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ON THE PRICING OF LDC DEBT: AN ANALYSIS BASED ON HISTORICAL EVIDENCE FROM LATIN AMERICA

by

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SUMMARY

This paper displays and discusses historical data on sovereign debt prices for two Latin American countries and provides a signalling framework to account for the following phenomena: (a) prices for old (defaulted) and newly-issued debts were the same, but such prices diverge and rise sharply once the countries stopped issuing new foreign debt, and, (b) the price of defaulted and newly issued debts both tend to rise as the latter approaches maturity and the country starts redeeming all its outstanding obligations. The analysis sheds some light on the valuation of different debt instruments in today's secondary market for LDC debt.

RESUMÉ

Ce texte expose et étudie les données historiques de deux pays d'Amérique latine sur le marché secondaire et propose un modèle de *signalling* pour rendre compte des phénomènes suivants : (a) les prix des dettes anciennes non honorées et des dettes récentes sont identiques mais de tels prix divergent et augmentent sensiblement dès que les pays cessent de contracter de nouvelles dettes et, (b) le prix des dettes anciennes non honorées et celui des dettes récentes a tendance à s'élever à mesure que ces dernières arrivent à échéance et que le pays commence à se libérer de ses engagements. L'analyse apporte des éclaircissements sur l'évaluation des différents instruments actuels de la dette sur le marché secondaire des pays en développement les moins avancés.

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PREFACE

Debt relief programmes, now in place throughout most of the developing world, involve the creation of new debt instruments which are gradually replacing old (defaulted) ones. How are these instruments priced in the so-called secondary market for LDC debt? What do such prices mean in terms of opportunity costs, and what do they represent in terms of present and future consumption of both the developing countries and their foreign creditors? These questions are very important for a more effective evaluation of debt relief packages in LDCs and therefore they are of much relevance to the OECD Development Centre's project on "Financial Policies for the Global Dissemination of Economic Growth".

This paper sheds some light on today's market prices for LDC debt by looking at such prices' historical counterparts during the 1930s. In particular, data on old (defaulted) and newly created debts for Chile and Colombia (1928-1959) is displayed and then accounted for by means of a simple signalling model. It is shown that whenever debt relief is carried out through a conversion process involving the replacement of old for new debts, the duration of such a process has an informational content about the country's ability to repay, and that the price of the debts will thereby evolve as shown in the data.

The historical and theoretical analysis performed by Beatriz Armendariz in this paper represents a useful basis for further research on a topic that is receiving increased attention in light of the widespread concern to bring about debt relief efficiently.

Louis Emmerij
President of the OECD Development Centre
November 1991

I. INTRODUCTION

As developing countries have begun resolving their debt-servicing difficulties of the 1980s, the so-called secondary market for LDC debt is increasingly filled with new debt issues. Typically, these newly created issues are part of negotiated — Brady-style — or unilateral — Morgan-Mexico-style — debt-relief programmes whereby an LDC offers its creditors the possibility of exchanging old (defaulted) debt against new (reduced-face value) debt. In either case, the increasing number of debt issues add complexity to the analysis of market valuation of LDC debt. How are prices of old and new debts determined? What do such prices mean in terms of opportunity costs, and what do they reflect in terms of present and future consumption for the developing countries and their foreign creditors? A thorough analysis of these questions could be crucial for evaluating current debt repayment programmes in many LDCs.

This paper intends to provide an insight into current market prices for LDC debt by looking at their historical counterparts for the cases of Chile and Colombia during the 1930s. In particular, the paper analyses the following salient features from the historical data: (a) the prices of foreign debts (both old or defaulted and new begin the same, but then diverge and rise sharply once the country decides it will no longer keep on issuing new foreign debt); and (b) the prices of both old and new debts (which increase the closer the latter are to maturity).

These phenomena are explained in a simple two-period signalling framework where the availability of foreign exchange reserves for making debt repayments is the private information of the country concerned. It is shown that information about true levels of reserves is conveyed to the creditors whenever the country's debt repayment policies are adopted, and that the prices of sovereign debt will vary accordingly.

