason is that although incomplete payment is possible, it is not certain. Suppose that a country might eventually make payments equal in present value to its outstanding debt, but that the risk of nonpayment is sufficiently large that it cannot borrow on a voluntary basis. Then, without concerted action by its creditors, the country will either have to meet its obligations out

of current resources or, if this is impossible, default immediately. The latter will guarantee that creditors do not get all that they are owed, foreclosing the possibility of benefiting from any later good fortune on the part of the country. It may therefore be in the creditors' interest to postpone at least part of a country's obligations, avoiding a current default and preserving at least the possibility of a favorable outcome later.

A country's obligations to amortize debt can be postponed by rescheduling principal, a standard procedure. For heavily indebted countries, however, this is not enough, since even the interest payments on debt exceed what debtors can reasonably be expected to pay out of current resources. There is thus a need to postpone interest obligations as well. Such a postponement could be achieved directly, through interest capitalization, but this has so far been opposed strongly by creditors because it makes the process excessively automatic (and perhaps also excessively transparent). Instead, the method has been to round up existing creditors and require them to provide new loans that cover a fraction of interest payments, effectively deferring interest obligations. This is the process of "involuntary" or "concerted" lending.

The potential gains from concerted lending were argued strongly in the well-known study by Cline (1983) and have been demonstrated in formal models (see Sachs 1984 and Krugman 1985). The point may be seen informally if we think in terms of the present value of expected actual repayments of debt that fall short of a country's legal obligations. Suppose that creditors believe that if no concerted lending is undertaken, a country will be forced into a disorderly default in which creditors will receive only a fraction, $1 - d$, of the nominal value of their claims. Suppose also that they believe that a sufficiently large program of concerted lending — say, lending L dollars — will reduce the expected loss from d to d^*. Then it is straightforward to see how such a program can produce a net gain. Each additional dollar lent as part of the concerted lending program is lent at an expected loss of d^*. But the program increases the value of existing debt by $(d - d^*)D$, where D is the initial stock of debt outstanding. Thus the benefits of the program to creditors exceed its cost as long as $d^* L < (d - d^*)D$, or as long as

$$L/D < \frac{(d - d^*)}{d^*}.$$

To take an example, suppose that without a program of concerted lending the subjective discount would be 0.5 — creditors would expect to get only half of what they are owed — but that with a program that avoids immediate default the discount falls to 0.25. It is then in the interest of creditors to pursue such a program as long as $L/D < 1$ — that is, as long as the increase in their exposure is less than 100 percent!

This example clearly shows the fallacy of some common arguments against lending to problem debtors. It is not true, for example, that the existence of a secondary-market discount on debt means that new money should not be put in. It only means that such new money will not be provided voluntarily — but that is, by definition, true of a problem debtor. Therefore, it also is not true that the unwillingness of lenders other than the existing creditors to provide funds is an argument against provision of new money by the creditors. Showing that concerted lending *can* make sense is, of course, not the same thing as showing that it *does* make sense. In essence, concerted lending represents a strategy of playing for time and for more favorable circumstances.[3] This is only likely to be desirable if a country's ability to service debt is expected to rise. Otherwise, concerted lending simply puts heavily indebted countries deeper into debt.

In the early years of the debt problem, it was common to emphasize the extent to which growth and inflation would make it possible to reconcile growing nominal debt via concerted lending with a gradual return to creditworthiness (see, for example, Feldstein 1986). As it has turned out, however, growth in many debtor countries has not been strong enough to reduce substantially the ratios of debt to GNP or exports, and normal access to capital markets seems further away than ever. This low growth performance breaks with past experience for many countries: a sharp deceleration in debtor growth coincided with the sudden seizure of international lending in 1982.

The possibility that the debt burden is itself responsible for slow growth is important. It implies that the insistence of creditors on maintaining the full extent of their claims on debtor nations may be self-defeating, reducing their expected repayment below what might be achieved through a settlement that reduces countries' debt burden. The possibility that less may be more — that a reduction in the debt burden of highly indebted countries, rather than financing that simply postpones debt repayment, might be to everyone's advantage —

suggests that the appropriate concerted strategy could be to forgive, not to refinance, some of the debt.

There are several reasons why a large nominal debt burden may impair a country's ultimate ability to repay. First, a debt that is so large that the country is unlikely to be able to repay in full acts like a high marginal tax rate on efforts to expand the country's foreign exchange earnings: the bulk of any improvement will benefit creditors rather than the country. Second, the debt burden may ultimately appear as a tax on domestic capital, thus acting as a disincentive for domestic investment. Third, to the extent that an inability to pay debt leads to a confrontational or disorderly default, the result may be to reduce eventual payment to less than the country might have paid if a reduced debt had been agreed on in advance. (We will return to discuss these mechanisms later in more detail.) For all these reasons, a reduction in creditors' nominal claims on a country may actually increase creditors' expected receipts when nominal claims are very high.

It helps to think about this burden in a diagram (figure 1). On the horizontal axis is the country's nominal debt obligation, and on the vertical axis are the repayments that the loans are expected to generate on average, *V*. Near the origin, when the level of debt is low, a one-dollar increase in obligations leads the market to expect an extra dollar in repayments. Thus the loans trade at par, and the loans' expected payments rise along the 45-degree line. As the level of debt increases, however, the country cannot always repay in full: the value of the debt begins to fall below the 45-degree line. This is the region in which concerted lending may help creditors as a group receive the highest possible return on their total commitments.

As the level of debt increases further, however, the curve eventually peaks and begins to fall. In this region, levels of debt are so high that they have become counterproductive: the loans are discounted so fast that an extra dollar of debt actually lowers expected debt service. For this reason, figure 1 is called the debt Laffer curve. Note that once the curve has peaked, a package of concerted lending may no longer maximize creditors' repayments. Instead, some forgiveness may be required.

There is nothing magical about the relief package that puts a country at the top of its Laffer curve. Banks might also accept a greater reduction in debt, one that barely preserves the status quo. Whether they view the status quo as acceptable depends on their view of the alternatives. Suppose, for example, that a country is initially at a point like 1 in figure 2. If creditors view the alternative as remaining at point 1, forgiving enough debt to raise *V* to point 2 — or to any point between points 2 and 3 — would make them better off, and therefore could conceivably be the basis of an acceptable bargain. But if banks expect that the alternative to debt reduction is a taxpayer bailout of, say, 75 percent of the face value of debt, they will agree to a partial write-down only in the unlikely event that it gives them more. Debt reduction will be hostage to creditors' expectations about how they will be treated if they don't go along.[4]

Figure 1
Debt-relief Laffer curve

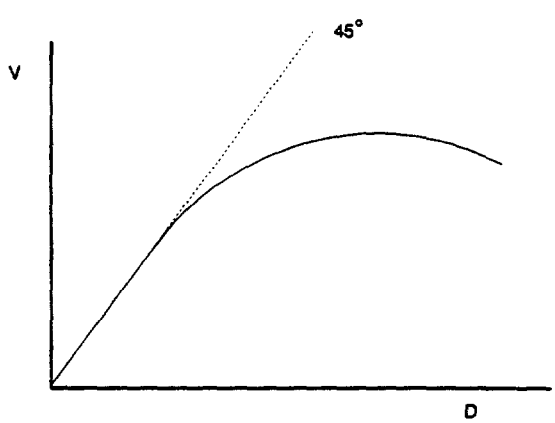
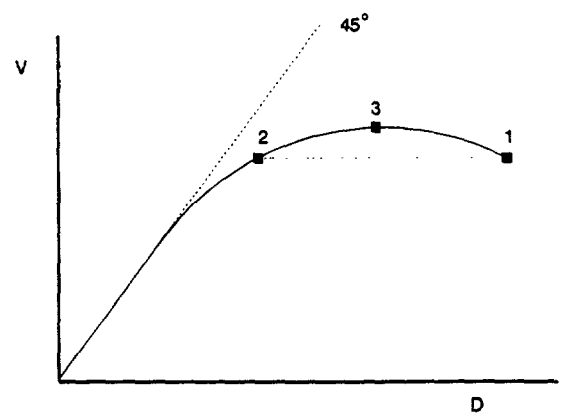


Figure 2
Value-increasing debt relief



It is worth mentioning that there are also several institutional reasons why banks might believe that they can do better than the Laffer curve analysis might imply. An example would be bank deposit insurance. Bank share values are determined in part by expected cash flows from loan portfolios and in part by deposit insurance, which allows banks to borrow cheaply. Even if forgiveness raises expected debt-service payments, it may lower by enough the expected subsidy from cheap borrowing to prevent debt reduction from being in the shareholders' interest. By creating a wedge between the loan portfolio's value and the interests of shareholders, deposit insurance will create a bias toward financing and away from forgiving debt.[5] We will discuss this and related problems further in section 10 below. For the time being, however, we will ignore any conflicts between policies which maximize the value of outstanding debts and those which maximize shareholders' return. As banks have rapidly reduced their exposures to major problem debtors, such conflicts are in the aggregate less likely to be important today than at earlier stages in the debt crisis. They may, however, still play an important role for individual banks making choices among the different elements of a market-based menu.[6]

To evaluate what relief and concerted lending imply for the value of a sovereign's loans, we need to know where the country is on its Laffer curve. This is a difficult, and surely disputatious, task. But quite independent of the details of the optimal package, we can be sure that any concerted action program will face a major problem: the gains from these concerted plans are collective. They arise because by relending or forgiving some of the debt, the likelihood of higher future payments increases. Looked at in isolation, however, each new loan that is made and each dollar of debt that is forgiven are done at a loss. So, each creditor would try to free-ride on the package by letting other creditors do the new lending or forgiving.

Debt-restructuring plans therefore face the now-familiar free-rider problem, in which debt relief may be in everyone's collective interest but fails to take place because no individual creditor finds it in his or her interest. Concerted lending — with creditors negotiating collectively, with pressure from creditor central banks on individual banks, with different forms of coercion from the international agencies, and with the somewhat ineffective threat by countries to declare moratoria if new money is not provided — is used to overcome this problem. In the case of market-based debt forgiveness, the free-rider problem is due to the gain of the non-exiting banks from the forgiveness of exiting banks, leading to less favorable outcomes for the debtor. The concerted debt forgiveness programs to date — the recent Costa Rican, Mexican, and Venezuelan agreements — were less of a favorable experience for the non-exiting banks since they were asked to provide concessions themselves instead of being able to free-ride on other creditors' debt reduction.[7] In sum, the results from concerted action are likely to be economically the most efficient, but the free-rider problem makes it problematic to mimic them in practice through market-based schemes.

The market-based alternative: general considerations

Given the difficulties of ensuring concerted action on debt, it is natural that the parties concerned would consider decentralized, market-based approaches as an alternative. The virtues of a market approach to economic management in general are widely appreciated, and it seems natural to suppose that the same general virtues apply to the management of international debt. Furthermore, the large discounts at which developing country debt trades on the secondary market seem to offer a clear opportunity for mutually beneficial trades.

Before turning to the specifics of such schemes, it is important to clear the air by pointing out that the easy presumption in favor of market-based debt reduction does not hold up under careful examination. Voluntarism is not necessarily virtue: the fact that a debt reduction takes place via a market transaction does not guarantee that it is beneficial. And the existence of a discount on the secondary market does not guarantee that mutually beneficial market-based debt reduction is possible.

Much economic analysis is concerned with showing how markets allow decentralized solutions to economic problems that are mutually beneficial to the participants in the market, and that are more efficient than centralized outcomes. Economists therefore tend to have a presumption that more use of the market mechanism is good. At first glance, market-based debt reduction seems to fall into the general category of market-opening, liberalizing reform — something similar to freeing up international trade or interest rates.

This is not a good analogy. For one thing, market-based debt-reduction schemes are not simply transactions between private parties — they re-

quire use of resources by the debtor government. It is always necessary to ask whether this is the best use of those resources. And by definition, a problem debtor may fail to repay its obligations in full. This possibility creates potential conflicts of interest among the creditors, because paying off one creditor may impair the debtor's ability to repay the rest.

In the worst case, a market-based debt-reduction scheme could make both the country and its creditors worse off. Consider the following simple example. Suppose a country owes $4 billion to its creditors. All that it has on hand is $1 billion in cash, which it could use for an investment project that would yield creditors a present value of $4 billion in debt repayments (and perhaps another half billion dollars for itself). Now suppose the country is persuaded instead to spend its billion dollars buying back debt in the secondary market. Clearly, if such a plan succeeded, it would make creditors worse off, since the only way that they can get the $1 billion now is to give up $4 billion in the future. In addition, the country would be worse off, since it would have spent all its current resources without providing itself with future investment income.

The foregoing example is exaggerated. The important point, however, is that the example cautions against any blanket assumption that market-based equals desirable. Here the voluntary actions of creditors work to their mutual misery. Each creditor reasons, "given that other creditors are redeeming their claims (and therefore that the investment project has effectively been canceled), my claims will be worthless if I try to hold onto them. But if I redeem my debt, I can walk away with at least some cash." Under a voluntary scheme, individual creditors do what is best for them individually. Thus, our creditor would claim his or her share of the $1 billion, as would all other creditors, who will have reached similar conclusions about their prospects.

This example shows that the market's ability to get around the free-rider problem is only part of the story. Market-based schemes have an additional, less-well-advertised property: in solving one collective action problem, they may create another one of their own. Although the above example is extreme, it indicates that letting individual creditors choose what is best — without any collective guidance as to which alternatives are admissible — can lead to unsatisfactory and unnecessarily costly outcomes. Market-based debt-reduction schemes differ from the usual market situation because the actions of individual creditors affect the well-being and the decisions of all other creditors: that is, they have externalities. At the local grocery market, one shopper's choices typically have no effect on what other shoppers choose. If they all shop according to their own preferences, it doesn't matter to their welfare that they don't take others' preferences into account. This is not true for a group of creditors. Each creditor will pursue his or her own goals without taking into account the effects on other creditors, yet these effects will nevertheless be important. This kind of "externality" may lead to highly inefficient decentralized outcomes — such as that described above.

The second fallacy that surrounds voluntary debt reduction is the view that the mere existence of a discount on the secondary market is enough for buybacks to be desirable for debtors. This view holds that since countries will need to repay fully their debts if they return to prosperity, they are better off retiring debt while it is cheap. Such reasoning is badly flawed, however. It doesn't take into account the very real possibility that debtors won't return soon — or at all — to prosperity. While a now prosperous country may be pleased that it took advantage of earlier discounts, a country that has foundered to the point where its debts must be forgiven would view any prior debt-reduction expenditure as wasted. Thus, the mere presence of a discount cannot reveal whether debt is a good buy for the country.

We should note at this point that much of our discussion is based on the assumption that secondary-market prices more or less reflect the present value of expected future debt service. Some supporters of market-based schemes argue that the potential gains from these schemes arise precisely because secondary prices do not reflect expected payments. They hold that such complicating factors as bank regulation and taxation, as well as competitive forces in the banking industry, explain most movements of secondary-market prices. Williamson (1988), for example, argues that most creditors view secondary-market prices as low, but that pressure from regulators and boards of directors prevents managers from buying. In such a case, prices reflect the expectations of only the most pessimistic banks, and therefore are likely to be considerably below what a more balanced estimate of expected cash flows would yield.

This argument must strain to explain the precipitous fall in prices in 1986-88. Did the pessimistic outlook become even more bleak relative to the

optimistic? Or did the ability for optimists to buy debt fall even as the market was becoming deeper and banks were becoming better capitalized? Institutional features are no doubt important for assessing secondary-market prices (we return to them in section 10), but they are unlikely to account for the entire decline in prices or for the differences in prices across countries.

Naturally, it is easy to build an equally convincing case for the opposite view that market prices are too high. After all, if prices are low relative to expected cash flows, investors other than banks could expect to earn excess risk-adjusted returns by purchasing some debt on the secondary market themselves. Outside investors are clearly not rushing to do that, so it is unlikely that prices are very far below expected payments. Even if the market is thin and only partially informed, it is as easy to argue that prices are too low as it is to argue that they are too high.

Thus, we assume that the low level of prices reflects a realistic appreciation on the part of banks that the debts may not be paid in full. If we are to try to gauge the amount of debt the market expects problem debtors to service, we will take the market price as the best single indicator of the average value of the debt. That is, the secondary-market price measures the average benefit of a dollar of debt to creditors.

In sum, the market-based approach gives each individual an ability to choose freely. But as with any decentralized approach, this does not necessarily lead to better outcomes. Concerted solutions are likely to be best for all parties, but require more coordination among individual banks. Often they cannot be implemented because of difficulties in disciplining free-riders. As we will see below, the trick to using voluntary schemes is to design them cleverly enough so that their outcome mimics that of the optimal concerted plan.

2

The mechanics of the market-based approach

Market-based schemes all involve debt repurchases at a discount. But the value of such purchases to both debtors and creditors is very sensitive to the precise structure of the repurchase. Although bank debt is retired in all cases, different obligations are used to replace it. The nature of these new obligations (whether they are cash, exit bonds, or equity) and their source (the debtors themselves, creditor governments, or multinational institutions) will directly influence the desirability of these schemes. Conceptually, the essential ingredient for understanding all varieties of market-based schemes lies in the distinction between the average burden imposed by the debt and the marginal cost to debtors and benefit to creditors of an additional dollar of debt.[8] As we shall see below, the marginal benefit of debt reduction is different from the average cost to the country of debt. Similarly, for creditors, the marginal cost of debt reduction is not equal to the average benefit from holding the debt. The failure to distinguish between average and marginal can lead to misleading conclusions about the merits of any given scheme.

For example, it is tempting at first glance to use average costs of the debt to the debtor for assessing the benefits of debt-reduction plans. The political and economic instability in debtor countries generated by years of austerity, the stresses put on the international financial system by the debt problem, and the possibility of worsening debtor-creditor relations are all valid support for the belief that the debts could inflict great damage (have high average costs) even if little is actually paid. As with a prohibitive sales tax that discourages all purchases, expected payments may substantially understate overall costs. Thus, if the cost of the debt is quite high, yet its market value low, it seems obvious that removing the entire debt burden from the country by buying up debt is a good deal, and debt repurchases are a bargain. This argument is correct — if substantial portions of debt can be wiped out at prices somewhat below those initially prevailing on the secondary market. Ironically, this could be accomplished under a concerted plan under which creditors receive the value of their claims and debtors get the advantage of a partial write-down. The market-based approach generally will not, however, allow such outcomes: it usually is not possible to buy large amounts of the debt on the open market at anywhere near the initial price. Typically, as more debt is purchased, the price of the remaining debt rises.

To see why, notice that if the entire debt is repurchased, individual creditors will give up their claims only if they receive a price of par. Anything less and each would reason that, as the last creditor remaining, he or she could be paid in full. So, why tender now at a lower price? This reasoning will lead creditors to prefer to hang onto their debt: none will be retired unless the repurchase price rises all the way to par. The pattern holds regardless of how low the price may have been before the buyback was announced. Such a repurchase

scheme could clearly be very expensive. The problem is the same mechanism that makes market-based schemes voluntary: the buyback price must leave individual creditors indifferent between trading in or hanging onto their debts. In other words, market-based transactions take place at the post-buyback price, not the pre-buyback price, of the debt and involve a wealth increase for the creditors that exit as well as for those that hang onto their claims. Because the post-buyback price is the average expected repayment on the debt *remaining*, we cannot evaluate such schemes by comparing the average expected repayments on the debt before the buyback to the average benefit of debt reduction.

To account properly for the costs of debt reduction to creditors and benefits to debtors, we need to know *marginal*, not average, costs and benefits. These marginal costs and benefits, which are generally different from the secondary-market price, take into account the effect on the price of the remaining debt of any forgiveness. Thus, if debt is forgiven, but the price of the remaining debt rises, the marginal benefit to the country will be less than the original market price.

From both the debtor's and the creditor's perspectives, the gains from market-based schemes will depend on factors that separate marginal from average. Three such factors are the source of the resources used to repurchase debt, the ability of debtors and creditors to reach agreement when the debt cannot be repaid in full, and the tax effect that debt has on the country. In the sections that follow, we will explore several detailed examples of market-based schemes, making alternative assumptions about the source of buyback resources and the ability of debtors and creditors to reach agreement in cases of partial default.

This is about as far as we can go on intuitive grounds alone. We now need to introduce a simple analytical framework to clarify how the source of buyback resources and the efficiency of debtor-creditor negotiations will influence the marginal value of debt reduction to the country. Although we will work with extreme examples, these examples form the building blocks of most debt-reduction schemes. Indeed, we will see how several plans already implemented are combinations of the basic cases we discuss.

3

An analytical approach to the costs and benefits of debt reduction

The task now is to develop a simple, unified framework to analyze all the examples that follow. Of course, analytical simplifications are used to keep us focused on the conceptual distinctions of different schemes. More detailed (and more accurate) models can always be built, but their essential features will be no different from the simple framework below. Indeed, one reason for the confusion surrounding market-based schemes is that it is easy to lose track of the conceptual underpinnings when confronted with the financial acrobatics built into actual debt repurchases. Our simple framework cuts through such complexities and explains clearly the outcomes of the repurchases, in both the abstract and real worlds.

It helps to think in terms of an explicit numerical example, to which we will return repeatedly below. Imagine a country that owes $100 billion, and suppose that the present value of the country's future payments is uncertain. With a probability of ⅓, the optimists will be vindicated, in that the country will be able to make payments whose present value covers the full value of its debt. Call this the "good state." With a probability of ⅔, however, the country will not be able to pay all that it owes. In these "bad states," of which there may be many, debtors and creditors bargain over the amount that the country will pay. In some bad states, debtors simply agree to pay a certain amount. In others, agreements are not so easily reached, and there may be penalties imposed on the debtor in addition to its cash repayments. In our numerical example, we assume that creditors expect to receive an average cash flow of $25 billion once they know the country did not reach the good state.