While this paper could be considered an addition to the abundant literature on LDC debt valuation[1], it is, however, closest in spirit to the evaluation of the Brady deal in Mexico which is found in Claessens and Van Wijnbergen's (1990) work. This is essentially an option-pricing framework which accounts for the observed price differences among Mexico's newly created debt instruments. That framework, however, is inadequate for analysing the historical data set contained in this paper. The reason for this could be that it does not take into consideration a possible change of a country's debt-repayment policy which, as we will show, is a crucial feature of the data set being analysed.

Section II provides a brief historical account of Latin America's debt servicing difficulties during the 1930s and presents some data on old (defaulted) and newly issued debts. Section III develops the signalling model which accounts for the data. In conclusion, Section IV contrasts some implications of such a model with those of the standard option-pricing approach to LDC debt valuation and points out some new avenues for future research.

II. THE NEGOTIATION OF LATIN AMERICA'S FOREIGN DEBT IN THE 1930s: SOME FACTS AND DATA

During the 1920s the governments of Latin America were able to issue a high volume of debt in the United States. During the 1930s almost 80 percent of it was defaulted. The main reason is well known: export revenues worldwide, and especially those of the Latin American countries, were falling very rapidly due to the Great Depression in the United States. Consequently, such countries found it increasingly difficult to continue servicing their dollar-denominated debts, and, being cut off from further lending, they had no alternative but to default.

Throughout the second half of the 1930s and after (especially during the Second World War), the Latin American countries were running fairly large trade surpluses. This provided an opportunity for debt renegotiation. More than half of Latin America's foreign debt was renegotiated by the end of the 1940s (Denburg, 1950), and most countries in the region provided normal debt servicing on their (newly) recontracted obligations throughout the 1950s and 1960s.

The standard way of negotiating defaulted debts in the 1930s was as follows. The country and the creditors' representative, the Council, first agreed on a debt repayment programme involving a reduction in the face value of the defaulted obligations[2]. Such an agreement permitted the country to issue new debt, which was Council-endorsed, and offer it for conversion against its old (defaulted) obligations. Creditors could then decide whether to surrender their original claims or hold on to them in the expectation of receiving a future counter-offer from the country. It was generally the case, however, that Council-endorsed debt was immediately accepted for conversion by the majority of the creditors. Concretely, it took only a year or two for 90 per cent of the creditors to decide to surrender their original contractual claims for conversion into the newly issued debt.

Another, though less common, way of negotiating defaulted debt was simply to bypass the Council by making a "take-it-or-leave-it" offer. Typically, a country would make such an offer to its creditors after a series of failed attempts to reach an agreement with the Council. Take-it-or-leave-it offers usually involved new debt issues being offered for conversion, which generally took many years to be accepted by a majority of creditors. It all depended on the nature of the offer, but there were cases where take-it-or-leave-it offers took ten years or more to be accepted by a majority of the creditors[3].

Independently of reaching agreement with the Council, a country could issue new debt for conversion. Furthermore, such new issues were traded on the stock exchange without distinction. More specifically, both Council-endorsed and non-Council endorsed newly issued debt were traded on the stock exchange under the single label of "assented" debt to differentiate it from old (defaulted) obligations which was labelled "unassented" debt.

Ideally, we would have wanted to compare the evolution of unassented and assented (hereafter: old and new, respectively) debt prices in the cases of both the

Council-agreed debt repayment offers and the take-it-or-leave-it offers. This exercise would have proved very helpful to our understanding of today's Brady-style agreements versus unilateral (take-it-or-leave-it) offers of the 1988 Mexico-Morgan style from the standpoint of the value such offers represent to both the creditors and the LDCs. Unfortunately, coherent data series on prices of old and new debts in the former case do not exist. This may reflect a rapid disappearance of old debt from the market after the Council had agreed to a country's debt repayment offer.

In contrast, data on debt prices for take-it-or-leave it offers is less difficult to obtain. Among the Latin American countries that made such offers were Bolivia, Chile, Colombia, Costa Rica, Guatemala, Mexico, and Peru (see Denburg, 1950). However, coherent data series are available for only a few of those countries. Figures 1 and 2 present the data for Chile and Colombia respectively.