Once we know the repayments in and the probabilities of good and bad states, we can easily determine the secondary-market price of debt. The expected payment from the country is just $\frac{1}{3} \times 100 + \frac{2}{3} \times 25 = \$50$. Absent any market-based scheme, the debt will sell at 50 percent of par.

Total costs of the debt

From this computation, creditors expect the debt to generate $50 billion in direct cash repayments. But their net receipts may be lower, since they may face "collection" costs that arise from the expense of actually imposing penalties. Similarly, while the debtor's expected direct cash repayment is $50 billion, there may be additional indirect costs imposed on the debtor's economy by the debt. In this section, we develop more precisely how these additional costs to the country and its creditors may arise. The point is to analyze the total costs of the debt to the debtor and the total benefits to creditors.

The best way to approach the problem is to imagine asking the country and its creditors how much value each would place on a complete elimi-

nation of the debt. In a sense we could think of this experiment as representing the simplest kind of market-based transaction, in which the debt is forgiven rather than repurchased. The cost of forgiveness to creditors and its benefits to the debtor represent each party's view of the total debt burden. After we understand this case better, we can turn to examples of more realistic and complex market-based transactions.

We separate the total debt burden into three components. The first is just the direct cost of the actual cash payments themselves. In our numerical example, both the market and the country expect this to be $50 billion. In a very simple world, in which contracts are costlessly enforced and in which the debt has no effect on economic activity, payments on the debt are pure transfers. In such a case, the direct cost of the actual cash payments is the only cost. But the real world is unlikely to be so simple. We therefore distinguish two types of indirect costs, the first from imperfect contract enforcement, and the second from the effect of past debt accumulation on current economic activity.

The first indirect cost of the debt involves what we will call extraction inefficiencies: the possibility that in bad states, negotiations break down and costly penalties are imposed.[9] In corporate bankruptcy cases, the legal system provides for a (relatively) smooth and efficient distribution of the value of the firm among its creditors. Although many observers argue that extraction inefficiencies are important for corporations, such inefficiencies are likely to be far more important for sovereign debts. After all, in the sovereign case creditors must extract resources themselves. There is no third party to prevent the imposition of costly penalties and delays, such as the disruption of trade or the failure to reach an agreement. As with labor-management disputes, negotiations may break down, imposing deadweight costs on both parties. Indeed, they do so more frequently when the two sides are further apart.

The simplest way to capture extraction inefficiencies is to suppose that negotiations break down in some of the partial-repayment states. In those states, the debtor may pay something toward its obligations, but creditors do not find the payment sufficient — perhaps because they are trying to develop a reputation for playing "tough" or because they think that the debtor's claim that it can pay no more is untrue and that it would actually pay more if pressed. Penalties, costly to the debtor, are then imposed. We might also think that these penalties are more likely to be imposed when a great deal of the debt goes unpaid. Creditor banks might, for example, refuse to provide trade credits to the country, warn their corporate customers not to do business with the country, or even try to confiscate some of the country's assets. All that matters is that these penalties harm the debtor more than they help the creditor.

In our example, suppose that creditors have at their disposal penalties that inflict on the country an average cost of $25 billion in the bad states. (If this number sounds large, recall that creditors must have some threat which induces the debtor to pay an average of $25 billion in default states.) If the cost of penalties to the debtor were substantially lower, the debtor would prefer to pay nothing and endure the penalties in partial-repayment states. Indeed, in the good state the country would agree to repay the $100 billion debt only if the ultimate costs of not paying were at least as high. Thus, we should view $25 billion as a lower bound on the debtor's assessment of the costs of conflict with creditors.

When are these penalties likely to be imposed? We might think that if the debtor initially owed, say, only $40 billion, creditors might think it less worthwhile to impose penalties. After all, if the debtor pays $25 billion, they are entitled only to another $15 billion. In such a case, the probability that penalties are actually imposed might be quite low, say 10 percent. But as the face value of the debt grows, so too does the amount that goes unpaid in bad states. Once the country owes $100 billion, creditors are still entitled to another $75 billion in bad states. They may reason that by imposing penalties more frequently, they more often get the country to knuckle under, and as a result may receive larger bad-state payments. Or they may reason that other countries with large debt burdens may be looking on, so that it is worth making an "example" of the country that tries to get away with paying a small fraction of what is owed. Then the probability that penalties are imposed in the bad states is perhaps 30 percent. That would make the indirect costs of extraction inefficiencies worth $0.3 \times 25 = \$7.5$ billion to the debtor in bad states.[10] So far, then, the debt costs the country $50 billion in direct payments and another $\$7.5 \text{ billion} \times 2/3 = \$5$ billion in penalty costs, for a total of $55 billion.

This is, of course, only the debtor half of the extraction-inefficiency ledger. It is presumably costly for creditors to impose these penalties. Loss of trade-credit profits, upfront legal expenses, the difficulties of reaching a consensus within the cred-

itor syndicate, and the opportunity cost of time spent negotiating, may easily amount to 10 percent of the debt. Suppose that the total cost is, say, $25 billion. Then the expected value of the debt to creditors is the direct payment of $50 billion, less the costs of the expected extraction inefficiencies, (⅔) 0.3 × 25 = $5 billion, or a subtotal of $45 billion. Thus, the presence of extraction inefficiencies that fall on creditors lowers the market price of the debt, in this case from 50 to 45 cents.

The second indirect cost of the debt is the presence of what many observers have called disincentive effects. These observers have argued that large external debts act to discourage a country's incentives both to invest and to undertake costly adjustment programs.[11] Their reasoning is that the more debt a country has, the more likely will increases in its ability to pay be absorbed entirely by increased debt service. In this view, it is as though an increase in the level of debt acts to raise the effective marginal tax rate on future income.

The analogy to increasing marginal tax rates makes it easy to see why disincentive effects result in an additional direct cost of the debt. Suppose that the debt were actually reduced to zero, and we were to ask how much additional economic activity was stimulated as a result. Suppose that, with no debt at all, the probability of reaching the good state is higher than ⅓, say ⅔ The country could more easily pay the expected value of the debt, $50 billion. In fact, if the high level of debt had this effect on the country's overall performance, the expected direct payments would be ⅔ × 100 + ⅓ × $25 = $75 billion, an increase of $25 billion. Of course, creditors could not benefit from the increase in economic activity related to a complete write-off of the debt. As a result, creditors' average valuation of the debt is not affected by the presence of disincentive effects. But as we shall see below, partial write-downs may allow creditors to benefit from disincentive effects.

What are the costs of disincentive effects to the debtor? Suppose for a moment in the good state that the debtor on average produced $175 billion, so that after paying off the debt it kept $75 billion for itself. In the bad states, suppose for simplicity that the country pays all that it has, leaving nothing left for itself. With the disincentive effects present, the country then expects to keep $75 billion with a probability of ⅓, for an expected revenue of $25 billion. If no disincentive effects existed, the country would reach the good state with a probability of ⅔ and would therefore expect to keep $75 × ⅔ = $50 billion. The debt overhang implies that the disincentive effects reduce expected future output by $50 – $25 = $25 billion.

The cost of the debt overhang to the country must, however, be less than this amount. The process of adjustment and investment required to improve its chances of reaching the good state must cost the country something, otherwise it would have gone ahead with the improvements in the first place. Perhaps these adjustment costs amount to half the increase in income, so that the debtor's net cost of the disincentive effects is $12.5 billion. Notice also that if the size of the debt obligation were even higher, say $200 billion, the probability of reaching the good state would be even lower than ⅓. As a result, the indirect costs due to disincentive effects tend to increase the overall debt burden.

To summarize so far, we have identified three costs to the country of its debt: actual repayments, inefficiencies in the extraction process borne by the debtor, and the disincentive effects generated by the debt's implicit tax on future income. he first is what we might call the direct cost of the debt: the market price times the amount of debt outstanding. In the numerical example, this was $50 billion. The next two costs are indirect effects attributable to inefficiencies that a large debt generates. Both tend to raise the cost of the debt to the country above its expected payments reflected in the market's valuation. It is these effects that lead to the widely and unreflectively held perception that the debt may be purchased cheaply on the secondary market.

As we argued earlier, the mere presence of inefficiencies created by the debt burden does not allow one to conclude that market-based plans will be beneficial to either the debtor or its creditors. To determine whether the market price represents a bargain, we need to know the country's marginal benefit from a dollar's worth of debt reduction. And to understand how (or whether) creditors will be affected by debt reduction, we need to know their marginal cost of debt forgiveness. We therefore turn to examine the marginal costs and benefits of debt reduction.

Marginal costs and benefits of debt reduction

The marginal gain from a dollar of debt reduction can be defined as the amount the country benefits if creditors unilaterally decide to retire one dollar of debt. Similarly, the marginal cost to creditors is the amount they need to be compensated in return for this forgiveness. Recall that there is no reason that

either of these marginal valuations need be equal to the market price. As with the total debt, the marginal benefits to debtors and marginal costs to creditors will have three components.

Clearly, the country benefits from debt reduction because expected cash payments to creditors fall. As before, we call this amount the direct benefit of a marginal dollar of debt reduction. Whenever the country is in the good state, removing a dollar of debt would save the country one dollar. Since full repayment occurs with a probability of ⅓, the country's expected saving from a marginal debt reduction must be 33 cents.

The first thing to notice is that this direct benefit is clearly less than the market price of 50 cents, which, as we saw above, is the average price of the debt. It is always the average price that the debtor would need to pay to retire a dollar of debt on the secondary market, yet the value of that debt reduction to the country is the lower marginal cost of 33 cents.

Second, notice that the direct cost to creditors of a dollar of debt reduction is the same amount — 33 cents — not the market price of 50 cents. This means that the marginal value of debt to creditors is 17 = 50 – 33 cents less than the average value represented by the market price. To see why, notice what happens to the market price if some debt is forgiven. Suppose creditors freely give up $10 billion of their $100 billion in claims. How much does this cost them? A naive guess would use the market price of 50 cents to calculate a cost of $0.5 \times \$10 = \$5$ billion. But such a calculation would be correct only if the market price remains unchanged at 50 cents. In fact, the price will rise with the forgiveness: the remaining $90 billion in claims pay off $90 billion in good states but the same $25 billion in bad states. Thus the price rises from 50 cents to $(\$90 \times ⅓ + \$25 \times ⅔) / \$90 = 52$ cents.

This price rise may seem insignificant unless one recalls that on $90 billion of debt, 2 cents per dollar amounts to an increase of $1.8 billion in value. This reduces substantially the cost of forgiveness from the initial estimate of $5 billion down to $3.2 billion — almost exactly the amount the debtor saves in debt service ($\$10 \times ⅓ = \$3.3$ billion) from the $10 billion write-off.[12] The increase in price in the remaining debt caused by debt reduction means that the marginal cost of debt forgiveness is below the average price of debt.

Once again, if the debt's existence does not create any distortions or inefficiencies, these direct costs are all that the country and its creditors face. The assumption that debtors pay the same $25 billion in default states regardless of the amount owed implicitly rules out our indirect costs of debt. Yet this assumption probably is not very realistic.

Of the marginal effects on indirect costs, the first is the marginal effect on extraction inefficiencies of a dollar in debt reduction. If the probability of a breakdown in negotiations increases with the amount of the debt that goes unpaid in bad states, debt reduction can be expected to lower the debt burden for the country in bad states. This, however, is not simply a result of the inefficiency of the extraction process. This source of debtor gain is present as long as some of the benefits of eliminating the inefficiencies accrue to the debtor.

Similarly, as long as some of the extraction inefficiencies are costly to creditors, lowering the debt will tend to reduce the cost of inflicting punishments (since the punishments are either less severe or imposed less frequently). Creditors, then, will also gain from eliminating this inefficiency.

The creditors' (but not the debtor's) gain from the reduction in extraction inefficiencies will manifest itself as an increase in the price of the remaining debt. To see this, suppose that with $100 billion of debt outstanding, creditors on average waste $2 billion on collecting the debts in partial-repayment states. The market value is then initially $\$50 - \$2 = \$48$ billion, so the price is initially 48 cents. Suppose next that the write-down to $90 billion reduces these collection costs to zero. The price then increases by 4 cents from 48 cents to $(\$90 \times ⅓ + \$25 \times ⅔) / 90 = 52$ cents. Of this price increase, 2 cents are due to the direct improvement in the quality of loans, as there are fewer of them. The other 2 cents come from the elimination of creditors' costs of extraction. Note that the debt reduction has now cost creditors $\$48 - (0.52 \times \$90) = \$48 - \$46.7 = \$1.3$ billion, about one-fourth of the initial, naive estimate of $5 billion.

The third, and perhaps most misunderstood, gains from debt reduction are the disincentive effects associated with a large debt overhang. We have already seen that overhang may be an important inefficiency which tends to raise the overall cost of the debt above the market value. Here we need to ask, how does the overhang affect the country's and its creditors' marginal costs of debt reduction?

For the debtor, the short and perhaps surprising answer is *not at all.* True, small amounts of debt

reduction increase a debtor's incentives to invest and therefore tend to encourage investment and growth. But this added benefit to the country is just offset by the costs of undertaking the additional growth and investment expenditures, assuming that the country is at the optimal investment-versus-consumption tradeoff. This offset occurs because the debtor's initial growth path already strikes a balance between additional sacrifices in current living standards and additional future revenues. As one would expect, debt reduction increases the future revenues that the debtor expects to keep (thus the direct benefit of 33 cents from above). But any gains to the debtor from increased growth and investment will be negated by the extra sacrifices needed to finance that growth. As long as the country is choosing its preferred level of adjustment, it must be indifferent between spending another dollar on adjustment and doing nothing. Thus, the marginal cost of adjustment exactly offsets the gain. The implication is that, even if debt reduction spurs a strong positive response in economic activity, the resources forgone to finance this activity offset the subsequent increase in future income accruing to the debtor.

This argument indicates that a debt overhang cannot itself affect the debtor's return from small amounts of debt reduction. Instead, it is creditors who, for a given buyback scheme, gain from the reduction in the overhang effect: the greater the overhang, the greater the investment response to a debt reduction, and therefore the higher the price creditors receive for surrendering some of their debts. Of course, which market-based scheme is ultimately chosen may in part be up to the debtor (see sections 4-8).[13]

Notice that the disincentive effects contribute to the rise in the secondary-market price as debt is reduced. To return again to our example, suppose that a write-down of $10 billion increases the probability of repayment by 1/12, from 1/3 to 5/12. Then the price of the debt after the forgiveness rises from 50 cents to $(\$90 \times 5/12 + \$25 \times 7/12) / \$90 = 58$ cents. This price rise is so large that the market value of the remaining debt is now $0.58 \times \$90 = \$52$ billion, $2 *billion greater than before the debt was forgiven.* In this example, the incentive effects are so strong that debt reduction actually raises expected debt service: the country is on the back side of its debt Laffer curve.

To sum up, debtors receive two types of benefits from debt reduction. The first is the direct reduction in payments in good states. The second is the reduction in wasteful sanctions imposed on the country in partial-repayment states. Recall that the debtor receives no net gain from increased growth since it alone must finance that growth. For small amounts of debt reduction, the gain of higher growth to the debtor and the cost of that growth will cancel out, leaving the creditors but not the debtor better off.

Notice that the total cost to creditors of writing off one dollar of debt is less than the market price for three reasons. First, as we argued above, the quality of the remaining claims improves when some are written off. Second, creditors may need to spend less money in the "collections" process, which may involve sanctions that are costly to impose. Third, creditors benefit from increased growth and stability in the debtor as a result of even higher prices of the remaining debt. Indeed, these latter two effects — individually or in combination — may be so strong that the value of the debt to creditors actually rises with the debt reduction. In section 9, we examine empirically whether there is any evidence that countries are indeed on the back side of their debt Laffer curves.

Appropriability of debt-reduction resources

Before we move on to consider the social -- as opposed to the private — gains from debt reduction, we pause to mention a simplification that we will want to relax in later sections. That is the assumption that the default-state repayment (in our example, this was the $25 billion paid with a probability of 2/3) is not itself affected by debt reduction. This assumption is probably sensible for the pure-debt-relief case we have been discussing. But most market-based schemes will involve a swap of existing debt for another asset or cash. And in a number of cases the creation of this new asset may adversely affect the debtor's ability to pay in bad states. For example, a simple debtor-financed repurchase could reduce the debtor's bad-state repayments. If the debtor funds a buyback itself, in part through the sale of assets that would have contributed to repayments in good as well as bad states, the buyback reduces the country's ability to pay. In such a case we might say that creditors will not be able to appropriate all the funds used for the buyback. The less a buyback is subject to bank appropriability, the less debtors must pay in default states. Thus, unless appropriability is complete, we would expect that bad-state repayments tend to fall as the debt is reduced. As we will see in more detail

later, appropriability can create a fourth type of marginal benefit of debt reduction.

Social gains from debt reduction

If there are no inefficiencies associated with economic performance and current debt levels, debt forgiveness is simply a transfer from creditors to debtors. The sum of the direct marginal gains to the debtor (33 cents) and its creditors (– 33 cents) will be zero. The presence of inefficiencies, however, suggests that marginal reductions in debt are a positive-sum game. As our discussion above indicated, various inefficiencies imply that creditors lose less than 33 cents when debt is forgiven, yet debtors may benefit by more than 33 cents. To the extent that extraction inefficiencies and investment-disincentive effects are important, the sum of the gains to debt reduction will be positive.

We have now completed our overview of how debtors and creditors should value debt. Despite its simplicity, this barebones setup will allow us to distinguish different types of market-based schemes and to evaluate their effects on debtor and creditor welfare as well as on prices.

We will consider generally two types of repurchases: cash repurchases and debt swaps. For cash repurchases, we need to know where the money comes from. One possibility is that cash is donated explicitly for a buyback by external sources. Another is that a new (senior) lender finances the buyback. Alternatively, the debtor may finance the cash buyback itself.

For the second type of repurchase — debt swaps — we need to know the attributes of the new security that is exchanged for bank debt. Here we will consider three kinds of new instruments. The first is a "senior" debt claim, one that receives payment ahead of the remaining sovereign loans. We will also show here that a reduction of commercial bank claims through buybacks financed by senior loans (mentioned before) is identical to such a "senior" debt swap. The second is an "enhanced" debt instrument which includes a collateralization or third-party backing of all or part of the payment stream. The third kind of swap we consider is debt-for-equity. All together, there are five different exchanges, differentiated both by the source of the repurchase resources and by the nature of the new obligation. We will also consider concerted debt-restructuring deals where debt-reduction schemes are combined with new-money contributions.

4

Cash repurchases using externally donated funds

Our first example, cash repurchases using externally donated funds, is perhaps the simplest. We assume that some bank debt will be purchased on the secondary market for cash, and that the cash, designated for the buyback, comes from an external party at no cost to the country.[14] We are concerned with the benefits to both the debtor and creditors of the buyback, and with the price at which the buyback takes place. To clarify the mechanics of the buyback, we apply the foregoing analytical framework and then turn to several numerical examples.

The effects of a small buyback on debtor and creditor welfare can be seen directly from the above discussion. For debtors, note that their gains under a cash repurchase using externally donated funds will be exactly equivalent to those under pure debt forgiveness. A grant of 50 cents from the external party allows the country to buy back a dollar of debt. From the debtor's position, this is equivalent to creditors spontaneously writing down the debt by a dollar. Thus, as above, debtors receive the direct gain of the debt reduction (33 cents) plus any attenuation in extraction inefficiencies borne by the debtor.

Creditors, on the other hand, receive the market price of 50 cents and in return effectively tear up a dollar of debt. We already know how costly forgiveness is to creditors. The direct effect is a cost of 33 cents, while the indirect effects — which contribute to a higher price of the debt after some is forgiven — are gains. If these indirect effects add up to a benefit of, say, 18 cents per dollar forgiven, the total cost of debt reduction is 33 – 18 = 15 cents, and the net gain to creditors of the one-dollar buyback is 50 – 15 = 35 cents.

Consider next how a buyback using externally donated funds divides up the money donated by the external institution. Let us focus first on the direct effects only, assuming for the time being that there are no inefficiencies associated with high debt levels. For each dollar spent on the buyback, 67 cents — the probability of full repayment divided by the market price, ⅓ / 50 cents — can be thought of as direct aid to the debtor. Since a one-dollar buyback retires two dollars of debt, it is as if the external party has agreed to give the country two dollars whenever the country repays in full. The remaining portion of the dollar spent on the buyback, or 33 cents, goes directly to creditors. They gain because the amount paid in partial-repayment states is divided up among fewer claims. This example is likely to be conservative about the share received by creditors. In many cases *creditors will receive a larger share of the direct benefits than debtors.*

To demonstrate, it is possible to use a little algebra to rewrite the country's share of the buyback money as

$$\left(1+\frac{(1-\pi)R}{\pi D}\right)^{-1},$$

where π is the probability of full repayment, R is the average amount paid in bad states, and D is the

total amount owed. The share the debtor gets depends positively on the probability of full repayment and negatively on the average amount paid in default states. If, for example, the country pays nothing in default states, it receives 100 percent of the buyback resources. Of course, the same is true if the probability of full repayment is equal to one, but in that case the secondary-market discount is zero.

The top panel of table 1 shows the share of the buyback monies that goes directly to the debtor, using alternative assumptions about the probability of full repayment (π) and the amount paid in default states (R/D). The bottom panel shows each scenario's implicit market prices. Note that with a large secondary-market discount of 50 percent, the gains to the debtor are very sensitive to π and R/D. If we believe that the probability of full repayment is rather low — for example, around 0.2 — a price of 50 cents implies that the expected payment in default states is about 35 cents on the dollar. Under such a scenario, the country will receive only 40 percent of the buyback resources; the remaining 60 percent will go directly to creditors. For many countries, both market prices and the probability of full payment are much lower. In those cases, an even smaller fraction of direct buyback monies would go to debtors.

Table 1 Fraction of externally funded buyback monies received directly by debtors

Probability of full repayment	*Average payment in default states as a fraction of total debtor obligations*				
	0.10	*0.20*	*0.33*	*0.50*	*0.67*
0.00	0.00	0.00	0.00	0.00	0.00
0.05	0.34	0.21	0.14	0.10	0.07
0.10	0.53	0.36	0.25	0.18	0.14
0.20	0.71	0.56	0.43	0.33	0.27
0.30	0.81	0.68	0.56	0.46	0.39
0.40	0.87	0.77	0.67	0.57	0.50
0.50	0.91	0.83	0.75	0.67	0.60
	Implied market price				
0.00	0.10	0.20	0.33	0.50	0.67
0.05	0.15	0.24	0.36	0.53	0.69
0.10	0.19	0.28	0.40	0.55	0.70
0.20	0.28	0.36	0.46	0.60	0.74
0.30	0.37	0.44	0.53	0.65	0.77
0.40	0.46	0.52	0.60	0.70	0.80
0.50	0.55	0.60	0.67	0.75	0.84

Source: Authors' calculations based on the equation on p.17.

So far, we have left extraction inefficiencies and disincentive effects out of the discussion. As before, these indirect gains raise the benefits of a one-dollar buyback to both the debtor and its creditors. The presence of these indirect effects makes it more difficult to do a computation like the one above, where we were able to determine unambiguously the fraction of buyback monies going to each party.

To see why such computations become ambiguous in the presence of indirect effects, suppose we observe a $10 billion debt repurchase financed by funds donated by the third party and that this buyback drives the price up from 50 to 55 cents. To allow the country to buy back the $10 billion in claims, then, the third party would need to donate $0.55 \times \$10 = \$5.5$ billion. The remaining expected payments are the price times the remaining face value of debt, $0.55 \times \$90 = \$49.5$ billion.

How should we measure the gains of the debtor and its creditors? First, note that creditors' gains can easily be computed as the difference between the initial market value of $50 billion and the sum of the remaining market value plus the cash, $5.5 + $49.5 = $55 billion. Creditors therefore gain $5 billion from the deal. This measure is dependable regardless of the presence or importance of the indirect gains from debt reduction. Creditors' gains can always be measured by the difference between the cash expenditure and the change in expected payments.

There is, however, no easy way to observe directly the debtor's gains from the transaction. In the simple case with no inefficiencies — a zero-sum game — debtors get whatever is left over from the computation above. Thus, since the third party put in $5.5 billion and creditors took $5 billion, the debtor was left with very little — just $0.5 billion. This is just equal to the change in the expected value of payments, $50 – $49.5 = $0.5 billion. Clearly, in this case buybacks will do little for the country. Indeed, if the country used its own (non-appropriable) funds for the buyback, it would practically be giving the resources away, for a net loss of $0.5 – $5 = –$4.5 billion. These computations, however, fail to be correct once there are inefficiencies present. The greater are the indirect effects, the more the change in expected payments understates debtor's benefits.

To see this, suppose that of the 5-cent increase in price, 2 cents came from an improvement in

country incentives, and another 2 cents from the drop in expected debt collection costs incurred by banks. Then the price increase due to the direct effect alone was 5 – 2 – 2 = 1 cent. These indirect sources of price increase are legitimate gains to creditors, but they are not costs to debtors. As we saw before, improvements in incentives neither help nor harm the debtor, and improved negotiating relations lower the costs of extracting resources without increasing the amount taken. Thus the only leakage from the initial $5.5 billion is the direct increase in the price times the debt outstanding, 0.01 × $90 = $0.9 billion. Thus, with inefficiencies present, our revised estimate of the country's gain from the buyback is $5.5 – $0.9 = $4.6 billion.

Even this computation understates the gain of the country, since it leaves out the reduced chances of costly penalties being imposed. (Recall that the deadweight costs to the debtor of any penalties imposed never enter the market price.) If these effects to the debtor are worth another 2 cents on the remaining debt, then the total debtor gain is $4.6 + $1.8 = $6.4 billion, more than the amount spent by the third party, $5.5 billion. In sum, the measured change in expected payments can substantially understate the debtor's gain from the buyback, and it should be interpreted as a lower bound on those gains in case of a buyback from externally donated funds.

A large buyback using externally donated funds

The foregoing analysis helps explain smaller buybacks, but may not convey the same message for a similar, but much larger, transaction. A second numerical example demonstrates how costly large buybacks using externally donated resources can actually be. Suppose again that the country owes $100 billion and, as earlier, has expected debt-service payments of ⅓ × $100 + ⅔ × $25 = $50 billion. Thus the initial secondary-market price of the debt is again 50 cents.

Suppose next that a third party is willing to spend enough to reduce the debt sufficiently so that the country can always pay in full. That means retiring $75 billion in debt. Although a buyback of three-quarters of the debt is much too large to imagine in practice, the example highlights how expensive buybacks are in comparison with other types of debt reduction. Assuming for the time being that there are no inefficiencies associated with the debt, we ask in sequence the following questions: What is the effect on the market price? What is the cost of the buyback to the third party? What is the effect on the welfare of the debtor and its creditors, respectively?

First, it is easy to understand what must happen to the market price. The buyback is so large that the remaining debt is certain to be fully repaid. If creditors are to relinquish their claims voluntarily, the market price must make them indifferent between holding onto their debts and retiring them through the buyback. The only price at which this will be true is one. The buyback must therefore take place at the higher secondary-market price of 100 percent of par.

Second is the amount to be donated. We know that the buyback takes place at a price of one, and that the third party's goal was to retire $75 billion in debt. Obviously the buyback must then cost the third party $75 billion.

Third is the benefit to the creditors. Note that their claims were originally worth $0.5 × 100 = $50 billion. They receive the buyback cash of $75 billion, and they retain $25 billion in claims for a total market value of $100 billion. Thus, of the $75 billion donated by the third party, the creditors received two-thirds of the total, $50 billion.

Finally, debtor benefits. The shortcut route for computing them is to measure the change in expected payments. Whereas the country was expected to pay $100 × 0.5 = $50 billion before the buyback, the expected payments drop to $25 billion afterwards — an expected savings of $25 billion. Recall from the discussion above, however, that the change in expected payments induced by the buyback will generally *not* be an appropriate measure of the debtor's benefit if there are indirect gains from the buyback. The generally correct way to compute these benefits is to note that with a probability of ⅓ the debtor is in the good state, where it saves $100 – $25 = $75 billion in debt service, an expected gain of ⅓ × $75 = $25 billion.

This simple example demonstrates two fairly general points about buybacks using externally donated funds. The first is that their voluntary nature makes them an expensive way of achieving debt reduction. The debt is retired at the post-buyback price, high because there are few post-repurchase claims among which to divide debt-service payments.

The second point is one that we have seen before: most of the gains from such buybacks are likely to go to creditors. Unless the distribution of payments is close to the extreme case in which creditors either

get repaid fully or get nothing at all, the debtor's direct gains from the buyback will be small.

Notice, using the same numerical example, that debtors received 67 percent of each dollar spent by the donor for a small buyback, but only 33 percent of the money spent on the large buyback. The implication is that bigger buybacks become progressively more expensive: the larger they are, the greater the share of the buyback funds garnered by creditors. From a policy perspective, this point is important because it suggests that small buybacks can be relatively beneficial to debtors even if large buybacks are a giveaway to creditors. The implication is that the larger the buyback, the more "below market" the buyback price will need to be if debtors are to retain a large share of the direct benefits, or the larger the indirect effects will need to be.

Of course, debtors may still enjoy additional large indirect gains from the debt reduction. The bad state in our example might also be associated with the imposition of trade sanctions on the country. If those sanctions cost the country an extra $10 billion, for example, then the debt reduction would save the country an additional expected $\frac{2}{3} \times \$10 = \$6.7$ billion.

The Bolivian buyback

In 1986 Bolivia began a series of negotiations with both donors and creditors, leading to an externally financed buyback in March 1988. Bolivia owed its commercial banks $670 million, debt valued by the market at $46.9 million on the eve of the buyback negotiations in September 1986.[15] In addition, Bolivia had accumulated some $300 million in interest arrears, some extinguished proportionally to the debt bought back.

In the buyback, $335 million of debt was retired, and banks waived their claims on the associated accumulated arrears at a price of 11 cents. In return, creditors received $36.9 million (most in cash). After the transaction, in March 1988, the remaining $335 million was valued at $38.5 million. Thus, the expenditure of $36.9 million by external authorities reduced Bolivia's expected payments by $46.9 – $38.5 = $8.4 million. Creditors' net gain was $36.9 – $8.4 = $28.5 million. Clearly, creditors received most, but certainly not all, of the direct benefits from the buyback. If we were sure that Bolivia's growth and adjustment incentives and the chances that penalties would be imposed were not affected by the debt reduction, we could conclude that the $8.4 million reduction in expected payments was the net gain to Bolivia from the buyback. But if these effects were present, this figure understates Bolivia's gain.

Suppose, for example, that on average across bad states, Bolivia would be able to pay $25 million, about half the expected value of payments. Assume that in the single best state, however, Bolivia could pay as much as $670 million, even though such a large payment would be extremely unlikely, with a very low probability of about 2 percent. Under these assumptions, and with the help of the market prices before and after the buyback, it is possible to compute that the buyback increased the probability of full repayment of the remaining $335 million in debt by about 1.5 percentage points.

How much of the $28.5 million benefit received by creditors is attributable to this rather small incentive effect? Recall that the increase in price due to incentives is given by

$$\frac{(1 - R_c/D)\, d\pi}{dD} = (1 - \$25/\$335) \times 0.015 = 1.39 \text{ percent.}$$

This price change is itself worth $0.0139 × $335 = $4.6 million to creditors. Thus, in the presence of incentive effects, creditors' direct gains from the Bolivian buyback were actually somewhat lower, $28.5 – $4.6 = $23.9 million. Since Bolivia's direct gains from the buyback were what was left over from the $36.9 million used to repurchase the debt, their gains are somewhat higher, $36.9 – $23.9 = $13.0 million. Thus, under this scenario Bolivia received about 33 cents for each dollar spent on the buyback. Clearly, the country would have been better off if it could have kept all of the money.[16] But if the question is whether Bolivia received any benefit at all, these calculations suggest yes.

5

Senior debt swaps

Suppose now that the debtor sells off a new set of debt securities — exit bonds — in return for outstanding bank debt. How does such a plan work, and what is the effect on market prices and on welfare?

The critical feature of such a debt swap is that the market accept the new securities as "senior" to the original bank debt: seniority means that any resource transfers that come out of the country go first to pay off the exit bonds and that the remaining bank debt obligations receive whatever is left over. To see why seniority is necessary for a swap to result in debt reduction, consider what would happen if the new debt were expected to be treated in the same way as the existing debt, throwing it into the same risk pool. The new debt would then sell at the same discount as the old debt, preventing any reduction in net debt. For example, suppose that debt sells at a discount of 50 percent. An issue of $10 billion in new debt would sell for $5 billion, which could then be used to repurchase $10 billion of old debt, but the overall debt burden would not be reduced.

There are obviously practical problems associated with the de jure creation of a new class of senior debt (see annex 2 for a discussion of some of the barriers). The syndication agreements covering existing debts include negative pledge clauses, which restrict the sale of more senior claims. Although difficult to obtain, unanimous waivers of these clauses are often required if the senior status of the new bonds is to be legally protected. Despite these difficulties, suppose that it is possible to establish credibly the seniority of a new debt instrument and that it can be sold in exchange for existing debt. We can then use our simple analytical setup to see how such a debt swap works.

Imagine that the country offers to sell $p/(1-p) = 0.5/(1-0.5) = \$1$ of a senior security, where p is the secondary-market price. Imagine also for the moment that there are no extraction inefficiencies or disincentive effects. To keep the example simple, assume that full payments on the new security are made with a probability of one. As a consequence, each dollar in face value of the new security will be riskless, and therefore worth one dollar. Because the market value of each dollar of original debt is only 50 cents, a dollar's worth of new debt will be swapped for a greater amount, $1/(1-p) = 2$ units, of original debt.

What is the gain from such a swap? Notice that by doing the swap, the country has issued some new debt but retired a greater amount of old debt. The net debt reduction is therefore just $1/(1-p) - p/(1-p) = \$1$ of old debt. By offering the senior security, the country has bought itself some debt reduction without using any cash. Once again, the security's senior status permits this kind of "bootstrap" debt reduction.

Look more closely at what happens to expected payments, with two parts, those on the senior bond plus those on the original bank debt. Suppose that the country issues one dollar of the new senior bond. The change in payments on the original debt

is as follows. In the good state the country can pay off all of its obligations. Since the swap has reduced the original debt by two dollars, payments in the good state fall by two dollars. But payments now also fall in bad states. Since the new claims are senior, the dollar needed to service new claims crowds out one dollar of payment on the original debt. The expected fall in payments on the old debt is then just the probability-weighted average across good and bad states: $\frac{1}{3} \times 2 + \frac{2}{3} \times 1 = \frac{4}{3}$. The senior bond's payments are simpler. Since that bond is riskless, the debtor is committed to repay one dollar in good as well as in bad states. Putting these two payment streams together, we have that the total change in expected payments is $-\frac{4}{3} + 1 = -\frac{1}{3}$.

This says that the debtor can reduce its expected payments by $\frac{1}{3}$ of a dollar — which is just the probability of landing in the good state — through a one-dollar offering of senior bonds. Notice that these savings have the same pattern across good and bad states as one dollar's worth of forgiveness from creditors. Generally, a successful issue of $p/(1-p)$ dollars' worth of senior bonds is exactly equivalent to forgiveness of one dollar of debt.

Senior bond issues can provide relief because, unlike externally financed buybacks, they lower the price of the existing debt. Note that after \$1 billion of an exit bond are swapped for a dollar of debt, \$98 = \$100 – \$2 billion is paid on the old debt in the good state, while \$24 = \$25 – \$1 is paid on average in bad states. The effect on the price of the original debt will be given by $(\frac{1}{3} \times \$98 + \frac{2}{3} \times \$24) / \$98 = 49.7$ cents. As more senior debt is issued (and old debt is retired) the price falls below the original level of 50 cents. Expected payments on the old debt are now $\$0.497 \times 98 = \$48.7$ billion. After including the extra billion dollars in senior debt payments, the country has gained through the swap (and creditors have lost) \$50 – \$48.7 – \$1 = \$0.3 billion. The price falls because the new claims have preferred access to payments in bad states, and so degrade the quality of the original debts.

Because this scheme expropriates some of the creditors' claims, why would they ever approve it? Recall that the presence of indirect effects tends to improve creditors' return from a buyback by raising the secondary-market price above what it otherwise would have been. If the inefficiencies due to the extraction technology and poor incentives are strong enough, both the debtor and its creditors can gain from a senior bond swap. Suppose in our example above that the market price, instead of falling from 50 to 49.7 cents, rises to 50.7 cents, as the efficiency of the bargaining process and the country's economy improve. After the swap, creditors expect to get \$1 billion from the senior bond and $\$0.507 \times \$98 = \$49.6$ billion from the remaining debt. Total expected payments now rise from \$50 to \$50.6 billion. Creditors therefore benefit by \$0.6 billion, whereas debtors still obtain debt relief worth \$0.3 billion. Note that if the indirect effects of the debt overhang are potent enough to turn the creditors' net position from a loss into a gain, the debtor must be on the back side of its debt Laffer curve.

At this point, one might object that if creditors could gain by forgiving some of the debt, they would already have done so. Pure debt reduction seems far more expeditious than the more complex engineering that goes into a senior bond issue. Such coordinated debt forgiveness can never be voluntary, however: rather than participate, each bank would prefer to have other banks do the forgiving. The free-rider problem will therefore prevent forgiveness, even when it is in the creditors' collective interest. Although senior bond offerings are equivalent to debt forgiveness, they might be undertaken voluntarily — especially when significant differences exist between banks — and therefore be a more practical way of getting off the back side of the debt Laffer curve.

A numerical example

Once again, it is useful to demonstrate the logic above for a larger exit bond issue, where the price changes are more exaggerated. To review, suppose that the country owes \$100 billion and that it can repay the entire obligation only in the good state, which occurs with a probability of $\frac{1}{3}$. In the bad state, which occurs with a probability of $\frac{2}{3}$, only \$25 billion is paid. Since the expected repayment is \$50 billion, the debt trades at 50 percent of par. Suppose also that there are no inefficiencies as a result of the debt.

Next assume that the country can credibly offer its creditors a senior bond in exchange for \$75 billion of the existing debt. The country must issue \$25 billion in exit bonds to accomplish this. To see why, notice first that this \$25 billion can be repaid in both states, so that the new debt trades for a price of one. What then must happen to the price of the existing debt? Once the exchange has been announced, creditors realize that if \$75 billion of old debt is traded in, each dollar of remaining debt will pay

one dollar in the good state and nothing in the bad state. In such a case, the price of the existing debt falls from ½ to ⅓. But this implies that the country's expected payment on the original $100 billion of debt drops from $50 to $33⅓ billion ($25 billion on new debt and ($100 – $75) / 3 + $0 = $8⅓ billion on old debt). The debt swap has expropriated $16 ⅔ billion from creditors and transferred it to the debtor. Note that all of the transfers occur in the good state, in which the debtor now expects to keep $50 billion. The exit bond offering therefore has the same effect on the payment stream as if creditors had simply forgiven $50 billion of debt.

Naturally, since this market-based scheme costs creditors $16 ⅔ billion, they would be unlikely to agree to it. But if debtor growth is sufficiently stimulated by the debt reduction, creditors need not lose. To see this, suppose that the probability of the good state rises to ½ from ⅓ as a result of the debt reduction. Then if creditors exchange $50 billion of old debt for the $25 billion in new securities, the remaining old debt would be worth ½. Indeed, ½ is the equilibrium price since the remaining old debt would pay off fully in the good state but would pay nothing in the now equiprobable bad state. Total creditor claims after the swap include $25 billion of senior bonds, plus $50 billion of old debt. The market value of these is $50 billion (= $25 + (½) $50 billion) — exactly the same as before the swap. Creditors, therefore, do not suffer from the exit bond issuance. If we made the debtor's incentive response slightly stronger, creditors would see the overall value of their claims increase through the senior debt swap. Similarly, if we added even a modest level of extraction inefficiencies, creditors would reap positive gains from the exchange.

Buybacks financed with senior loans

In the foregoing discussion, we assumed that a country could spontaneously create a new set of senior claims and sell them in return for existing debt. An identical situation occurs when a new creditor regarded as a senior lender lends money to the debtor for use in a buyback. In this case, old debt is retired and new debt created in the exact proportions described in the senior bond section above. All that is required to make this scheme work is that the new creditor be recognized by other creditors as a senior claimant. It is frequently argued, for example, that the traditional preferential treatment enjoyed by international institutions creates the presumption that obligations to them will be treated as senior. Creditors might reason that the country will make good on official obligations at the expense of other creditors: that is, that the new debt to the official sector would be senior de facto.

This issue is especially relevant under the Brady plan — where the official creditors provide the resources for buybacks or for credit-enhancements of exit bonds in return for a claim understood to be senior to those of the banks.

The Philippine 1990 debt buyback

The Philippines is one country that reached agreement in principle with its commercial banks and that received official support for debt and debt-service reduction. On October 12 the Governor of the Central Bank announced that the Philippines would offer to buy back $1.6 billion of its foreign commercial debt for $800 million, implying a price of 50 cents on the dollar. The announcement also stated that the Philippines expected to receive support from the World Bank, the IMF, and bilateral donors of about $710 million for the buyback. Banks were given three weeks to respond to the offer. Oversubscribed and completed in January 1990, the buyback reduced the number of Philippine creditor banks from 300 to 50. It was hoped that this smaller creditor group of banks with long-term interests in the Philippines would allow for better coordination in the future, allowing, for example, higher refinancing ratios.

Although the buyback reduced commercial debt by about 20 percent, it was achieved at a price (50 cents on the dollar) only slightly higher than the secondary-market price before the announcement and after the completion of the buyback (48 cents on the dollar). It seems two opposite effects were at play: reduced indebtedness pushed prices up, but the increase in senior debt pushed them down. There is also a third possibility: the market anticipated some form of buyback, so there was little change in price when the buyback was announced.

6

Self-financed buybacks

Senior bond issues are problematic in practice because debt repurchases using externally donated funds require a rich donor — an obstacle that may explain why a common market-based transaction remains a self-financed debt repurchase in which countries commit their own liquid resources.[17]

Before getting to the details of self-financed buybacks, there are three issues worth mentioning. The first concerns the importance of the source of buyback resources. Clearly, if a country spends a dollar on the buyback, the dollar could have come from its reserves or from a reduction in current consumption or investment. Since the country roughly equalizes its gain from the last dollar put into each of these, the source that generates the buyback resources is unimportant in principle. The value to the country of an extra dollar in reserves should not be much higher than an extra dollar in investment. If it were, the government would likely cut investment expenditures and build reserves. Thus, our analysis need not account for separate costs to the country of alternative sources of cash.

The second issue concerns how the countrywide shadow value of the buyback dollar is determined. Clearly, a highly illiquid debtor will find that each dollar in cash today is worth more to it than the same dollar (with accrued interest) tomorrow. Thus, the debtor may attach a "liquidity premium" to current resources, making the current "shadow" value of a dollar greater than the value placed on a dollar by creditors. Under such circumstances, self-financed buybacks are clearly less attractive to the debtor. The costs of the buyback are greater the more liquidity-constrained the country is. Indeed, a country sufficiently short of cash will always find a given self-financed market-based scheme harmful. Although the precise source of buyback resources is unimportant for the costs of the buyback, it does affect the benefits.