FIGURE 1.
AVERAGE PRICE OF CHILIAN FOREIGN DEBTS (1928-1959)
(In cents per dollar of face value)

Source: The Commercial and Financial Chronicle.

FIGURE 2.
AVERAGE PRICE OF COLOMBIAN FOREIGN DEBTS (1928-1959)
(In cents per dollar of face value)

Source: The Commercial and Financial Chronicle.

These two data sets are strikingly similar and both reveal the following phenomena: First, prices of both old and new debts are the same, but then diverge and rise sharply once the country in question changes its repayment policy, in particular, when the country stops issuing new debt. Second, the price of both types of debts increases as the new debt approaches maturity and, in particular, when the country decides to redeem **all** its previously defaulted debts. We will next try to account for these two salient features of our data.

III. A SIGNALLING FRAMEWORK OF LDC DEBT VALUATION

Assume a two period model with two players: a defaulting LDC debtor (hereafter: the country) and its foreign creditors. At date t = 0 the country attempts to regain creditworthiness by making a "take-it-or-leave-it" debt-repayment offer which involves a new debt issue in the amount of X_0. Accepting such an offer implies that creditors surrender their original contractual claims and they are willing to sacrifice both interest and principal repayments against an early reimbursement b_1 (per unit of new debt) at date 1, plus a priority claim of b_2 at date 2. The latter will be paid out of the country's period 2 revenue θ and out of the country's foreign exchange reserves available at that date. At date t = 1, the country may decide (e.g. on the basis of new information concerning its level of foreign exchange reserves; see Section B below to make an additional debt issue in the amount X_1 under the same terms as Xo was previously offered. It should be noted that as long as all creditors have not accepted the country's offer of X_0 and X_1 there will be two types of debt, namely old and new. Finally, we will assume that at date t = 2, the country redeems all its old and new debts in order to restore full creditworthiness and again have access to the international capital markets.

The timing of the model is described by:

The country issues X_0 units of new debt.	The country reimburses b_1 on each new claim (out of its reserves R_1 in period 1). In addition, the country may decide to issue X_1 extra units of new debt which also pay b_1 in period 1.	The second-period revenue θ is realized. The country then uses this revenue plus its reserves available in period 2, R_2, in order to redeem old and new debts and thereby restore creditworthiness.

Suppose the old debt at t = 0 is held by identical creditors with utility function: $u(c_1,c_2) = c_1 + \delta c_2$, where $\delta \in (0,1)$ is the discount factor. We denote by D the total amount of outstanding (old) debt at the beginning of date t = 0.

The country's intertemporal behaviour will depend upon its available reserves in periods 1 and 2, upon the share of those reserves that must be devoted to domestic

consumption within the country at each period, and upon the net present value (NPV) of regaining access to the capital market, i.e. of restoring full creditworthiness. More precisely, we assume the following intertemporal utility function for the country:

$$\begin{cases} U(p,C,E) = C + \delta[p.W - E], \text{ when } C \geq \underline{C} \\ U(p,C,E) = -\infty \text{ when } C < \underline{C} \end{cases} . \qquad \textbf{(1)}$$

where:

— p is the probability of regaining access to the international capital markets in period 2;

— W is the NPV of regaining access to the international capital markets;

— C is period one consumption, which must be at least equal to the subsistence level $\underline{C}$;

(For simplicity we assume that second period revenues are always larger than $\underline{C}$, so that θ denotes the second period revenue **net** of the same subsistence level of consumption to be also guaranteed in period 2.)

— E is the expected cost of redeeming all foreign obligations outstanding and thereby regaining access to the international capital markets.