The third point concerns the "appropriability" of those resources: how much of the dollar used to buy back debt would have been paid to creditors anyway. Put differently, how much of a marginal change in a certain type of debtor resource can be appropriated by the creditors through greater second-period debt repayments? To show why appropriability is important, we consider two polar cases.

In the first polar case, suppose that the debtor reduces current consumption to finance the debt repurchase. Since resources consumed today cannot also be available for debt service tomorrow, this is the case of near-zero appropriability. Both the debtor's ability to pay and the creditors' power to extract resources in the future are independent of the repurchase, since future output remains unchanged. With no appropriability, a dollar spent on debt reduction will reduce payments only in states in which the debtor would have paid in full. Payments in all other states would remain unchanged. A low-appropriability buyback is therefore analogous to the externally financed buyback discussed earlier, leading to a reduction of π dollars —

where π is the probability of the good state — in expected debt service for each dollar spent on the buyback. Of course, in this case the debtor itself must generate the money for the buyback. If one dollar less of consumption, already likely to be at low levels, costs the country at least one dollar (there are no inefficiencies), the overall gain from the buyback is sure to be negative. In our example, $1/3 - 1 = -2/3 < 0$.

The other polar case is where appropriability is nearly complete, most likely for corporate debt restructuring. With corporate debt, bondholders already own a bankrupt firm's assets, so any cash sold off will reduce the firm's ability to pay remaining bondholders. An example of high appropriability in the sovereign debt case would be as follows. Suppose that the debtor currently holds reserves which in all states of the next period will go toward principal or interest repayment. The use of these reserves for a buyback clearly reduces the debtor's payments in every state, not just good ones. Analytically, a high-appropriability buyback is equivalent to a senior debt swap. By offering money to the highest bidder — money that would have been shared equally among creditors — bank debt becomes of poorer quality. All the country needs to do is to announce credibly such a buyback, and creditors' claims are diluted. As a consequence, the price of the debt tends to fall, rather than rise, with the buyback offer.

In the foregoing model, a one-dollar buyback will repurchase $1/p = 1/0.5 = \$2$ of debt. In good states, the country will pay two dollars less in order to fulfill its obligations fully. With complete appropriability, every dollar spent on the buyback in bad states will reduce payments by a dollar. Assuming that the country is not badly liquidity-constrained, its total return on the transaction is the cost of the dollar (–1), plus the gain in good states from retiring two dollars of debt ($1/3 \times 2$), plus the gain in bad states from the reduced ability to pay ($2/3 \times 1$); this comes to a total expected return of $-1 + 1/3 \times 2 + 2/3 \times 1 = 33$ cents. This buyback is therefore equivalent to a dollar in pure debt relief from creditors. As the previous section showed, it is also equivalent to a one-dollar senior debt swap. Of course, problem debtors will generally value a dollar in current cash more highly than will banks. As a consequence, completely appropriable self-financed buybacks will be inferior to pure debt reduction or a successful senior bond swap.

Typically, the appropriability of funds will be somewhere between these two examples. That is, the buyback will often reduce payments in bad states of nature, although not dollar for dollar. Expected debtor benefits will therefore lie between $1/3$ and $-2/3$ It is therefore possible, although by no means assured, that the debtor can gain from a self-financed buyback. The overall gain will depend on the severity of liquidity constraints and the appropriability of the buyback resources. Intuitively, it is straightforward to understand just how much appropriability is required if the debtor is to be just as well off before as after a self-financed repurchase. Since the buyback takes place at the average price of the debt, the buyback is a good idea only if the marginal value to the country of debt reduction is greater than or equal to the average price. Thus, the appropriability must be large enough to equate the country's marginal value of that debt with the market price.

The simple rule for the threshold of appropriability is that it be equal to the share of market value that comes from partial-repayment states. If most expected payments come from bad states (implied either by a low probability of full repayment or by a high average level of repayment in bad states), the marginal cost of the debt is substantially below the average cost, and a high degree of appropriability is needed to make up the difference. But if a more modest share of value comes from payments in bad states, the marginal cost of the debt is already close to the average cost, and only a small degree of appropriability is required to make the country just indifferent to the buyback. In sum, if the marginal reduction in bad-state payments is greater than the average bad-state payments for each dollar of debt retired, the buyback tends to lower the price of the debt — and therefore to benefit the debtor.

Note that at the threshold of appropriability, the equality of marginal and average cost implies that the buyback has no effect on the price of the remaining debt. Of course, if a country could buy up substantial amounts of debt at the current secondary-market price, it would be unlikely to lose, since it would be retiring each dollar of debt at its average value. If the price actually falls with the buyback, the country can buy up the debt at less than its initial average value. Clearly, if the debtor gains from high-appropriability buybacks, creditors lose (without inefficiencies) to the extent that the buyback lowers prices.

As in the senior bond swap, if there are indirect gains from the reduction of inefficiencies, both the debtor and its creditors can gain from a high-appropriability buyback. Exactly as before, extraction

inefficiencies and disincentive effects will tend to raise the repurchase price as the debt is reduced. If this effect is sufficient to offset the downward price pressure exerted by high appropriability, expected creditor receipts rise. Of course, as long as prices remain constant, creditors will be exactly as well off after the buyback as before.

Although domestically funded buybacks could help the debtor, several cautionary notes about such policies are in order. The first is that debtor illiquidity drives up the opportunity cost of consumption for any buyback program. For a cash-starved country, a better strategy would be to use highly appropriable assets to raise the living standards of its people, instead of its creditors. Illiquidity also implies that the shadow value to the country of a dollar of reserves is greater than one dollar. If reserves act as a buffer for financing imports, they allow a credit-constrained country to smooth consumption over time.[18] A third, more subtle, effect of illiquidity is that it may dampen the incentive-effect response to debt reduction. Imagine a country which is badly liquidity-constrained and barely able to provide a subsistence level of consumption. Debt reduction may improve incentives for investment markedly and yet little additional growth will occur: illiquidity may make the opportunity cost of funds rise so rapidly that it stunts an otherwise powerful investment response.

Two other points about self-financed buybacks are important. The first is that a variety of other schemes — the most prominent of which is a debt-equity swap — have an internally financed buyback component. In such schemes, investors may purchase debt on the secondary market and redeem it for domestic currency, which is then used for investment in the country. To the extent that these investments would have taken place anyway, even without the buyback program, the country is effectively using its own resources to fund the repurchase of debt on the secondary market. Since most investments under debt-equity swap programs do not appear to be "additional," most of these transactions are disguised buybacks, often at terms worse than the secondary-market price. e return to these swaps in greater detail in section 8 below.

Second, while both direct and disguised internally financed buybacks have become common practice, they cannot be an important solution to the debt problem. Debtors may not eventually — and in any case cannot currently — repay their debts. Large buyback programs using internally generated funds are therefore not realistic. Debtors currently able to afford large repurchases are unlikely to find their debts trading at substantial discounts.

The 1987 Mexican swap

In December 1987 Mexico initiated the first major debt swap scheme since the onset of the debt crisis. The new debt consisted of 20-year zero-coupon bonds, with the principal (but not the interest) collateralized by U.S. Treasury obligations that Mexico purchased with its foreign exchange reserves. Mexico was prepared to issue up to $10 billion of the new debt. With a secondary-market discount of roughly 50 percent, Mexico hoped that $20 billion or more of the old debt could be retired.

Of course, Mexico was hoping to induce the market to believe that the new debt was senior. Although it was not possible to obtain waivers to establish this de jure, Mexican officials attempted to suggest that the new bonds would be given de facto seniority. In particular, they claimed that the new bonds would be excused from any future restructuring agreements and that the loans exchanged for these bonds would be excluded from the base for any future requests for concerted lending.

The Mexican plan essentially packaged two transactions described earlier: a self-financed buyback plus a senior debt swap. If the Mexicans failed to persuade the market of the new bonds' seniority, the transaction would be a failure, just equivalent to a self-financed buyback of the principal amount out of Mexican reserves.

Indeed, this is what happened. At the then-current interest rate, the collateral was worth about 20 percent of the face value of the debt. With the existing Mexican debt selling for about 50 percent of its face value, a price above 20 + 50 = 70 cents would have indicated that the market accepted some of Mexico's promises for seniority. Of course, if the debt were fully senior, it would have sold for a price of almost a dollar.

For the $3.67 billion in bids that exceeded Mexico's minimum acceptable price, $2.56 billion of the new bonds were issued, backed by $492 million in collateral. When account is taken of the fact that the interest rate on the new bonds exceeded by a small margin that on rescheduled bank debt, the transaction turns out to have reduced the present value of Mexican obligations by almost exactly the same amount as would have been achieved by a straight

cash buyback using the same amount of resources.[19] The Mexicans failed to establish true seniority, and therefore their debt swap degenerated into a domestically financed buyback.

The major lesson of the Mexican experiment seems to be how difficult it is to establish seniority. This does not portend well for debtor-financed market-based schemes, because such schemes cannot get very far unless they involve the issue of new assets regarded by the market as senior to the existing debt.

Other countries have had some success in establishing credible claims of seniority. Brazil has consistently attempted to convince the market that it considers its bonds to be more senior than its commercial bank debt. Indeed, Brazil continued to service its new money bonds (issued as part of its 1988 rescheduling agreement) during its recent moratorium. As a result, in February 1990, these bonds were trading on the secondary market at a discount of 40 percent, while its general obligations were trading at a higher discount of 70 percent.

7

Enhanced securities

The terms of any involvement by creditor governments or multinational institutions will be largely determined by political as well as economic considerations. Rather than proposing to fund debt repurchases directly, many plans now envision that existing bank debt would be swapped (at a price set by the market) for new securities that carry partial enhancements. An example is a rolling guarantee, whereby a country sets up an escrow account for creditor banks to draw upon if the debtor does not fully meet its interest obligations for a specified period. Frequently, some or all of this money comes from a loan from an international financial institution (IFI).

The first important feature of enhanced securities is their similarity with the buybacks discussed earlier. Guarantees might at the outset appear more complex than the market-based schemes: buybacks provide new cash upfront, but most guarantee schemes release funds to creditors only conditionally on certain events. But if creditors are risk-neutral and the new securities are treated pari passu with the existing debt, these swaps are quite easy to understand. Indeed, under these conditions *they are equivalent to the externally funded buybacks discussed above.*

To see this equivalence, note that any equal-seniority security expected to increase creditors' receipts by one dollar (in present value terms) will repurchase an amount of debt equal to what a dollar in cash would buy. That is, externally funded buybacks and guaranteed-debt swaps are equivalent, as long as the *expected* resources contributed by third parties are equal. Of course, guaranteed securities usually are not advertised according to their expected cost. Instead, the guarantor stipulates a maximum amount that it will pay as well as the conditions under which the escrow funds may be drawn upon.

To judge the efficacy of an enhanced security, then, we first need to know what we will call its "commitment ratio," the expected new funds as a fraction of the stipulated maximum payment. For example, suppose an IFI says that it will lend Mexico 75 cents, and that this amount is then placed in an escrow account to guarantee up to 75 cents of interest payments. For now, assume that Mexico will pay back to the IFI only the undisbursed portion of the guarantee (later we consider what happens when Mexico must repay the entire 75-cent loan, regardless of how much of the guarantee is used). Next suppose that Mexico swaps a one-dollar issue of a new one-dollar Mexican security that carries a guarantee of up to 75 cents on interest payments. If the guarantee is limited to a short three-year period, or if it covers only the *first* $1 billion in each year's interest payments (an amount Mexico can pay in virtually all years), perhaps only 15 cents will be drawn from the guarantee pool on average. (Naturally, there is always the chance that the entire 75 cents is used, but most of the time Mexico is able to make far greater payments.)

Now suppose that Mexico offers this enhanced security to its creditors in exchange for existing

debt. Suppose, too, that there are no indirect gains from debt reduction. If the price of the old debt is 50 cents, the new security will be worth 50 + 15 = 65 cents, and will therefore retire 1 + 15/50 = $1.3 worth of old debt. This means that Mexico's net obligations to banks are reduced by 15/0.5 = 30 cents, which also would have been the case had the World Bank initiated a straight buyback with only 15 cents in cash. (Recall that at a 50-percent discount, 15 cents would retire 30 cents' worth of debt.) This guarantee scheme is, however, an inefficient way to retire debt. It delivers a commitment ratio of only 15/75 = 20 percent of the stated guarantee amount. That is, this one-dollar guarantee is equivalent to an externally financed buyback using 15 cents in cash.

In this example, we have assumed that the country draws down the guarantee funds as needed and that it repays to the IFI only the unused portion. In effect, the IFI is providing funds for an externally financed buyback; only the exact amount of funds to be released is not yet certain. As with the externally financed buyback, each dollar that is *expected* to be drawn out of escrow benefits the country by one dollar when the good state of the world is eventually reached. If a bad state is realized, the country pays all it can even without the guarantee — and therefore gains nothing. Thus, the country's benefit from a dollar's worth of expected guarantee spending is the same as its benefit from an externally financed buyback of one dollar: ⅔ of a dollar — just the probability of the good state, ⅓, times the amount of debt reduction of two dollars. As before, the remaining 33 cents of the guarantee liability go to benefit creditors.

What happens if this expected dipping into the escrow fund must also be paid back to the IFI, that is, if the country is expected to repay the entire IFI loan? If we suppose that the debt to the IFI is treated pari passu with existing debts, it is as though the IFI is lending at an expected loss: in return for one dollar of lending through the guarantee program, the IFI will get an expected promise to pay one dollar, currently valued by the market at 50 cents. The distribution of the remaining 50 cents between the debtor and its creditor banks depends on the commitment ratio.

Clearly, if the commitment ratio is zero (if there is no swap at all), there is no debt reduction, and the 50-cent loss of the IFI is distributed equally among the banks, with no gain to the debtor. If the ratio is ½, so that the new security offered by the debtor carries a guarantee valued at 50 cents, there is some debt reduction: one dollar of the enhanced security (worth 0.50 + 0.50 = $1) will be swapped for two dollars of old debt (also worth $2 × 0.5 = $1). From the debtor's point of view, bank debt has been reduced by 2 – 1 = $1, and IFI debt has been increased by one dollar, so there is no change in gross debt outstanding. However, the country retains the unused portion of the guarantee, or 50 cents. Since this amount is not paid to creditors in the good state, it provides a direct gain to the debtor of 50 × ⅓ = 17 cents.[20]

If the IFI loses 50 cents and the debtor gains only 17 cents, banks must receive the remaining 33 cents. Creditors receive a capital gain from the swap because, in bad states, they receive the 50 cents left over from the guarantee. The total direct gains then are 17 + 33 = 50 cents, just equal to the cost to the IFI of providing one dollar in a new loan. Note that these are exactly the results we would get if we thought of the enhanced-security swap as an externally financed buyback using 50 cents in cash.

Two things about guarantees have become clear from our discussion so far. First, if guaranteed securities are to be a major source of bank debt reduction, they must carry a very high commitment ratio. Of course, the higher the commitment ratio, the higher the price at which the existing debt is swapped: debt reduction through guarantee swaps is as expensive as through externally funded buybacks. Second, as we saw in the analysis of externally funded buybacks, the debtor receives benefits equal to only a fraction of the expected loss at which the IFI lends to the country. This expected loss may, in turn, be only a small fraction of the expected guarantee expenditure. The net result is that the debtor may gain very little from guarantees: the loss at which the IFI lends may mostly flow back to bank creditors.

It is possible to structure guarantees such that they do not give away so much to creditors. If the liability to the IFI is perceived to be senior to (rather than pari passu with) existing claims, the enhanced-security swap works just like a senior bond issue by the country, and not like a straight buyback. This means that by swapping into guaranteed claims the country moves back along its Laffer curve, just as though some of the initial debt had been forgiven.

To see this more clearly, suppose that the expected subsidy implied by the IFI's guarantee is $1 billion and that the debtor will give top priority to servicing any obligation to the IFI. The new, guaranteed security — for which the old debt is

swapped — is then junior to the expected obligations to the IFI, which (if assumed to be riskless) are worth $1 billion. With the $1 billion subsidy and a price of 50 cents on the old debt, $2 billion of bank debt is cancelled in the swap. From the debtor's point of view, there is a net debt reduction of $1 billion, and the debtor gains are therefore $⅓ billion. Because the IFI can expect to get paid in full on its senior claim, bank creditors must bear the entire cost of the $⅓ billion decline in expected debtor repayments.

It is not clear in practice that the traditional preferential treatment enjoyed by international institutions ensures that additional obligations to the IFIs will be effectively senior. It is possible that the market expects the IFIs to apply tougher conditionality when their own securities are in arrears than when payments lag on the original debt only. Creditors might reason that the country will therefore try harder to make good on IFI-debt payments: that the new debt would be de facto senior. In our extreme example above, it is literally costless for the IFI to lend to the country, since the IFI always gets repaid. In practice, there will be some expected costs to lending through enhancements, but these may nevertheless be diminished by the implicit seniority the IFIs seem to receive. Clearly, it is in the interest of both the country and the IFIs to emphasize to the banking community that IFI lending will be honored ahead of private claims.

In sum, guarantee securities may have a role in tailoring debt repayment schedules to fit debtor preferences more closely. They may also lead to somewhat better terms of exchange than a comparable externally financed buyback if the seniority of the IFIs' claims can be established.

8

Debt-for-equity swaps

Among all market-based debt-reduction methods, swaps of debt for equity have attracted the most attention and enthusiastic support.[21] We have postponed consideration of these swaps until this point, however, because they are complex transactions that are more difficult to unravel.

The basic idea of a debt-equity swap is that the holder of some debt is allowed to redeem the debt, perhaps at a discount, on the condition that the proceeds be used for direct investment in the country. A naive view, still held in some quarters, sees this as a transaction that simultaneously cancels some of the country's external obligations and generates a capital inflow. This is a misleading picture on both sides. The obligation has not been canceled through the swap — it has been exchanged for a different obligation. Moreover, there has been no capital inflow: any investment by the firm that makes the swap is in effect being financed by the country's domestic savings, not by externally supplied resources.

The potential benefits of a debt-equity swap are generally more limited than some of the transactions discussed earlier. First, it is possible, though not certain, that the present value of the stream of repatriated earnings from the direct investment financed by a debt-equity swap will be less than that on the original debt. Second, to the extent that the repatriated earnings come later than the debt service on the original claim, the country may find its current liquidity situation improved. Third, the public sector may be faced with short-run monetary and fiscal pressures as a result of the swap. These potential benefits may be realized in practice. A reduction of net external obligations is possible from a debt-equity swap, just as it is from a bond swap. But the same caveat applies: the new asset must be regarded as senior to the old. The dividend stream flowing from the equity must not just displace some debt service on the commercial debt — it must come ahead of the remaining debt-service requirements. If, in bad states of nature, the country taxes private firms very heavily to continue debt service, private equity may effectively be junior — not senior — to public debt. The point is that there should be no general presumption that debt-equity swaps, simply by transforming the nature of the security, can actually reduce net obligations to the rest of the world.

The argument that debt-equity swaps lead to short-run liquidity gains may be more defensible, but two related problems may offset such liquidity gains: "round-tripping" and "additionality." Round-tripping occurs when a firm that engages in a debt-equity swap finds a way to take an equivalent amount of capital out of the debtor country again. In this case the supposed swap degenerates into a cash buyback financed by the debtor (probably at less favorable terms than the straightforward buyback transaction), and additional capital flight. Additionality becomes a problem if a debt-equity swap finances an investment that would have taken place in any case. Again, the swap has degenerated into a cash buy-

back. Careful screening and monitoring of debt-equity swap programs can, if feasible, limit the extent to which both round-tripping and lack of additionality undermine their stated purpose. But this also limits the potential for debt-equity programs to become a major source of debt reduction.

The case of Chile

Since mid-1985 Chile has aggressively pursued debt reduction through debt-for-equity and debt-for-cash swaps. This policy is primarily responsible for the 50-percent reduction — more than $6 billion — in Chilean medium- and long-term private debt held by commercial banks. For Chile, unlike other countries, these swaps have had a major impact on the composition of external liabilities.

The major formal debt-reduction schemes are spelled out under chapters 18 and 19 of the Chilean Law of International Exchanges. Chapter 18 outlines acceptable debt repurchases by Chilean nationals. Under it, nationals purchase Chilean debt held by commercial banks on the secondary market, and then redeem it for pesos from the central bank.[22] Under annexes 4 and 5 of chapter 18, residents can ask the central bank to retire the debt and equity commitments of certain local companies and household mortgage debts, respectively. By mid-1988, $2.1 billion of external debt had been extinguished under chapter 18 and annexes 4 and 5. In addition, individual firms frequently repurchase their external debt obligations directly from commercial banks, without involving the central bank. While this practice is not fully legal, the authorities have done little to prevent it, and by mid-1988 approximately $2.0 billion of external debt had been retired.

It should be immediately clear that these schemes are, at best, as good for the country as the self-financed buybacks discussed above. Recall that nationals' alternative to participating in these schemes is direct repayment of debts or mortgages at a discount. If they are to participate, the government must be willing to give them a somewhat better deal, so any external debt reduction must cost the government somewhat more than a cash purchase by the government itself.[23]

Chile also allows foreigners to swap external debt for equity in Chile under chapter 19 and the D.L. 600 program. These programs have accounted for only about half as much commercial bank debt reduction as swaps initiated by nationals. By mid-1988 another $2.1 billion of external debt had been retired through these programs. Since it is not possible to remit profits outside Chile for four years following the swap, these transactions are likely to have thus far reduced Chile's total service payments on external obligations. In the next few years, however, foreign investors will begin to repatriate the proceeds from these investments. Only then will it become clear whether Chile's strategy of transforming bank debt into other types of liabilities has been a success.[24]

Informal conversions in Brazil

We have treated problem debts as though they are the obligations of a country. In practice, many of the outstanding claims are obligations of private companies, at least originally. Because of distortionary taxation in debtor countries, the incentive for governments to buy back debt can be quite different from the incentive of private companies. Brazil shows how these incentives may diverge.