The probability *p* of regaining access to the international capital markets is endogenous in the model and defined by:

$$p = \text{probability}\left(\theta + \frac{R_2}{\delta} > D_2\right)$$

where:

— $R_2/\delta = R_1 - C - b_1X_0$ is the remaining amount of reserves held by the country at the beginning of period 2 (i.e., the amount of reserves the country is left with once it has consumed C and reimbursed b_1 per unit of assented claims in period 1);

— $D_2 = D - X_0 + b_2X_0$ is the remaining amount of debt to be honoured in period 2; and

— θ is the country's second-period revenue net of the amount of consumption $\underline{C}$ necessary for the country's subsistence constraint be satisfied in period 2. To simplify our analysis we assume that θ is deterministic, so that $p \in \{0,1\}$, although it is easy to extend our results to the case where θ is a random return (see note 5 below).

Now, if we assume that the newly issued debt becomes **senior** to the old, then the unit price of the former at the beginning of period 1 will be:

$$p_1^n = b_1 + \delta \min\left(b_2, \frac{\theta + R_2}{X_0}\right). \qquad \textbf{(2)}$$

If we denote by p_1^o the unit price of the old debt at the beginning of date t = 1, it must be true that $p_1^o \leq p_1^n$; otherwise no creditor would agree to hold new debt. On the other hand, the country will offer new debt at the minimum possible price to maximize its intertemporal utility. We then have in equilibrium:

$$p_1^o = p_1^n . \qquad \textbf{(3)}$$

a. Perfect information

Here we assume that the country's reserves R_1 are publicly known in period 1. We can actually provide an explicit expression for the unit price of old debt p_1^o:

$$p_1^o = \delta \cdot \frac{1}{D - X_0} \min\left(D - X_0, \quad \theta + R_1 - b_1 X_0 - C - b_2 X_0\right). \qquad \textbf{(4)}$$

$$D_2 \qquad\qquad R_2$$

Now, assuming that W, the NPV of regaining access to the capital markets is sufficiently large, the optimal policy for the country to follow is:

$$R_1 - b_1 X_0 = \underline{C} \qquad (\text{i.}e., \quad R_2 = 0) . \qquad \textbf{(5)}$$

More precisely, by increasing X_0 the debtor country will increase its probability p of regaining access to the international capital markets, since $b_2 < p_1^o \leq 1$.[4] This in turn will increase the country's utility whenever $\delta W > 1$. On the other hand, the country cannot violate its subsistence constraint by committing itself to an excessive amount of debt repayments in period 1. Hence equation (5) above.

Going back to the no-arbitrage condition (3) between new and old debt, we can easily see that this condition, together with the seniority assumption on new debt, implies that:

$$b_2 < \frac{\theta + R_2}{X_0} = \frac{\theta}{X_0} . \qquad \textbf{(6)}$$

Indeed, in a situation in which (6) were violated, the price of old debt p_1^o would be equal to zero. However, this cannot be an equilibrium because all creditors would strictly prefer to agree to the country's offer at any price $p_1^n > 0$. This, in turn, implies that the

country could afford to lower b_2 and still make it attractive for creditors to agree to such a debt repayment offer. This establishes the above inequality (6).

The second period return b_2 on new debt will then be determined by the equation:

$$\begin{cases} \dfrac{R_1 - \underline{C}}{X_0} + \delta b_2 = \delta \dfrac{\theta - b_2 X_0}{D - X_0}, \quad \text{if } p_1^o = \delta \dfrac{\theta - b_2 X_0}{D - X_0} \\ \qquad P_1^n \\ \qquad\qquad \text{or} \\ \dfrac{R_1 - \underline{C}}{X_0} + \delta b_2 = \delta, \quad \text{if } p_1^o = \delta. \end{cases} \qquad \textbf{(7)}$$

b. Asymmetric Information

Suppose now that $R_1 \in \{\underline{R}, \bar{R}, \bar{\bar{R}}\}$, with R_1 being **privately** known by the LDC country in period 1. We assume that $\underline{R} < R < \bar{\bar{R}}$ and that creditors have prior probability beliefs $\underline{q} = \bar{q} = \bar{\bar{q}} = ⅓$. Furthermore, we assume that $R + \theta - \underline{C} > D$, i.e. that all the outstanding debt D in period 0 could be entirely repaid in period 2 if $R = \bar{\bar{R}}$.