At the beginning of 1988, Brazil had a sizable amount of unmatured debt owed by Brazilian private sector companies to external creditors. At that time, the Brazilian authorities required private borrowers of external funds to repay to the central bank the cruzado equivalent of the principal due on maturing foreign debt. Even though some of these borrowers were themselves excellent credit risks, their debts nevertheless traded at a substantial discount in the New York market, reflecting the uncertainty over whether the central bank would in turn relay the funds to external creditors. By early 1988, Brazil's moratorium on debt service had raised the discount on Brazilian debt in the secondary markets to more than 50 percent. Healthy companies naturally preferred to buy back their debts at the 50-percent discount rather than pay in full to the central bank. This method of taxing successful enterprises created profit opportunities for firms and their financial intermediaries that could arrange informal operations to repurchase their discounted debts before the central bank requested payment.

Such informal repurchases require that the debtor obtain hard currency, and the only way to do this in countries such as Brazil is through the (illegal) foreign exchange black market. During 1988 the premium of the parallel exchange rate over the official rate — at which foreign debt is serviced to the central bank — was about 30 percent. The borrower could then gain by repurchasing its debt from foreign creditors at any discount larger than

30 percent. The creditor could also gain if it settled its claim before maturity at any price above 50 cents on the dollar, the prevailing secondary-market price of central bank obligations. This trading opportunity gave rise to an estimated $5 billion of debt repurchases in 1988, extinguishing most of the private debt before it reached the central bank, and producing a huge gain to São Paolo's financial institutions. The swap business attracted many new intermediaries, some drawn from the highest offices in government.

The difference between the two reservation prices — about 20 cents — had to be shared among the intermediaries that organized the transactions, the borrower, and the lender. How were the gains divided? The market has not been very transparent, in part because of the unlawfulness of most operations, but it appears that the largest share was appropriated by the foreign banks. At first the intermediaries may have earned high fees, but these were competed away as more institutions entered. Unmatured private debt was soon trading in New York at only about a 30-percent discount, even while the debt already deposited at the central bank was trading at about 50 cents. Foreign banks therefore captured most of the gain.

There are two ways to interpret this kind of informal swap. The first is that the Brazilian government's need for external liquidity was great enough to justify the central bank's being unwilling to spend money directly on debt repurchases, even at a 50-percent discount. In that light, such informal repurchases are simply a form of tax evasion. The second, more cynical view is that the central bank was effectively able to run interference for the Brazilian private sector. By playing "tough" in its apparent willingness to repay debt, the central bank lowered secondary-market prices and then allowed firms to repurchase their debts at deep discounts. Under this view, the central bank could not itself repurchase debt (even ignoring the legal problems) at such a low price, for that would have revealed a conciliatory posture, leading to higher secondary-market prices. Of course, once foreign banks caught onto this game and the price of unmatured private claims rose, the central bank's policy transferred the would-be tax revenues to foreign creditor banks.

9

Sovereign debt inefficiencies: an empirical assessment

A simple conclusion about the advisability of market-based schemes emerges from the details of our discussion. Debtors are likely to get only a small fraction of the overall benefits unless the inefficiencies generated by the debt are large, or unless the market-based scheme successfully involves a swap of debt for a more senior claim. Short of this, only coercive schemes that punish free-riders can hope to keep the price of existing debt from rising rapidly as more is retired.

This leaves us with two critical issues, one practical and one empirical. The practical issue is whether senior claims or coercive restructurings can be engineered without any free-riding. Although the economics are by now transparent, no one — not even the lawyers — can say definitively whether such restructurings can in many cases be accomplished. More straightforward is the empirical issue: whether it is in creditors' best interest to object to such schemes. Creditors' preferences will depend on the entire range of outcomes to the debt crisis. But as a first step it is sensible to evaluate creditors' welfare against the benchmark of the status quo: that is, what the debt is worth to them today, without any debt reduction or externally financed bailouts.

In that case the empirical issue is really whether many countries are on the back side of their debt Laffer curves. If not, then even if the practical obstacles to senior swaps can be overcome, creditors will be unlikely to participate unless substantial external funds become available or unless they are threatened with punitive measures by their regulating institutions. If so, creditors will gain (or at least lose little) from debt reduction, even without new nonappropriable resources becoming available. We thus turn to estimate debt-relief Laffer curves.

Empirical evidence on the debt Laffer curve

There have been several attempts to measure empirically the debt Laffer curve. The early estimates by Claessens (1988) and Purcell and Orlanski (1988) provided little evidence in favor of the hypothesis that the market value of loans tended to decrease with increases in debt. These estimates suggested that Laffer curves peak at relatively high levels of debt, so only a few countries were on the curve's back side. However, as the authors were aware, the Laffer curve's humped shape makes estimates sensitive to the precise functional form that the regression tries to fit. After examining a number of functional forms in annex 3, we selected the logistic equation:

$$ln\left(\frac{p_{it}}{1-p_{it}}\right) = \alpha - \beta\, ln(D/X)_{it} + \tau\, Y_{it} + \varepsilon_{it}, \qquad (1)$$

where p is the secondary-market price of the it country, D/X is the debt-export ratio, and Y is a set

of other regressors (such as measures of arrearages and reschedulings).[25]

We estimated a version of equation (1), dropping all independent variables besides the debt-export ratio. The rationale for doing this is that other variables commonly included on the right-hand side, such as arrearages or recent GNP growth, may also be influenced by the level of external debt. One concern with such an approach is that countries which borrowed more were allowed to do so precisely because they are more creditworthy. In that case, since we do not condition our estimates on prior creditworthiness, our estimate of β will be biased downward. In spite of this, our estimates of equation (1) on a cross-section of 35 countries were $\alpha = 7.88$ and $\beta = 1.41$. The estimate of β is statistically greater than one at the 10-percent level of significance. This implies that the Laffer curve does indeed bend backward, at high enough levels of debt to exports. Figure 3 shows the curve fit by estimating equation (1).

Two methods of computing elasticities give different implications about which countries are on the back side of their Laffer curves (see annex 3). The first places any country for which price is very low or the debt-export ratio is very high on the back side of the curve. Thus, Argentina, Bolivia, Nicaragua, Madagascar, Sudan, Zambia, Peru, Liberia, Costa Rica, Honduras, Zaire, Panama, Nigeria, Jamaica, and the Dominican Republic are all on the back side of the curve.

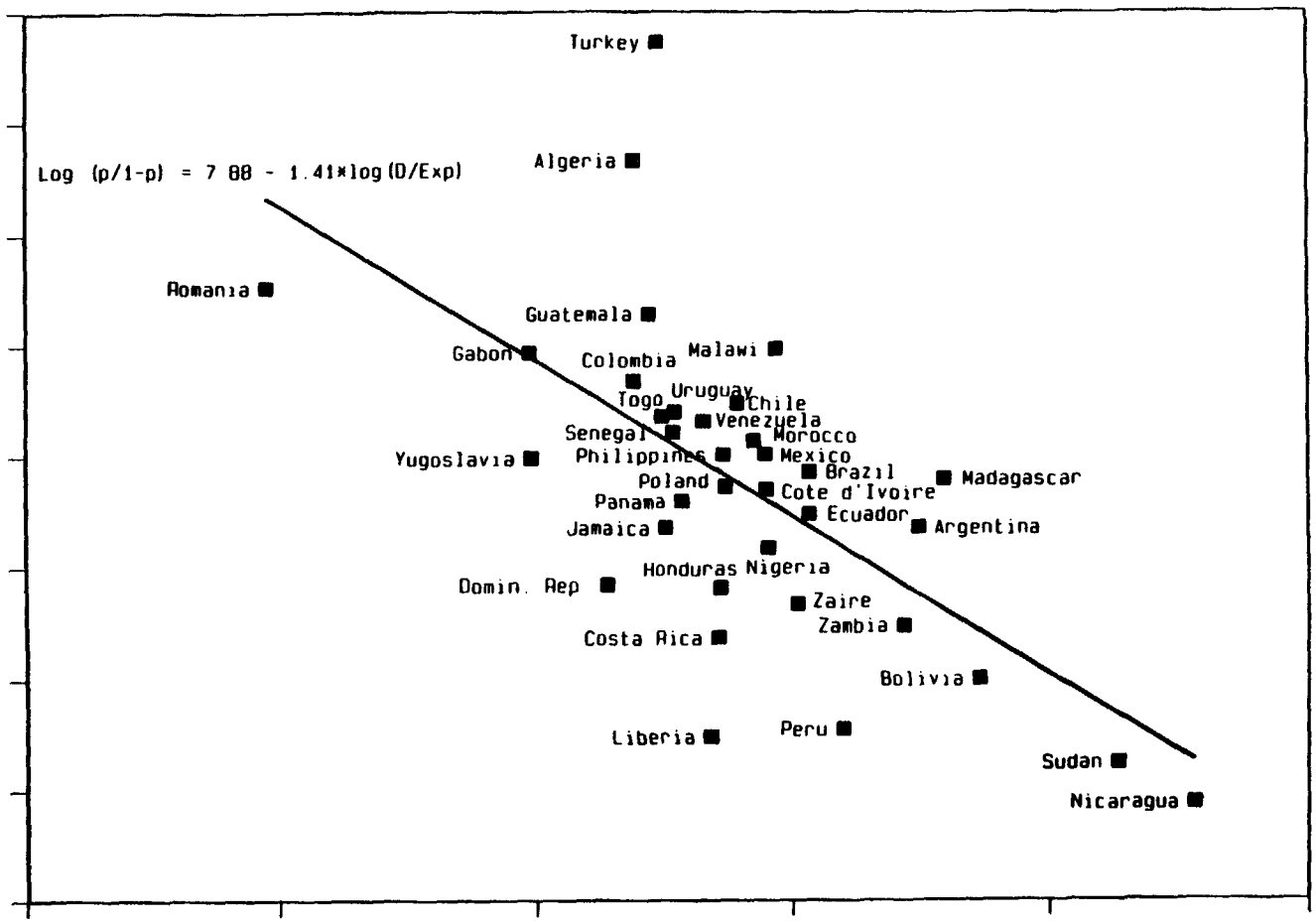
The alternative method places countries on the back side of the curve only if they have sufficiently high levels of debt to exports (D/X). This method leads to an estimate of the value of D/X at which the debt Laffer curve peaks of 490 percent. Only a few countries have debt-export ratios higher than this: Argentina, Bolivia, Nicaragua, Madagascar, Sudan, and Zambia. These are the only countries that the estimates suggest are on the back side of the Laffer curve. Debt reduction can therefore raise the value of bank claims only in extremely indebted countries.

Figure 4 plots the Laffer curve corresponding to the estimate for equation (1). Most striking in figure 4 is that the estimated Laffer curve does not turn down quickly. This indicates two things. First, the curve becomes flat at relatively low levels of D/X, which are clearly serviceable in at least some states of the world. This means that extraction inefficiencies and incentive effects are likely to have an important effect on price — and that their effect starts at fairly unsensational levels of debt. Second, the flat curve indicates that it would be a mistake to overemphasize the question of whether the Laffer curve does eventually bend back. Even if creditors don't make money directly by forgiving some of the debt, the estimated curve indicates that a relatively small pecuniary inducement by a third party tied to debt reduction will be enough for creditors to gain. That is, a small externally funded buyback combined with a relatively large senior bond swap will leave creditors better off. The flatness of the curve therefore indicates that a little official money can be leveraged to provide a large amount of debt reduction, even within a voluntary framework and especially in a concerted framework.

To see this more clearly, take Ecuador, which has a D/X of 4.3, well below the critical debt-export level of 5.2. Yet our estimates indicate that a 50-percent debt reduction — equivalent to 2.1 times exports — would cost creditors only 23 percent of exports. Since Ecuador owes about $10 billion, pure debt reduction of $5 billion would lower expected payments by only about $(0.23/2.1) \times \$5$ billion = $550 million. Thus, an externally funded payment of $550 million tied to 50-percent debt reduction through a concerted mechanism will leave creditors just as well off as if nothing had been done. To compare this with the cost of a standard externally funded buyback of 50 percent of Ecuador's debt, a little arithmetic shows the foregoing model to predict that the price of Ecuador's debt after a 50-percent reduction would be 58 cents. An externally funded buyback would therefore have cost $\$0.58 \times 5 = \$2.9$ billion, more than five times as much.

The implications of this kind of calculation are very important for problem debtors as a group. For example, take the 17 highly indebted countries (HICs). Their combined debts are approximately $528 billion, with about $290 billion owed to commercial banks. Exports of these countries are $147 billion annually, leading to a debt-export ratio of 357 percent. The average market price of these claims is around 40 cents, very close to the 39.8 cents predicted by the model. Consider a large debt reduction of $200 billion. This would eliminate more than ⅔ of the exposure faced by banks. The model shows that if $200 billion were forgiven, the price on the HICs' debt would rise from 40 to about 56 cents. Pure debt forgiveness of $200 billion in HICs' debt would therefore cost banks only about $25 billion ($\$528 \times 0.56 - \$328 \times 0.40$). This amount is less than the $25 billion that the World Bank and the IMF have already been authorized to spend on

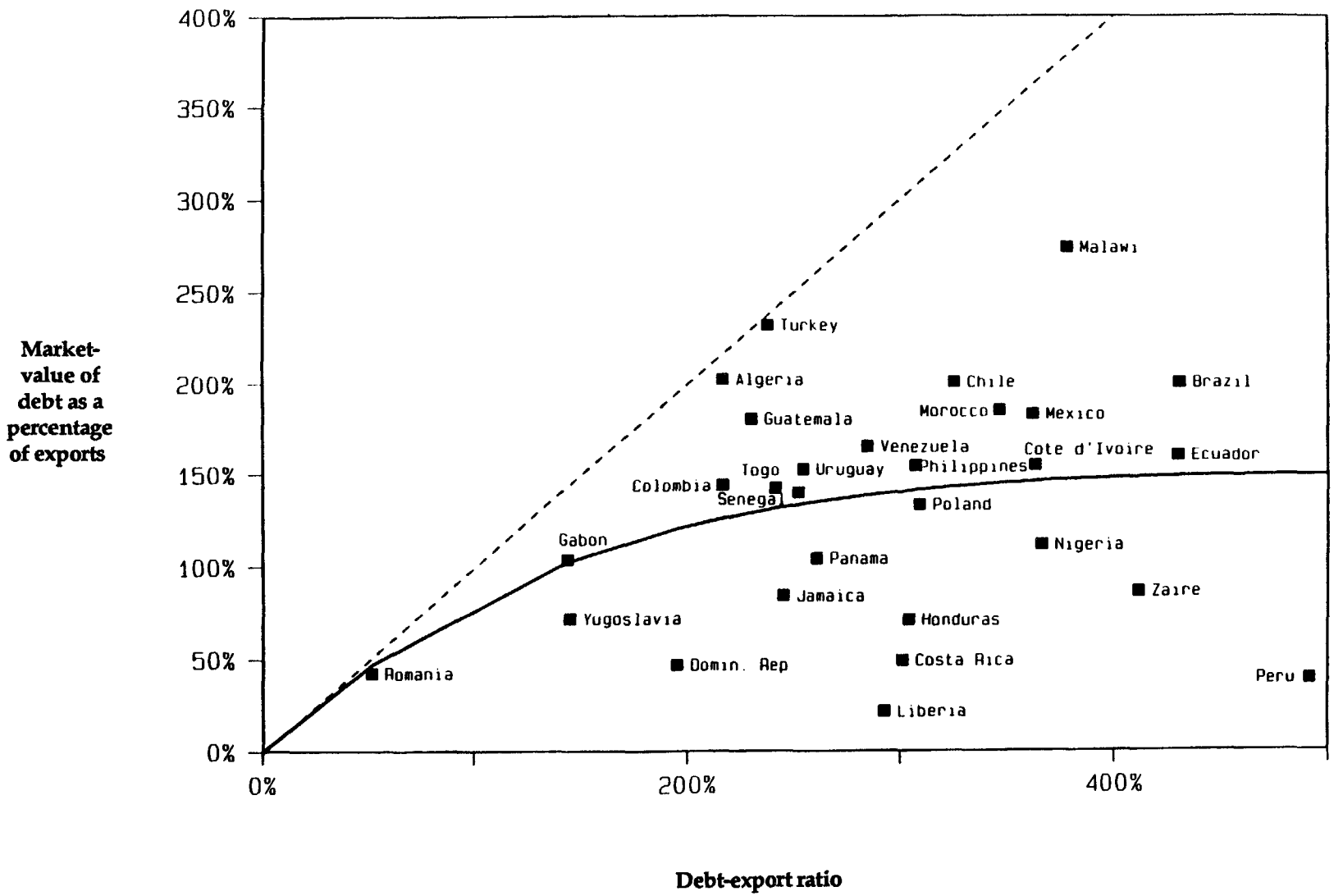
Figure 3
Estimates of logistic equation



Logistic of secondary-market price

Log of debt-export ratio

Figure 4
The debt Laffer curve

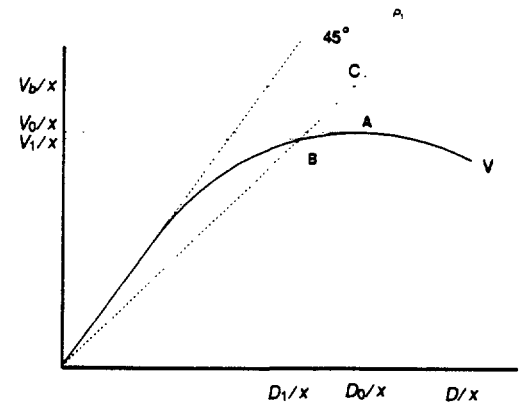


debt reduction. It is also far less than that required for a market-based buyback of the same amount of debt. Such a buyback would cost $\$0.56 \times 200 = \$113$ billion, or 4.5 times as much. Clearly, there is much room for negotiating the price that banks will accept, especially in a concerted framework.

Figure 5 shows graphically why the market-based debt repurchase is so much more expensive than direct compensation for write-downs. The debt Laffer curve is given by the V/X curve. Suppose that we are initially at point A, where the initial level of debt and market value are D_0/X and V_0/X, respectively. Debt reduction to D_1/X brings us to point B, where the market value of the claims is V_1/X. To agree to such a reduction in debt, creditors would clearly need to be compensated by the amount $V_0 - V_1$.

Now consider the value of the claims to creditors if the same amount of debt is repurchased on the market. Recall that the buyback must take place at the price of the debt immediately after the debt is reduced, represented by a line from the origin through point B, marked P_1. This price is higher than the price at point A but still less than one. If creditors place a value of P_1 on their debts, and initially hold D_o, their value is given by point C, at the buyback level V_b. This value is clearly much greater than V_o. Because the debt Laffer curve is relatively flat, the difference $V_0 - V_1$ is much smaller than the amount $V_o - V_b$: creditors would profit handsomely from a market-based scheme, yet lose relatively little from a coordinated debt reduction. The flatter the debt Laffer curve, the less expensive is reducing debt while maintaining the value of creditors' claims.

Figure 5
Market-based debt reduction vs. pure debt forgiveness



10

Issues in debt reduction

Our empirical results suggest that heavily indebted countries generally lie on a relatively flat portion of their debt Laffer curves. This has two main implications for policy.

The first implication is that debt reduction looks like an attractive policy. Since the marginal value of debt is low if not actually negative, quite large reductions in debt, with potentially significant effects on the future prospects of the debtor countries, would have only small financial costs to the creditors. But the flatness of the curve argues against relying on purely voluntary schemes, such as buybacks on the secondary market, to implement debt reduction. Because the marginal value of debt is low relative to its average value, a buyback of debt will sharply raise the market price of the remaining debt, thus conveying much of the benefit to creditors rather than to the country — and making large-scale debt reduction prohibitively expensive.

The potential costs of a simple buyback strategy were signaled by the events following the announcement of the Brady plan. In the four weeks after the March 10, 1989 announcement, the market value of seven major debtors whose debt was up for renegotiation in the near future increased by 31 percent, or nearly $23 billion in market value. This increase presumably reflected creditors' belief that external funds would be assembled for debt repurchases.

Since the external resources for debt reduction are limited and the objective of the reduction is to benefit countries rather than banks, there is a compelling case for "nonvoluntary" debt reduction — that is, for concerted schemes in which all creditors are compelled to participate and external resources are offered as a compensation rather than as an inducement. As we pointed out in the example in the previous section, the minimum necessary compensation to leave creditors no worse off than before the debt reduction should be much less than the market value of the forgiven debt.

In practice, debt-reduction schemes will not be quite so simple, for two reasons. First, there will typically be some nonparticipating creditors, who will be able to some extent to free-ride on the debt reduction. Second, participating creditors will not be a completely homogeneous group. Differences among creditors may make it desirable to allow creditors to choose among several options within an overall debt-reduction scheme. If differences among creditors are important, such a "limited menu" approach can improve substantially on take-it-or-leave-it debt reduction.

The problem of nonparticipating creditors

Most schemes for debt reduction apply only to creditors who have already been part of the rescheduling and concerted lending process: commercial banks holding long-term claims. A significant share of debt is, however, held by other creditors. In the 1989 Mexican debt-reduction package, for example, only $52.7 billion of an initial debt

of $107 billion was covered. Short-term debt, bonds, and (most important) official claims were not part of the negotiation.

The presence of nonparticipating creditors introduces a serious free-rider problem even when participating creditors act in a concerted fashion: part of the gains from reduced debt accrue as capital gains to the nonparticipants. A hypothetical example can make the point. Imagine a country that has $100 billion in debt, with an initial average value of 0.4, but a marginal value of only 0.10. Now suppose that we seek to reduce the outstanding debt by $10 billion. If all creditors could be brought into a collective deal, they could be compensated for the reduction in nominal claims with $1 billion in "enhancements." The reason is that the apparent loss of claims with a market value of $4 billion is partially compensated for by a capital gain of $3.0 billion on the remaining $90 billion in debt.

But now suppose that half the initial claims were held by parties who do not participate in the debt-reduction package. Then 5/9 of the capital gain will accrue to these free-riders, leaving only 4/9 — approximately $1.3 billion — for the participants. The result will be that the enhancements needed to finance a $10 billion debt reduction will be 4 – 1.3 = $2.7 billion, rather than the $1.0 billion we started with.

The presence of large blocks of nonparticipating creditors raises the cost in enhancements of any given debt reduction — or limits the size of debt reduction possible for any given volume of official resources. It is important to note, however, that much of the nonparticipating debt is held by official creditors — multilateral agencies and creditor-country governments. These are effectively the same parties supplying the resources for debt reduction! Thus the apparent increase in the cost of debt reduction is partly illusory, with liabilities of creditor-country taxpayers simply shifted from one account to another. The basic point that the flatness of the debt Laffer curve makes debt reduction inexpensive from the point of view of taxpayers in the creditor countries is unaffected.

Differences among creditors and the menu approach

Our basic discussion assumes that creditors are interested only in maximizing the expected value of their loan portfolio. Private claims on problem debtors are, however, overwhelmingly held by commercial banks. These banks benefit from explicit or implicit insurance of their deposits, but are subject to regulation. Both insurance and regulation may distort the banks' incentives. Furthermore, since regulation differs across countries and since its impact depends on the state of a bank's balance sheet, banks may have different incentives and prefer different options for debt reduction.

Deposit insurance biases the incentives of banks with thin capitalization and large holdings of risky debt. The reason is that there is a significant probability that these banks will go bankrupt, with depositors paid off by the insuring authority. The stockholders of these banks thus have reduced incentives to agree to schemes that improve payoffs in unfavorable states at the expense of payoffs in favorable states, even if there is a net gain, since the benefits accrue to the insurer rather than the bank. For banks with large holdings of developing country debt, this distortion provides an incentive to avoid debt reduction, which reduces the most that they can receive while increasing the payoff in other states.

Minimum capitalization requirements also bias banks against debt reduction, since such reduction may force banks to reduce the nominal value of their assets and hence the book value of their capital. Since bank stockholders normally prefer to avoid raising new capital, this creates a preference for debt management that avoids explicit forgiveness.

The important point for attempts to produce debt reduction in practice is that banks may differ in the extent to which these biases apply, depending on their home jurisdictions and on the condition of their balance sheets. As a result, somewhat better terms may in principle be extracted from a debt-reduction strategy that allows banks to choose from a menu of options. Annex 4 presents an example of how differences among banks cause them to attach different values to problem debts.

In the largest debt-reduction package offered under the Brady Plan to date — that of Mexico — banks were in effect given a choice between reducing their claims or extending new money, and banks that chose forgiveness were compensated with some "enhancements." The details of the Mexican scheme and its results will be reviewed below. Initially, however, it may be useful to consider a simplified version of that scheme — to make a crucial point. If banks are not very different, the contribution of the menu approach to debt reduction will be only marginal. In this case, debt

reduction achievable with a given amount of external resources will, as a first approximation, not be changed by an arrangement under which some banks provide new money in lieu of reducing their claims.

A numerical example: debt reduction with a "menu approach"

Consider again a country with an initial debt of $100 billion, of which $50 billion are held by non-participating creditors. The initial secondary price of the debt is 0.4, with a marginal value of 0.10 — that is, the country is not on the backward slope of the Laffer curve, but the curve is quite flat in the relevant region. Suppose as a first approximation that all creditors are simply value-maximizers. That is, assume away any differences that would make a menu approach productive. Nonetheless, a debt-reduction scheme is introduced that offers creditors a choice between debt reduction and new money. The specific form of this scheme is the following: each creditor has the option of selling off its claims at the initial secondary price of 0.4, or of providing new money in some proportion to the original claim. The objective of this scheme is to produce a reduction in the net debt (inclusive of new money) of $10 billion. How will the scheme work, and what will it cost?

First notice that creditors must be indifferent between selling off their claims at 0.4 or offering new money. A creditor that does not sell off its claims benefits from the debt reduction, which raises the secondary price of its holdings, but the new money is lent at an expected loss. The amount of new money that can be demanded from creditors who choose not to sell out is therefore set at a level where the expected losses just match the capital gains.

But the rise in the secondary price can be calculated from the overall debt reduction. Debt is assumed to fall from $100 billion to $90 billion. Given a marginal value of debt of 0.10, the expected payments on debt fall from 40 to 39, and thus the secondary price of debt rises from 0.4 to $^{39}/_{90}$ = 0.433. Each dollar of new money is lent at an expected loss of (1 – 0.433), so new-money creditors can be induced to lend (0.433 – 0.4) / (1 – 0.433) = $0.058 per dollar of initial claims. It is now straightforward to work out what must happen. In this example, creditors holding claims of $12.2 billion sell out at the price of 0.4; the cost of this buyout is $4.88 billion. The creditors holding the remaining $37.8 billion in claims, however, can be induced to provide 40 – 37.8 = $2.2 billion in new money, which is available to help in the buyout. The required size of external resources is therefore 4.88 – 2.20 = $2.68 billion.[26]

This is exactly the sum that we argued (in section 10) was necessary to compensate creditors if they were not to lose from a pure concerted debt reduction. On reflection, this should not be surprising: by requiring creditors either to sell out at the initial secondary price, or do something that is equally painful, one is in effect forcing them to offer a debt reduction in which all the benefits go to the country.

Now one might hope that by offering banks a menu one could do a little better than this. Specifically, one could demand somewhat more new money from banks that do not choose debt reduction, hoping to take advantage of the desire of some banks to avoid realizing losses. As we will see shortly, however, the results of the Mexican agreement do not suggest that this is a major consideration.[27]

The important point, then, is that offering creditors a menu— while making the mechanics of concerted debt reduction more complicated — does not significantly change the arithmetic of how much external funding is needed to achieve a given debt reduction.

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An application: the Mexican debt reduction

In 1989 Mexico and its creditors reached an agreement on a debt-restructuring package. The package covered only medium- and long-term commercial bank claims — $52.7 billion of a total debt estimated at $107 billion. This limited coverage is crucial in understanding the deal: while the debt reduction was concerted among the participants, more than half the creditors were free-riders.

Participating creditors were offered the choice of three options:

(1) Exchange of claims for a 30-year bond with a principal of only 65 percent of the original debt;
(2) Exchange of claims for a bond at par value but paying only a reduced interest rate;
(3) A commitment to provide new money, in an amount equal to 25 percent of the original claim.

The principal of both bonds was guaranteed through collateralization of a 30-year zero-coupon bond. In addition, escrow accounts were established to guarantee, on a rolling basis, the first 18-24 months of interest payments. The agreement also included a recapture clause that would enable creditors to share in the revenue increase if oil prices were to rise above specified levels after 1997, as well as several other clauses.

The key legal aspect of the deal was a paragraph stating that the conversion of the base debt into new instruments would explicitly constitute a new contract (a "novation"). This was taken to imply that the new contracts would no longer be subject to the sharing clauses, and in effect meant that banks that refused to participate would not be able to demand payment.

Most calculations (including our own) suggest that the new-money option was clearly inferior to the two bond options, and indeed the new-money option was taken by only a small fraction of creditors. In essence, therefore, the Mexican deal should be viewed as a concerted debt reduction, in which creditors were offered enhancements to offset their reduced nominal claims.

The key question in evaluating the deal is therefore whether the price was right. How much of the expenditure of resources by governments went to benefit the country, and how much to benefit private creditors?

Several factors make evaluating the Mexican deal difficult. First, there is still some confusion over the numbers. Second, the mix of options complicates calculation. Third, the nature of the enhancements makes it difficult to put a precise dollar value on them.

Here we make an effort to cut through these problems by following a somewhat different approach from other studies — evaluating a stripped-down version of the actual deal.

Suppose that banks had simply been forced to accept a 65-percent reduction in the face value of their claims and been compensated by receiving two years' interest guarantee and guaranteed principal. Would they have gained or lost? This simplified deal is close enough to the actual deal that answering this question gives a pretty good

view of the overall evaluation. And by simplifying the problem in this way, we are better able to put the answers into a broader context.

We begin by noting that, given Mexico's initial debt of $107 billion and exports of $28 billion, our estimated debt Laffer curve would predict a secondary price of 0.377. This is fairly close to the actual price on the eve of the deal, and we will use it as our benchmark.

A debt reduction of 35 percent on the $52.7 billion of debt covered under the agreement would reduce debt by $18.5 billion. For a variety of technical reasons, the actual debt reduction was considerably smaller. We will, however, use a full 35-percent reduction as a benchmark.

What would we expect to be the results of a reduction in debt from $107 billion to $107 – 18.5 = $88.5 billion? Our debt Laffer estimate suggests that the market price would rise from 0.377 to 0.441; the market value of all debt would fall from $40.3 to $39.1 billion. That is, the aggregate cost to all creditors of a debt reduction would be quite small, because Mexico is estimated to lie on a very flat part of its debt-value curve. The marginal value of debt to creditors is only about 0.07.

Would a creditor participating in the scheme be hurt or helped? It is necessary to make some further assumptions at this point, because the guarantees do not apply to the whole stream of payments. We make perhaps the simplest assumption: that the same secondary discount applies to all payments.[28] Thus any dollar of payments that is guaranteed rises from an expected payment of 0.441 to 1.0. Under this assumption, and using a 10-percent discount rate, the value of the guaranteed bond turns out to be 0.371 of the face value of the original claim — very close to the original secondary price. That is, our calculation suggests that a debt deal roughly comparable to Mexico's would leave banks just about as well off as under the status quo — and that Mexico succeeded in denying participating creditors any significant capital gains.

This is not the same as saying that the debt reduction was accomplished efficiently. It is possible to calculate the value of the guarantees under our assumptions; they come to approximately 9 cents per dollar of initial claims, with a total cost of $4.6 billion. Thus each dollar of debt reduction costs approximately 25 cents in external resources, less than the secondary price, but much more than our estimate of the marginal value of the debt.

Why is a debt-reduction package that does not benefit the participating creditors so costly? The answer is that more than half the debt is not part of the package, and the nonparticipating debt free-rides on the debt reduction. There is a capital gain of approximately $3.4 billion on the approximately $54 billion of nonparticipating debt; this gain is exactly the difference between the true cost of the debt reduction to all creditors and the much larger enhancements needed to achieve the debt reduction in fact.

Part of this free-rider problem is actually an illusion, since approximately half the nonparticipating debt represents claims of multilateral agencies and governments, the same group that is financing the debt relief. Thus some of the cost of debt relief is a transfer from one pocket to the other. The true cost of our hypothetical debt relief to creditor-country taxpayers is not the $4.6 billion in outlays, but the sum of the costs to all creditors — about $4.6 – 3.4 = $1.2 billion — and the capital gains of the private nonparticipating creditors, about 3.4/2 = $1.7 billion.

In sum, this kind of menu approach with voluntary provisions allows for debt reduction at a lower price than a straightforward buyback, but at a higher price than a purely concerted scheme. In the Mexican case, a simple externally financed buyback would have taken place at the higher price of 0.441, and therefore would have cost 0.441 × 18.5 = $8.16 billion. Nevertheless, the actual cost of $4.6 billion (or $2.9 billion if capital gains on creditor-government-held debts of $1.7 billion are netted out) is still considerably higher than the actual value of the debt reduction to creditors — 0.07 × 18.5 = $1.3 billion. The presence of nonparticipating creditors waters down the effectiveness of the menu approach.

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Conclusions

There is no market solution to the debt problem. That is, applying the market mechanism to debt reduction does not easily resolve debt-servicing difficulties. Indeed, an excessively enthusiastic attempt to institute market-based debt reduction could easily aggravate the debt problem. If mishandled, market-based debt reduction can worsen the liquidity problems of debtor countries while providing little real long-term debt relief. In the worst case, an overenthusiastic program of buybacks could make both the debtor and its creditors worse off. More typically, buybacks will be an expensive route to debt reduction, with a substantial share of the resources going to provide windfall gains to the creditors rather than relief to the debtor.

Market-based approaches to debt reduction may nonetheless be able to play a useful role in facilitating concerted approaches to the debt problem. This study suggests two key features that a market-based scheme should have if it is to play this role. First, the scheme should be sufficiently transparent that the costs and benefits are relatively easy to determine — complex schemes, like debt-equity swaps, can easily contain hidden costs for the debtor. Second, the scheme should as far as possible involve the creation of new assets that are de facto senior to existing debt. This will allow greater debt reduction for any given amount of resources supplied from the international community and will tend to limit the windfall gains to creditors.

Although this study is aimed at assessing the prospects for market-based, decentralized debt reduction, the empirical results suggest a more favorable case for concerted debt reduction than is widely appreciated. The debt Laffer curve relating the market value of debt to the level of debt appears to be quite flat at levels of debt typical of highly indebted developing countries. This flatness suggests that the marginal cost of debt reduction to the private creditors is low. In other words, modest enhancements from the international community can, in principle, compensate private creditors who participate in a concerted debt reduction for large reductions in their nominal claims.

Finally, a menu approach that offers creditors the choice of several options as part of a debt-reduction package might improve the efficiency of the scheme, allowing a greater debt reduction for any given commitment of international resources. Offering creditors several options is not, however, the same as a market approach. The bottom line of our analysis and evidence is this: If debt reduction is to take place on any large scale, the mechanism must be concerted action with mandatory participation by as many creditors as possible. Extensive debt reduction through a purely voluntary market-based approach is neither desirable nor feasible.

Annexes

Annex 1 An algebraic model

In this annex we develop a simple algebraic model that parallels the discussion in sections 3-8 of the text. After presenting the model and discussing the total and marginal costs of debt, we proceed to analyze mathematically the market-based schemes examined above.

The model

A brief overview of our setup is as follows. We allow for only two time periods; in the first the buyback takes place, and in the second the country is obligated to repay its outstanding debt, D. The gross interest rate and the debtor's subjective discount factor are equal and set to one. We also assume that the marginal value of wealth to the debtor remains constant at one in both periods. While these assumptions are clearly untrue, relaxing them will not help us better understand the mechanics of market-based schemes. [29]

The debtor is assumed to repay its entire debt in the second period with probability π. With probability $1-\pi$ the country pays only a portion of its obligations. (Given less-than-full repayment, there may be a number of states in which the debtor repays different amounts.) Creditors receive an average bad-state payment of $R_c < D$, which is measured *net* of any collection costs creditors incur. The market value of the debt, V, can then be written as the expected value of future net cash flows,

$$V = \pi D + (1-\pi) R_c. \qquad \text{(A1)}$$

It follows that the secondary-market price is given by the average cash flow per dollar of debt:[30]

$$p = V/D = \pi + (1-\pi) R_c/D. \qquad \text{(A2)}$$

For our discussion later, it will be useful to think of V as a function of price, $p = p(D)$, and D, $V = p(D)\,D$.

Total costs of the debt

We focus on three types of costs represented by the debt. The first is the direct cost of the actual cash payments themselves. In the good state these costs are D, and in the bad states they are on average R. If there were no inefficiencies due to overhang or debt collection costs, then these cash flows would determine the market value of debt, V. In that case future payments are pure transfers and have no effect on economic activity. However, if there are inefficiencies present V will generally not equal the expected cash payments made by the debtor.

The second source of costs is extraction inefficiencies: the possibility that in bad states, negotiations break down and penalties are imposed. We let y represent the "collection costs" creditors bear in imposing penalties and confiscating assets. These costs are the difference between average bad-state repayments made by debtors and those received by creditors. Thus, net creditor receipts are total payments less y,

$$R_c = R_c(y) = R - y.$$

Note from equations (A1) and (A2) that in the presence of extraction inefficiencies both the market value of the debt, V, and the secondary-market price, p, are lower as y is greater. We also assume that in bad states the debtor bears an average cash-payment cost of R, but that it also pays a deadweight cost, x, for those states in which penalties are actually imposed. The debtor's total expected bad-state payments are thus $R_d = R + x$. We assume that both types of deadweight costs, x and y, are positive and increasing functions of the average amount of unpaid debt in bad states, $x = x(D-R)$, $y = y(D-R)$, and $x' > 0$, $y' > 0$.[31]

The second inefficiency which tends to raise the total costs of the debt is the presence of *disincentive effects*. High levels of debt may discourage adjustment and investment if much of the improvement in growth goes toward increasing debt service. To see how incentive effects may arise, suppose that in the good state, the country earns an income of Yg, of which it retains $Yg - D$ after servicing the debt. In bad states, the country's net average income is $Y_b - R - x$, where $Y_g - D > Y_b - R - x$. Now suppose that if there were no debt at all, the country would put in place programs to raise the good state's probability of occurrence to $\pi^* > \pi$. Expected income would therefore be $(\pi^* - \pi)\ ((Y_g - Y_b) - (D - R))$ higher if there were no debt. Of course, to raise expected income by this amount, an extra adjustment expenditure, denoted by A, is required. Debt overhang therefore imposes an additional burden on the debtor of $(\pi^* - \pi)\,((Y_g - Y_b) - (D - R)) - A > 0$. The cost of overhang to creditors, on the other hand, is just the difference between their net expected cash payments with and without incentive effects, $(\pi^* - \pi)\,(D - R_c)$.

Collecting terms from the three effects, we have that total direct and indirect costs of debt to the country, C_d, are

$$C_d = V + (1-\pi)(x+y) + (\pi^* - \pi)\Big((Y_g - Y_b) - (D-R)\Big) - A > V. \quad \text{(A3)}$$

Similarly, total expected gains to creditors are equivalent to the current market value of the debt,

$$-C_c = V. \quad \text{(A4)}$$

Marginal costs and benefits of debt reduction

Of course, the cost of the last dollar of debt to the country and its creditors — the marginal cost of the debt burden — may be quite different than the average. Taking the derivative of (A3), we have that the marginal cost of an extra dollar of debt to the country is

$$\frac{dC_d}{dD} = \frac{dV}{dD} + (1-\pi)(x'+y') - \pi'\left(\frac{dA^*}{dD}\right) = \pi + (1-\pi)x', \quad \text{(A5)}$$

where $\pi' = \partial\pi/\partial A > 0$. The terms in the last line of (A5) correspond to the first two costs of debt identified above.

The first term is the direct change in expected cash payments induced by an increase in D. This term is simply $V' = \partial V/\partial D = \pi$: the direct cost to the country of an extra dollar of debt is the probability that the country will repay that dollar (given no other effects of D on the ability to pay or the efficiency of the payments process).

The second term in (A5), $(1-\pi)x'$, is the debt's marginal effect on extraction inefficiencies borne by the debtor. As the unpaid portion of the debt, $D-R$, increases, the probability of a breakdown in negotiations rises as well. Since such inefficiencies occur only in partial-repayment states, the expected cost is the probability of reaching a bad state times the change in x.

Before we go on, it is worth commenting on terms that have *dropped out* in the last line of (A5). In particular, (A3) stressed the costs to the country of debt-overhang incentive effects. Why are these costs not present for a marginal increase in debt? After all, even small added amounts of debt reduce a debtor's incentives to invest and therefore tend to discourage investment and growth.

The reason is that, for *small* amounts of debt reduction, the added benefits to debtor adjustment are just offset by the costs of undertaking the additional growth and investment programs. To see this, consider the country's decision to adjust and invest. The debtor initially has expected utility

$$U_d = (U_d(A,D) = -A + \pi(Y_g - D) + (1-\pi)(Y_b - R_c - x). \quad \text{(A6)}$$

If it chooses A optimally, then the optimal level of adjustment, $A = A^*$, is given by the first-order condition, $U_A(A^*, D) = 0$.[32] From the implicit function theorem we then have that $A^* = A^*(D)$:

$$\frac{dA^*}{dD} = \frac{U_{AD}}{-U_{DD}}, \quad \text{(A7)}$$

where it is straightforward to show that $U_{AD} < 0$ and, by the second-order conditions, $U_{DD} < 0$. Thus, an increase in the level of debt reduces debtor adjustment, $dA^*/dD < 0$. Now the overall effect on debtor utility of an increase in debt is:

$$\frac{dU}{dD} = U_A(A^*, D)\left(\frac{dA^*}{dD}\right) + U_D = U_D, \quad \text{(A8)}$$

where the second equality follows from the first-order condition. Equation (A8) says that the effect of an increase in debt is *independent* of incentive effects — the strength of which is measured by dA^*/dD — since the cost of funding any additional adjustment just offsets the gains from that adjustment.

While the debtor does not benefit directly from the presence of positive incentive effects, creditors do. Creditors' overall gain is given by the change in total payments:

$$\frac{-dC_c}{dD} = \frac{dV}{dD} = \pi - (1-\pi)y' + \pi'\left(\frac{dA^*}{dD}\right)\Big(D - R_c\Big). \quad \text{(A9)}$$

Once again the first term in (A9) is the direct gain in cash flows from an increase in debt. Naturally, the direct cost of an extra dollar of debt is π for the debtor and $-\pi$ for creditors. The second term measures the adverse effect of extra debt on expected creditor collection costs. The third term is the impact on expected payments of the disincentives to debtor adjustment.