In period 0, we assume that the debtor country chooses both the amount X_0 of debt it wants to issue, and the first period return b_1 on newly issued debt in such a way that it never defaults on its repayment offer (e.g. we are assuming here that defaulting on newly issued debt would be too costly in terms of reputation). Then we have: $\underline{R} - b_1 X_0 = \underline{C} < R - b_1 X_0 < \bar{\bar{R}} - b_1 X_0$. This means that in period 1, if the country learns that $R > \underline{R}$, it may choose to issue an additional amount of new debt X_1 which, by the same arbitrage condition as above, would be offered at price:

$$p_1^n = b_1 + \delta b_2 = p_1^o .$$

The main idea underlying the following analysis is that the amount X_1 of newly issued debt in period 1 may signal the true amount of reserves R_1 to the country's creditors and thereby affect the prices of new and old debts in period 2. Assuming that W is sufficiently large that the country would be ready to issue a maximum amount of debt so as to increase its prospects of regaining access to the capital market, we look for an equilibrium where:

1) $R_1 = \underline{R} \Rightarrow X_1 = 0$ because $\underline{R} - b_1 X_0 = \underline{C}$.

2) $R_1 = \bar{R} \Rightarrow X_1 = \dfrac{\bar{R} - b_1 X_0 - \underline{C}}{b_1}$ in order to maximize probability of regaining access to the capital market[5].

3) $R = \underline{R} \Rightarrow X_1 = 0$, because in any case the probability of regaining access to the capital market is equal to one, and furthermore the country does not want to sacrifice present consumption for future consumption. (This will typically be the case if δ is sufficiently small.)

Assuming that the equilibrium defined by 1), 2), and 3) exists (which will be established in the following Proposition) we can describe the evolution of prices following the country's decision **not** to issue any new debt in period 1 (i.e., the decision to set $X_1 = 0$), as follows:

Having observed $X_1 = 0$, the creditors will infer that $R_1 = \underline{R}$ with probability q and $R_1 = R$ with probability (1-q), where by Bayes rule:

$$q = pr(\underline{R} \mid X_1 = 0) = \frac{pr(X_1 = 0 \mid \underline{R})\, pr(\underline{R})}{Pr(X_1 = 0 \mid \underline{R})\, pr(\underline{R}) + pr(X_1 = 0 \mid \bar{R})\, pr(\bar{R}) + pr(X_1 = 0 \mid \bar{R})\, pr(\bar{R})}$$

$$= \frac{\frac{1}{3}}{\frac{2}{3}} = \frac{1}{2} = 1 - q\,.$$

Then the unit price of old debt will become equal to:

$$\hat{p}_1^{\,o} = \frac{\delta}{2}\left[\frac{\theta - b_2 X_0}{D - X_0} + 1\right] \qquad \textbf{(8)}$$

whereas prior to the country deciding **not** to issue any new debt, this price was equal to:

$$p_1^{\,o} = \frac{\delta}{3}\left[\frac{\theta - b_2 X_0}{D - X_0} + \frac{\theta - b_2 (X_0 + X_1)}{D - X_0 - X_1} + 1\right]. \qquad \textbf{(9)}$$

When D is large compared to $\bar{R}$ (i.e. to X_0 and X_1), we have therefore:

$$\hat{p}_1^{\,o} > p_1^{\,o}\,.$$

As for the evolution of new debt prices before and after the country's decision to set $X_1 = 0$, we have:

$$(a) \quad \text{prior to } X_1 = 0: \quad p_1^n = p_1^o \tag{10}$$

$$(b) \quad \text{after } X_1 = 0: \quad \hat{p}_1^n = p_1^n \text{ since in any case} \tag{11}$$

creditors that agreed were guaranteed a return b_2 on each new bond in period 2. **Therefore**: $\hat{p}_1^n < \hat{p}_1^o$, as described by our data.