There is a second useful way to decompose the change in total creditor receipts in (A9). Instead of separating V into direct and indirect effects, we can split the change in market value into average and inframarginal components:

$$\frac{dV}{dD}=\frac{d(pD)}{dD}=p+D\left(\frac{dp}{dD}\right)=$$

$$p+\left(-\frac{(1-\pi)R_c}{D}-(1-\pi)y'+\pi'\left(\frac{dA^*}{dD}\right)\left(D-R_c\right)\right). \tag{A10}$$

Here the first term is just the average cost of the debt, $p = V/D$. Recall that this is what someone would have to pay to purchase one dollar of debt on the secondary market. The second term (in large parentheses) measures the effect of an extra dollar of debt on the value of the inframarginal claims. Now we can clearly see the factors responsible for the change in the price of the debt as claims are retired.

The first of these factors is the share of expected payments that come from bad states, $-\frac{(1-\pi)R_c}{D}$. Clearly, if $R_c = 0$ and there are no inefficiencies, then the average and marginal costs of the debt are equal. The price therefore does not rise as debt is retired. When $R_c > 0$ reductions in the level of debt *raise* the price of the remaining claims. The second term, $-(1-\pi)y'$, measures how much debt reduction raises prices through a decline in creditor collection costs. The third term picks up the incentive effects. As debt is reduced, prices rise more markedly if the debtor takes greater steps to adjust. This last term makes it clear that, although the debtor does not gain from overhang disincentives, creditors do. The reason is that the debtor alone must finance the added investments, whereas the creditors costlessly take a share of the country's higher growth. If these three terms are large enough in magnitude, then the price of debt can rise so rapidly that the market value actually increases as debt is reduced, $dV/dD < 0$. In those instances, the country is on the back side of its debt Laffer curve.

To sum up, a marginal debt reduction gives the debtor a gain of:

$$\frac{dC_d}{dD}=\frac{dV}{dD}+(1-\pi)(x'+y')-\pi'\left(\frac{dA^*}{dD}\right). \tag{A11}$$

Creditors gain $-dV/dD$, so the total economic return from reducing debt by a dollar is:

$$\frac{dC_d}{dD}-\frac{dV}{dD}=(1-\pi)(x'+y')-\pi'\left(\frac{dA^*}{dD}\right)>0. \tag{A12}$$

In the presence of inefficiencies, debt reduction is clearly a positive-sum proposition.

As we discussed in the text, the presence of incentive effects has important implications for measuring the gains to debt reduction. If there are no inefficiencies, then from (A12),

$$\frac{dC_d}{dD}=\frac{dV}{dD}:$$

the debtor's gain is equal to the change in expected repayments. Since the value of dV/dD is easy to measure from the market price before and after the debt reduction, we can easily estimate how the debtor and its creditors fare. Once there are inefficiencies present, however, debtor gains are given by (A11), and are no longer simply equal to the change in expected payments. Indeed, from (A11) it is clear that the presence of extraction inefficiencies and incentive effects *raises* the debtor's return from debt reduction *above that given by the change in expected payments alone.* The change in expected debt service should therefore be viewed as a lower bound on the debtor's gain from debt reduction.

Before concluding, we pause to mention a simplification we have made thus far which we relax later. That is the assumption that the default-state repayments, R, are not affected by debt reduction. In a number of buyback schemes, the debtor's ability to pay will be impaired by the buyback itself. That is, creditors will not always be able to *appropriate* all the funds used for the buyback. For example, suppose that the debtor funds the buyback itself, in part through the sale of assets which would have contributed to R. Then the buyback partially reduces the country's ability to pay. Unless appropriability is complete, we would expect that $dR/dD > 0$.

If we add the possibility for incomplete appropriability to our model, we have that the change in expected payments includes an additional term. Since incomplete appropriability corresponds to a deterioration in the ability to pay, this term tends to make the price *fall* as the debt is reduced:

$$\frac{dV}{dD}=p+D\left(\frac{dp}{dD}\right)$$

$$=p+\left((1-\pi)\left(\frac{dR}{dD}-\frac{R_c}{D}\right)-(1-\pi)y'+\right.$$

$$\pi'\left(\frac{dA^*}{dD}\right)(D-R_c)\Bigg). \tag{A13}$$

Clearly, incomplete appropriability will affect both debtor and creditor return on a buyback.

Now that we have distinguished the marginal costs of debt to the country and its creditors we can ask how much each gains from a variety of market-based schemes. Recall that, for small repurchases, it costs p dollars — the debt's average price — to retire one dollar of debt. The only real differences across these schemes are who pays the p dollars and how the form of payment affects the debtor's ability to service the remaining debt. We now turn to the market-based repurchases discussed in detail in the text.

Externally funded repurchases

Here an independent institution decides to spend p dollars and repurchase one dollar of debt, which it then retires. The gain to the debtor is the same as that from simple debt reduction, given in equation (A11). Creditors, on the other hand, receive p dollars in cash from an externally financed buyback of one dollar of debt, but give up dV/dD — the value of the last dollar of debt. Using equation (A10) we have that the buyback gives creditors an amount:

$$p-\frac{dV}{dD}=-D\left(\frac{dp}{dD}\right)$$
$$=-(1-\pi)\left(\frac{R_c}{D}\right)+(1-\pi)\,y'-\pi'\left(\frac{dA^*}{dD}\right)(D-R_c)>0. \tag{A14}$$

Creditors' gains from this transaction are always positive; and the greater the inefficiencies, the greater is the gain. The effect on the price of this buyback scheme, dp/dD, is just (A14) divided by D: prices can never fall under externally funded buybacks.

Senior securities

Here the country offers p dollars' worth of a (riskless) senior bond in return for one dollar of existing debt. The net reduction in the face value of obligations is thus $1-p$. Because the new bond is senior, the funds left over to repay the original claims in bad states are now $R-p$ on average. Thus, the transaction *lowers* the debtor's ability to service the old debt by p dollars in bad states, $dR/dD=p$. Using this fact and (A13), the change in expected payments on the original debt is:[33]

$$\frac{dV}{dD}=p+\Bigg((1-\pi)\left(p-\frac{R_c}{D}\right)-(1-p)\,(1-\pi)\,y'+$$
$$(1-p)\,\pi'\left(\frac{dA^*}{dD}\right)(D-R_c)\Bigg)$$
$$=p+(1-p)\left(\pi-(1-\pi)\,y'+\pi'\left(\frac{dA^*}{dD}\right)(D-R_c)\right). \tag{A15}$$

Creditors' overall return is then equal to the cash flow on the senior bond, which is worth p, plus the change in expected payments on the original debt:

$$p-\frac{dV}{dD}=$$
$$-(1-p)\left(\pi-(1-\pi)\,y'+\pi'\left(\frac{dA^*}{dD}\right)(D-R_c)\right). \tag{A16}$$

Notice that this expression is exactly proportional to (A9): swapping old debt for p dollars of senior bonds is exactly equivalent to debt reduction of $1-p$ dollars of old debt. Notice also that the left-hand side of (A16) can be written as $-D\,dp/dD$. Thus (A16) is also proportional to the change in price of the original debts. If, for example, the negative effect on price of a senior bond swap is exactly offset by the positive effect of decreased inefficiencies, the creditors' welfare is unaffected by the transaction, and secondary-market prices remain unchanged.

The debtor's gains from the swap can be seen by plugging the change in expected total payments in (A16) into equation (A11), after multiplying the latter by the amount of *net* debt reduction, $1-p$. Using (A11) and (A5) we therefore have

$$\frac{dC_d}{dD}=-p+\frac{dV}{dD}+(1-p)\,(1-\pi)\,(x'+y')$$
$$-(1-p)\,\pi'\left(\frac{dA^*}{dD}\right)$$
$$=(1-p)(\pi+(1-\pi)\,x'). \tag{A17}$$

Thus, from the debtor's point of view the swap is unambiguously beneficial, being equivalent to pure debt reduction of $1-p$ dollars. This is true for the debtor regardless of the importance of inefficiencies.

Internally financed repurchases

Suppose next that the debtor itself comes up with p dollars to finance the repurchase of one dollar of debt. Here we must allow for the possibility that appropriability is not complete, in case some of the repurchase funds would have been paid to creditors anyway. Thus, the gains to creditors are once again $-D\,dp/dD = p - dV/dD$, where dV/dD is given by equation (A13). As long as appropriability is low enough — that is, if dR/dD is low — creditors will gain from this transaction. Of course, the stronger are the inefficiencies, the more prices rise. Indeed, with strong inefficiencies creditors may gain even if appropriability is nearly complete — just as with the senior bond swap above.

The debtor's gain is based on the degree of appropriability and extraction efficiency only. Using equation (A11) and dV/dD from (A13) gives the country's welfare after subtracting the cost of the buyback itself, p:

$$\frac{dC_d}{dD} = \frac{dV}{dD} - p + (1-\pi)(x' + y') - \pi'\left(\frac{dA^*}{dD}\right)$$
$$= \pi + \frac{dR}{dD} + (1-\pi)\,x' - p. \qquad \text{(A18)}$$

Note that if appropriability is zero and there are no inefficiencies, then debtors must lose from the buyback:

$$\frac{dC_d}{dD} = \pi - p = -\frac{(1-\pi)\,R_c}{D} < 0. \qquad \text{(A19)}$$

However, the debtor tends to gain through a lower buyback price if appropriability is high (which acts to raise dR/dD), and also tends to gain if the likelihood of penalties falls with the level of debt (if $(1-\pi)\,x'$ is large).

Annex 2 Current estimates of market-based debt reduction

Table A1 presents some indications of volumes of transactions on the secondary market for different highly indebted countries.[34] The debt swap volume figure includes interbank transactions and thus does not necessarily represent actual debt reductions or debt transformations.

Table A2 indicates an approximate division of the secondary-market transactions over debt-equity swaps, informal conversions, exit bonds, buybacks, and other types of transactions involving the debtor country.

Table A1 Secondary market for developing country debt: debt conversions, 1984-88
($ millions)

	1984	*1985*	*1986*	*1987*	*1988*[a]
Argentina	31	469	—	35	1,330
Brazil	731	537	176	1,800	8,643
Bolivia	—	—	—	1	349
Chile	11	313	987	1,983	2,905
Costa Rica	—	—	7	146	17
Ecuador	—	—	—	125	258
Honduras	—	—	—	6	11
Jamaica	—	—	—	2	100
Mexico	—	769	1,023	3,804	6,670
Peru	—	—	—	—	15
Philippines	—	—	15	266	438
Uruguay	—	—	—	—	95
Venezuela	—	—	—	—	130
Yugoslavia	—	—		—	50
Sudan	—	—	—	—	1
Zambia	—	—	—	—	3
Total[b]	773	2,088	2,208	8,167	21,111
Debt swaps[c]	2,000	4,000	7,000	12,000	42,784

a. Identified to date in 1988.
b. Debt-for-equity and domestic debt swaps, loan-to-bond conversions, and debt repurchases and other transactions excluding interbank trading.
c. All transactions, including interbank trading.
Source: World Bank.

Table A2 Debt conversions in all countries, 1984-88
($ millions)

	Debt-equity swaps	*Informal*	*Exit bonds*	*Buy backs-*	*Other*	*Total*
1984	773	—	—	—	—	773
1985	1,843	—	—	—	245	2,088
1986	1,494	—	—	—	714	2,208
1987	3,435	3,500	15	—	1,216	8,167
1988	8,854	4,813	4,725	648	2,072	21,111

Source: World Bank.

Relevant legal provisions affecting debt reduction

Commercial bank loan agreements (syndicated loan agreements signed between commercial banks and borrowing countries) usually contain a number of provisions which can impede debt-reduction transactions.[35] These provisions were included in original loan agreements to protect individual creditors against discrimination by the debtor over other creditors and in that way ensured more security for the lenders, thus leading to a larger supply of funds for the debtor (see Folkerts-Landau 1985). If the creditor group finds these provisions unnecessary or undesirable, they can be waived under certain rules.

There are basically three categories of provisions which can affect debt-reduction transactions: (1) provisions which ensure equal treatment of lenders within a syndicate; (2) provisions which ensure equal treatment between lenders in a syndicate and other creditors; and (3) waiver and amendment provisions. In addition, there are provisions included in more recent agreements which permit borrowers to undertake certain debt-reduction transactions.

The upshot of these legal provisions is that they do not allow for debt repurchases that use the debtor's current assets or pledge its specific future assets. Waivers must often be signed to make such repurchases possible. In most cases, waivers can be granted only with the consent of the majority or a supermajority of creditors. Unanimous or near-unanimous consent is most often required for debt-reduction transactions to proceed, and this means that every creditor must perceive the transaction to be in his or her interest. This imposes some severe restrictions on the type of market-based transactions that are possible. We now turn to a more detailed discussion of loan provisions that affect debt reduction.

Equal treatment provisions within a syndicate ensure that all lenders are placed on an equal footing within the syndicate. This policy is reflected in the following provisions; (1) The sharing provision is designed to ensure that payments received by

any individual lender are shared pro rata with all co–lenders. A buyback of debt is generally considered as a form of prepayment and might therefore trigger the sharing provision, implying that the receiving bank should share its payments with all other banks, defeating the intention of the buyback. Exceptions are sometimes found in agreements, but usually require a waiver. (2) The optional prepayment clause allows a debtor to prepay its part of the loan on a pro rata basis and may — like the sharing provision — prevent buybacks.

Equal treatment provisions between lenders in a syndicate and other lenders are of three kinds. *Pari passu provisions* mean that the borrower states that the payment obligation will at least rank equally (pari passu) in priority of payment with all other external indebtedness, current or future. In cases where the debtor in a debt-reduction scheme collateralizes a portion of a newly created claim, the pari passu clause would be violated. *Negative pledge provisions* (companions to the pari passu provision) provide that the debtor will not create any lien with respect to any of its present or future assets to secure payment to other creditors. If the debtor uses any assets to secure payments the negative pledge clause may be violated. *Mandatory prepayment provisions* provide that if the debtor makes any prepayments to a specific creditor, the borrower must also make prepayment to other creditors which fall under this provision. In a few instances, a general prohibition of prepayment provision may be present. Most debt-reduction schemes will require waivers of these provisions.

Waiver and amendment provisions vary in their requirements for obtaining waivers or amendment of each of the relevant provisions discussed above. Sharing provisions require unanimous or near-unanimous consents to be waived or amended. Prepayment, pari passu, and negative pledge waivers are generally easier to obtain (more than 50-percent approval is usually sufficient).

Some of the more recent (pre-Brady) commercial loan agreements (Mexico 1986, Brazil 1988, Chile 1988, Philippines 1987, Argentina 1987) include a new provision that permits the borrower to undertake specific debt-reduction transactions — mainly debt-for-equity exchanges, debt-for-debt exchanges, and debt-buybacks — up to certain amounts and subject to certain conditions and limitations.

Annex 3 Statistical estimation of debt Laffer curves

The standard method for estimating a debt Laffer curve uses a regression of the log of the price on the log of the debt-export ratio and other conditioning variables:

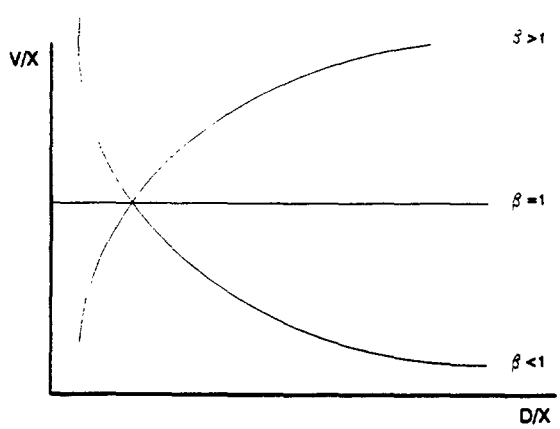
$$ln(p_{it}) = \alpha - \beta ln\,(D/X)_{it} + \tau Y_{it} + \varepsilon_{it}\,, \qquad \text{(A1)}$$

where p is the secondary-market price of the ith country's loans at time t, D/X is the debt-export ratio, and Y is a set of other regressors (such as measures of arrearages and reschedulings). The coefficient on the log of D/X is the elasticity of the price with respect to the debt-export ratio: it measures the percentage increase in market prices in response to a 1-percent reduction in the D/X ratio.

If β is larger than one, the *value* of the debt (and not just its price) is decreasing as D increases, which is equivalent to being on the back side of the Laffer curve. Typically, estimates of β have been statistically less than one, usually in the range $0.3 < \beta < 0.7$.

The specification in (A1) is problematic because it forces the elasticity to be the same at all levels of D/X. With the elasticity constant, the value of the debt is given by $V/X = p\,D/X = c\,(D/X)^{1-\beta}$, where c is a constant related to α in (A1). Pictorially, this implies that the regression is actually choosing among the three families of curves pictured in figure A1. In the case where $\beta = 1$, an increase in D/X is associated with an equiproportionate price decline. The value of the debt (scaled by exports, $p\,D/X$) therefore does not vary with D/X. In the case where $\beta > 1$ the curve

Figure A1
Constant elasticity curves



is decreasing and convex, whereas if $\beta < 1$ it is increasing and concave. Of course, even if many countries are on the back side of the Laffer curve, *as long as there are a few with low D/X and therefore low pD/X, the regression will choose a curve from the $\beta < 1$ family.*

The implication is that estimated equations of the form of (A1) are unlikely to provide evidence of inefficiencies, even when such effects are extremely important in most countries. Figure 3 in the text suggests that by eliminating countries with low D/X from the sample, the bias toward finding $\beta < 1$ should disappear. Indeed, this seems to be the case: when only those 16 countries with a debt-export ratio greater than 3 are used, the estimate of β jumps to 1.2 (with a standard error of 0.34).[36]

A better functional form for estimation is the logistic equation:

$$ln\left(\frac{p_{it}}{1-p_{it}}\right) = \alpha - \beta\, ln\,(D/X)_{it} + \tau Y_{it} + \varepsilon_{it}\,. \qquad \text{(A2)}$$

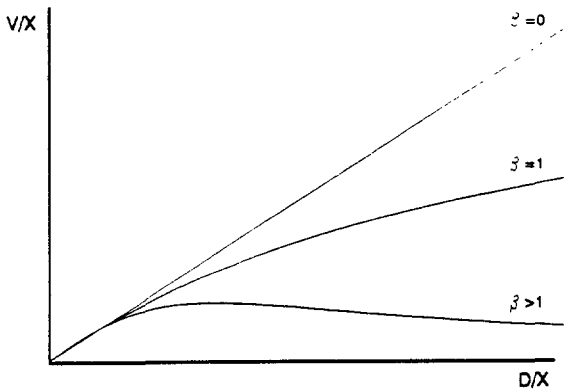
In (A2) the elasticity of price is not restricted to be the same across different countries. There are actually two ways to compute a country's elasticity from this equation. The first is to assume that prices are exactly equal to expected cash flows. Then each country is by definition on its own Laffer curve, and the error term in (A2), ε_{it}, is best thought of as a country-specific factor. Under this interpretation the elasticity of a country's Laffer curve is $\beta(1-p)\,D/X$. The second measure of elasticity assumes that random noise may separate the market prices of two countries with an equal debt burden, incentives, and so on. In such a case (A2) should be thought of as an estimate of the "average" debt Laffer curve across developing countries. Since the error term washes out, the elasticity of price with respect to debt should be thought of as a function of D/X alone,

$$\frac{dln(p)}{dln\,(D/X)} = \frac{c\,\beta\,(D/X)^{\beta-1}}{c\,(D/X)^{\beta}+1}\,,$$

where c is now a constant related to α in (A2).

Using either method, if $\beta > 1$, V tends to decline when D/X is high and rising: adding more debt reduces the total market value of claims. Figure A2 shows the families of curves between which the regression chooses. In contrast with figure A1, none of these curves explodes for low levels of D/X, so there is no strong bias toward finding $\beta > 1$. Indeed, estimates for β in equation (A2) are gener-

Figure A2
Logistic curves



ally between 1.4 and 1.6, and are about one standard error greater than one. These estimates, taken literally, imply that the incentive effects become powerful enough to make the curve slope downward for high D/X.

The estimates of equation (A2) using a cross-section of 35 countries are reported in the text. The resulting Laffer curve is presented in figure 4 in the text and in figure A3. We estimated equation (A2) on high and low D/X countries separately and found similar estimates for both sets of countries. This suggests that the results are not being driven disproportionately by any particular subgroup of countries.

Seniority, prices, and buybacks

The importance of seniority has been pointed out in the discussion on exit bonds. Changes in the degree of seniority can have an important impact on the amount of debt reduction that can be achieved in any deal and on the net change in the value of claims of each seniority class. The debt-value function that has been used (equation A2) did not account for differences in seniority between commercial bank debt and other debt and was estimated using the secondary-market price for commercial bank debt as the average price for all debt. If commercial banks are the most junior creditors, however, the secondary-market price would reflect not the average price for all debt but the price of the debt that is serviced after all other creditors are serviced. The secondary-market price would then be below the average price for all debt.

A debt-value function which accounts for this seniority structure can be estimated. The procedure used was as follows. Going along the debt-value curve, the market value of debt accrues first to the most senior lenders, then to the more junior lenders, and then to the most junior lenders. If we assume that there are only two classes of debt, the market value of the debt of the senior lenders will be the value of debt given by the debt-value curve for the face value of their debt only. The market value of the junior creditors will be the market value of total debt minus the market value of the debt of the senior lenders. We can write this as: $V(D_j; \alpha, \beta) = V(D_j + D_s; \alpha, \beta) - V(D_j; \alpha, \beta)$, where D_j is the face value of junior debt, D_s is the face value of senior debt, and where all market values depend on the parameters for the debt-value curve α and β. Since $V(D_j; \alpha, \beta) = p(D_j; \alpha, \beta) \times D_j$, where $p(D_j; \alpha, \beta)$ is the predicted (secondary-market) price for junior debt, this can also be written as:

$$p(Dj; \alpha, \beta) = \Big(V(D_j + D_s; \alpha, \beta) - V(D_s; \alpha, \beta)\Big) / D_j .$$

A debt value which allows for seniority can now be estimated by minimizing the sum of squared errors between predicted and observed secondary-market prices, $p(D_j; \alpha, \beta) - p$ over the parameters α and β. The result is as follows:

$$ln\,(p/(1-p)) = 7.438 - 1.2134\, ln(D/X) . \quad \text{(A3)}$$

The estimated coefficient for the slope is lower than with the no-seniority curve (1.234 compared with 1.44), a reflection of the fact that the debt-value curve flattens out less rapidly when the debt-to-export ratio increases. Using an example where total debt D = \$100 billion, and exports are \$30 billion, and assuming that debt senior to commercial bank claims O = \$50 billion, we calculate the average price of all debt as 59.6 cents, the price of senior debt as 77.4 cents, and the price of commercial bank debt as 41.8 cents. Table A3 provides prices for alternative combinations of total and senior debt.

It can be verified that prices for total debt are consistently above the prices predicted on the basis of the no-seniority curve. The elasticity of the price for bank debt with respect to the total amount of debt is similar to before. The bottom panel can be used if there exist multiple seniority classes to eval-

Figure A3
The country-specific debt Laffer curve

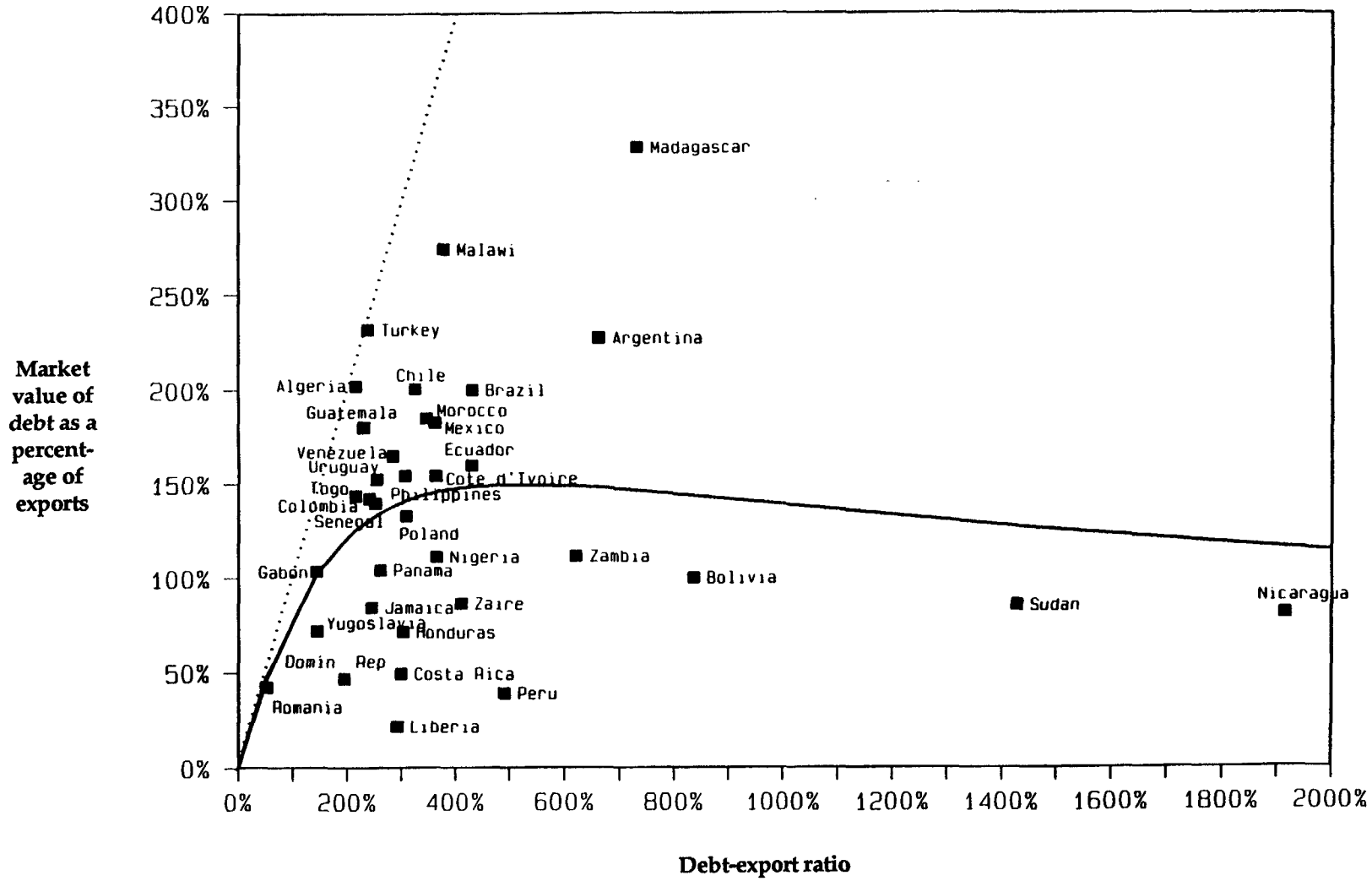


Table A3 Prices for alternative levels of total and senior debt
(cents)

D	80	90	100	110	120
O	50	50	50	50	50
p (banks)	46.8	44.3	41.8	39.6	37.6
t (total)	65.9	62.7	59.6	56.8	54.2
s (senior)	77.4	77.4	77.4	77.4	77.4
D	100	100	100	100	100
O	20	30	40	60	70
t (total)	59.6	59.6	59.6	59.6	59.6
p (banks)	51.7	48.1	44.8	39.1	36.6
s (senior)	91.2	86.4	81.8	73.3	65.9

Source: Authors' calculations based on equation (A3).

uate the value of debt in each class. For instance, the price of the $20 billion of most senior claims is close to par: 91.2 cents. The price of the next most senior $10 billion of claims is 76.8 cents:

$$\frac{\$30 \times 86.4 - \$20 \times 91.2}{\$10}.$$

Keeping total debt fixed, the larger the share of senior debt, the lower the price for the commercial bank claims.

Table A4 provides information on the costs and benefits of buybacks done at the ex post price for commercial bank debt and accounting for the seniority structure. The buyback can be financed domestically from a reduction in consumption (dom.) or through a loan from a senior lender (loan).

Table A4 Cost and benefit of buybacks with seniority structure
($ billion)

Cash used	*2*		*5*		*8*	
Source	*Dom.*	*Loan*	*Dom.*	*Loan*	*Dom.*	*Loan*
ΔD	4.66	4.77	11.20	11.09	17.04	19.00
p (cents)	42.09	41.09	44.50	42.00	42.02	46.01
t (cents)	61.00	60.04	63.00	61.07	63.00	65.00
ΔND	4.66	2.77	11.20	6.90	17.04	11.00
ΔV	0.88	1.90	2.27	4.78	7.65	3.69
$D^* \Delta p$	1.12	0.10	2.73	0.22	4.31	0.35

Notes: Buybacks take place at the ex post price *p*. Computations are based on an initial debt of $100 billion and exports of $30 billion.
Source: Authors' calculations based on equation (A3).

The main difference compared to a no-seniority case is that the ex post price does not increase as much when a senior loan is used to buy back debt. It is even possible that the price for commercial bank claims will fall as a result of more senior debt, even if total debt is reduced. The net debt reduction when domestic resources are used will be larger than if we had not accounted for the seniority structure as the price of commercial bank debt rises less.

Annex 4 Bank regulation and exit

Regulatory factors create differences in incentives among banks, contributing to their desire for at least a limited menu of options in debt reduction. In particular, "weak" banks are likely to be less willing to sell off their claims on highly indebted countries than "strong" banks. In this annex we present a simple example designed to illustrate this point.

Imagine that there are two banks, each of which has two kinds of asset: claims on a highly indebted country (HIC loans), and other assets. We suppose that the banks know that the claims on the HIC will in fact pay only 20 percent of face value but the banks are initially allowed by regulators to carry the loans at par. Other bank assets, meanwhile, are risky: each dollar of face value will actually pay either $1.05 or $0.95 with equal probability. Both banks have assets with a book value of 1,000.

On the liability side, the banks receive deposits, which are insured and thus viewed as riskless by the depositors. The book value of banks' capital is the difference between the value of deposits and the book value of assets. And we assume that as a matter of statute, the banks must maintain capital equal to 1/10 of assets — that is, initially they have deposits of 900, book capital of 100.

One bank is "weak": of its assets, 100 are HIC loans. The other is "strong": only 10 of its assets are HIC loans. The balance sheets therefore look like this:

	Weak bank		*Strong bank*		
HIC loans	100	900	10	900	Deposits
Other assets	900	100	990	100	Book capital

What is each of these banks worth to its owners? For the strong bank, we need only note that the HIC loans are really worth only 2, not 10; so the true capital is 92, not 100. The weak bank, however, will actually go bankrupt if its other assets pay only $0.95 (because in that case its assets will be $20 + 0.95 \times 900 = 875$, less than its deposits). So its value is the expected value to its owners only if its assets yield $1.05. If the good state occurs, the net worth of the bank will be $20 + 1.05 \times 900 - 900 = 65$, so the expected value to stockholders is $65/2 = 32.5$.

Now suppose that each bank is forced to liquidate its holding of HIC loans at their true value of 0.2, and to put the proceeds into other assets. In both cases this will put the banks in violation of the capital requirement. Assume that the banks bring themselves into compliance by selling off part of their other assets, and paying off depositors with the proceeds. Then after the liquidation the balance sheets will look like this:

	Weak bank		*Strong bank*		
HIC loans	0	180	0	828	Deposits
Other assets	200	20	920	92	Book capital

Once again we can calculate the value of each bank to its stockholders. The strong bank is still worth 92. The weak bank will no longer go under in the bad state, so its value is now 20. But this means that even though the weak bank has been paid fair value for its HIC loans, its value has declined by 12.5.

The reason for this loss is that by being forced to increase its capitalization, the weak bank's owners lose a hidden subsidy that results from deposit insurance. Before the liquidation, there was a 50-percent probability that deposit insurance would have to cover the negative net worth of 25; this expected subsidy of $25/2 = 12.5$ is now lost.

It is now apparent that there is a difference in the incentives of banks. The strong bank will be willing to exit if it is offered a price for the debt above 0.2. The weak bank will require a higher price before it will voluntarily exit. (In this example, it can be shown that the weak bank's exit price is 0.325.) In a "limited menu" approach in which banks must choose either to exit or to provide new money, we would expect weak banks to prefer the new-money option.

In this example the difference between a weak and a strong bank comes from differences in their capital positions. Clearly, however, similar differences in incentives could come from differences in regulatory environments. For example, suppose that the banks were equally well capitalized, but that one was based in a country where the statutory capital requirement was 20 rather than 10. This bank would then take on the "strong bank" role, because sales of debt would require less recapitalization.

Endnotes

1. Many of these schemes have been explored in other work. See, for example, Dooley (1989), Bulow and Rogoff (1988), Froot (1989), Krugman (1989), Helpman (1989), and Claessens and Diwan (1989).

2. See Cline (1983) for a discussion of the early dangers posed by the debt crisis.

3. Playing for time can make sense if it keeps the option open for the creditors of capturing an upside potential a debtor may be experiencing due to favorable shocks or its adjustment efforts.

4. This is particularly relevant under the Brady plan where creditor-country governments have generally made nonparticipation in a debt-restructuring mechanism less attractive through different forms of "coercion."

5. For work on the impact of deposit insurance on secondary-market prices of debt, see Huizinga and Ozler (1990).

6. See Demirguc-Kunt and Diwan (1990).

7. For more details on the 1989 Mexican agreement, see section 11.

8. Bulow and Rogoff (1988) originally stressed the distinction between average and marginal prices of debt.

9. See Rotemberg (1989) for a theory of how bargaining inefficiencies affect the return of buybacks.

10. We assume in the good states that penalties are never imposed and that the country is always willing to repay $100 billion.

11. See Sachs (1988) and Krugman (1988) for the original expositions of these effects of debt overhang.

12. The difference of $0.1 billion is due to rounding error.

13. If the terms of the repurchase are determined in negotiations between the debtor and (a committee of) the creditors, the distinction between market-based schemes and concerted schemes becomes blurred. Clearly, the debtor may be able to return to itself some of the efficiency gains that follow from debt reduction through successful bargaining tactics.

14. If the cash would have been available otherwise (as is the case for the so-called set-asides under the Brady plan), the transaction would amount to a debtor-financed debt repurchase, which is considered in more detail in section 6.

15. The bid and ask prices for Bolivian debt were 6 and 8 cents per dollar of debt before the buyback, and 11 and 12 cents after the buyback. We use the

average of bid and ask prices (7 and 11.5 cents) for computing the market value before and after the transaction. See Bulow and Rogoff (1988) and Lamdany (1988) for different sets of computations on the Bolivian repurchase.

16. It is unclear whether the donors would have been willing to provide all the funds.

17. See annex 2, table A1 for data on alternative market-based schemes.

18. See van Wijnbergen (1990) for an exposition of this argument.

19. Lamdany (1988) presents detailed calculations of the Mexican deal.

20. To keep things simple, this example assumes that in both the good and bad states the expected guarantee of 50 cents is used. This assumption is made entirely for convenience, however, and does not affect the results.

21. See table A2 in annex 2 for data on how widely such swaps have been applied.

22. To limit the effects on the money supply of these transactions, the central bank auctions off quotas that limit the redemptions participants may receive.

23. Observers frequently argue that certain types of private assets — such as deposits in overseas accounts — can be repatriated only at a loss (due to taxes or administered exchange rates), and therefore that under chapter 18 the government can only pay nationals less than a dollar to get them to repatriate a dollar's worth of external debt. This argument, however, neglects the fact that the taxes paid by repatriated foreign assets represent a source of income to the government which is forgone when the assets are repatriated under chapter 18.

24. See Larrain (1989) for more details on the Chilean debt-reduction experience.

25. See also the work of Cohen (1989) and Koen (1990).

26. What happens if the new-money obligation is set higher or lower? The size of the net debt reduction changes. If the new-money requirement is set at more than 0.058, creditors will be willing to choose the new-money option only if the secondary price is expected to rise to more than 0.433; this will happen if fewer banks choose the new-money option and more choose to exit. Conversely, if the new-money requirement is set lower, fewer banks will exit, and the net debt reduction will be less.

The point is that getting the new-money obligation exactly right is not essential. There is a range of values for which some banks will choose each option, even if banks have identical preferences (a point emphasized by Diwan and Kletzer 1990). If the new-money obligation is set too high, however, the resources available for buybacks may not be sufficient; if it is set too low, little net reduction in debt will take place.

27. See Diwan and Kletzer (1990) for evidence that a model of identical bank preferences tracks the results of the Mexican package quite well.

28. This assumption may make the deal appear more advantageous to Mexico, and less advantageous to its banks, than is the case. Arguably the "commitment ratio," the share of funds actually likely to be used, is higher on funds used to guarantee principal than on those used to guarantee interest, because Mexico will reclaim the value of the zero coupons only if it services its debt for the full term — and if a default is permanent, this is less likely than the repayment of the average dollar of debt obligations. So, the effective cash component of the funds used may be higher than our numbers suggest, and the package therefore involved some gains to creditors.

29. Within this simplified framework, the debt is repaid in a single lump sum. Therefore, there can be no clear distinction between the rate of debt service and the level of debt. For models which go beyond the single-payment assumption, see Cohen (1989) and Froot (1989).

30. In expressing the market price this way, we have implicitly assumed that the country and its creditors agree on the probability of full repayment.

If creditors instead believe that the debts will be serviced fully with a probability of $\tilde{\pi} \leq \pi$, and that the average payment in default states is $R'_c \leq R_c$, then the market price is

$$p' = \tilde{\pi} + (1 - \tilde{\pi})\, R'_c / D \leq p\,.$$

Clearly, if the creditors are less bullish on repayment than is the country, the debt will be cheaply priced from the country's point of view.

31. See Rotemberg (1989) for this model in more detail.

32. It is straightforward to show that this first-order condition is given by, $\pi'\Big(Y_g - Y_b - (D - R - x)\Big) = 1$. This expression, plus some algebra, explains the equality in (A5).

33. In equation (A15), we assume that the inefficiencies are scaled by the *net* debt reduction of $1 - p$ (the reduction in the face value of existing debt less the increase in outstanding senior bonds).

34. These figures are preliminary. See the March 1989 issue of the *Quarterly Review of Financial Flows to Developing Countries*, the World Bank, for additional information and sources.

35. This section draws on Morais and Duvall (1989).

36. See Cohen (1989) for details.

References

Bulow, Jeremy, and Kenneth Rogoff. 1988. "The Buyback Boondoggle." *Brookings Papers on Economic Activity* 2:675-704.

Claessens, Stijn. 1988. "The Debt Laffer Curve: Some Estimates." World Bank, International Economics Department, Washington, D.C.

Claessens, Stijn, and Ishac Diwan. 1989. "Market-based Debt Reduction." In Ishrat Husain and Ishac Diwan, eds., *Dealing with the Debt Crisis.* Washington, D.C.: World Bank.

Cline, William. 1983. *International Debt and the Stability of the World Economy.* Washington, D.C.: Institute for International Economics.

Cohen, Daniel. 1989. "Is the Discount on the Secondary Market A Case for LDC Debt Relief?" PRE Working Paper 132. World Bank, International Economics Department, Washington, D.C.

Demirguc-Kunt, Asli, and Ishac Diwan. 1990. "The Market-Based Menu Approach in Brazil: An Analysis of Commercial Banks' Choice Behavior." World Bank, International Economics Department, Washington, D.C.

Diwan, Ishac, and Ken Kletzer. 1990. "Voluntary Choices in Concerted Deals: Mechanics and Attributes of the Menu Approach to LDC Debt." World Bank, International Economics Department, Washington, D.C.

Dooley, Michael. 1989. "Buybacks, Debt-Equity Swaps, Asset Exchanges and Market Prices of External Debt." In J. Frenkel and others, eds., *Analytical Issues in Debt.* Washington, D.C.: International Monetary Fund.

Feldstein, Martin. 1986. "International Debt Service and Economic Growth." NBER Working Paper 2138. National Bureau of Economic Research, Cambridge, Mass.

Folkerts-Landau, David. 1985. "The Changing Role of International Finance." *IMF Staff Papers* 32:317-33.

Froot, Kenneth A. 1989. "Buybacks, Exit Bonds, and the Optimality of Debt and Liquidity Relief." *International Economic Review* 30(February):49-70.

Helpman, Elhanan. 1989. "The Simple Analytics of Debt-Equity Swaps and Debt Forgiveness." *American Economic Review* 79(June):440-61.

Huizinga, Harry, and Sule Ozler. 1990. "Secondary Market Prices for Developing Country Debt: The Role of Creditor Country Factors." Department of Economics, University of California, Los Angeles.

International Monetary Fund. 1989. *World Economic Outlook*. Washington, D.C.

Koen, Vincent. 1990. "Estimates of the Debt-Relief Laffer Curve." Massachusetts Institute of Technology, Cambridge, Mass.

Krugman, Paul. 1985. "International Debt Strategies in an Uncertain World." In Gordon Smith and John Cuddington, eds., *International Debt and the Developing Countries*. Washington, D.C.: World Bank.

Krugman, Paul. 1988. "Financing vs. Forgiving a Debt: Some Analytical Notes." *Journal of Development Economics* 29(November):253-68.

Krugman, Paul. 1989. "Market-Based Debt-Reduction Schemes." In J. Frenkel and others, eds., *Analytical Issues in Debt*. Washington, D.C.: International Monetary Fund.

Lamdany, Ruben. 1988. *Voluntary Debt-Reduction Operations: Bolivia, Mexico, and Beyond*. World Bank Discussion Paper 42. Washington, D.C.

Larrain, Felipe. 1989. "Debt Reduction Schemes and the Management of Chilean Debt." World Bank Internal Discussion Paper IDP-0030, Washington, D.C.

Morais, Herbert and Thomas Duval. 1989. "Relevant Provisions of Commercial Bank Loan Agreements Affecting Proposed Debt Reduction Schemes." World Bank, Legal Department, Washington, D.C.

Purcell, J., and D. Orlanski. 1988. "Developing Country Loans: A New Valuation Model for Secondary Market Trading." Salomon Brothers, Corporate Bond Research, International Loan and Trading Analysis. New York.

Rotemberg, Julio. 1989. "Sovereign Debt Buybacks Can Lower Bargaining Costs." Massachusetts Institute of Technology, Cambridge, Mass.

Sachs, Jeffrey. 1984. "Theoretical Issues in International Borrowing." Princeton Studies in International Finance No. 53. Princeton, N.J.: Princeton University.

Sachs, Jeffrey. 1988. "The Debt Overhang of Developing Countries." In J. de Macedo and R. Findlay, eds., *Diaz Memorial Volume*. Helsinki: WIDER Institute.

Sachs, Jeffrey. 1989. "Conditionality, Debt Relief, and the Developing Country Debt Crisis." In Jeffrey Sachs, ed., *Developing Country Debt and the World Economy*. Chicago: University of Chicago Press.

Sachs, Jeffrey, and Harry Huizinga. 1987. "U.S. Commercial Banks and the Developing Country Debt Crisis." *Brookings Papers on Economic Activity* 2:555-606.

van Wijnbergen, Sweder. Forthcoming. "Cash Debt Buy Backs and the Insurance Value of Reserves." *Journal of International Economics*.

Williamson, John. 1988. *Voluntary Approaches to Debt Relief*. Policy Analysis in International Economics 25. Washington, D.C.: Institute for International Economics.

World Bank. 1989. *Quarterly Review of Financial Flows to Developing Countries*. Washington, D.C. (March)

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