It remains to be shown that for an appropriate choice of θ, the country would indeed choose:

$$X_1 = 0 \text{ if } R_1 \in \{\underline{R}, \bar{R}\} \text{ and } X_1 = \frac{\bar{R} - b_1 X_0 - \underline{C}}{b_1} = \bar{X} \text{ if } R_1 = \bar{R}.$$

First, if $R_1 = \underline{R}$, we know that the country can simply not afford to choose $X_1 > 0$ without putting its subsistence in period 1 at stake. Suppose now that $R = \bar{R}$. Then, if we denote by $u(X_1|R)$ the country's intertemporal utility when its reserves are equal to R and the country converts into new bonds the additional amount of debt X_1 in period 1, we want to show:

$$u(X_1 = 0 \,|\, \bar{R}) > u(X_1 = \bar{X}_1 \,|\, \bar{R}).$$

Using the fact that:

$$u(X_1 = o \,|\, \bar{R}) = \bar{R} - \underline{R} + \underline{C} + \delta [W - b_2 X_0 - (D - X_0)]$$

and

$$u(X_1 = \bar{X}_1 \,|\, \bar{R}) = \bar{R} - \bar{R} + \underline{C} + \delta [W - b_2 \bar{X}_1 - b_2 X_0 - (D - \bar{X}_1 - X_0)],$$

the above inequality can be rewritten:

$$\bar{R} - \underline{R} + \delta b_2 \bar{X}_1 - \delta \bar{X}_1 > 0$$

which is satisfied if the country is sufficiently impatient, i.e. if δ **is sufficiently small**.

Now suppose that $R = \bar{R}$: We want to show:

$$u(\bar{X}_1 \,|\, \bar{R}) > u(0 \,|\, \bar{R}), \text{ which can be rewritten:}$$

$$\underline{C} + \delta\left[W - b_2\bar{X}_1 - b_2X_0 - (D - \bar{X}_1 - X_0)\right]$$

$$> \bar{R} - \underline{R} + \underline{C} + \delta\left[-b_2X_0 - (D - \bar{X}_1 - X_0)\right]$$

provided the second-period revenue θ is such that:

$$\begin{cases} \bar{R} + \theta - (X_0 + \bar{X}_1)(b_1 + \delta b_2) - \underline{C} > D - X_0 - \bar{X}_1 \\ \qquad \text{and} \\ \bar{R} + \theta - X_0(b_1 + \delta b_2) - \underline{C} < D - X_0 \end{cases}$$

[It suffices to assume that $\theta = D + (b_1+\delta b_2-1)X_0 + \underline{C} - \underline{R} - \varepsilon$, where ε is positive but sufficiently small.]

Then for W sufficiently large, we have[6]:

$$u(\bar{X}_1 \mid \bar{R}) > u(0,\bar{R}).$$

Hence:

Proposition: When δ is sufficiently small and W is accordingly sufficiently large, then there exists a semi-separating equilibrium in which the debtor country chooses:

(a) $X_1 = 0$ if $R \in \{\underline{R},\bar{R}\}$

or

(b) $X_1 = \bar{X}_1 > 0$, if $R = \bar{R}$.

IV. CONCLUDING REMARKS

This paper has provided historical evidence on sovereign debt prices when repayment programmes involve the issuing of new securities to replace old (defaulted) obligations. It was striking that in Chile and Columbia, the two countries considered, the evolution of debt prices followed similar patterns from the start of repayment programmes in the 1930s to maturities in the 1960s. In particular, the data for both countries revealed the following salient features: (a) prices for defaulted and newly issued debts were the same, but then diverged and rose sharply when the country stopped issuing new debt, and (b) the price of defaulted and newly issued debts both increase as the latter approaches maturity.

These phenomena have been analysed in a simple two-period signalling framework in which the level of foreign exchange reserves for making debt repayments is private information of the debtor country. Creditors have prior views about the actual level of those reserves which are updated when they see a change in repayment policy by the debtor country. In particular, when creditors observe that the country stops issuing new debt, prices for both defaulted and newly-issued debts rise and diverge markedly, as we have shown in the data. The explanation is that this change in repayment policy signals that future foreign exchange levels in the country will be relatively higher than their present level. Therefore, prior estimates are revised upwards and, consequently, prices (of both old and new debts) rise sharply. At the same time, the model accounts for the divergence of old and new debt prices, notably, by showing how the informational value embodied in the country's shift in repayment policy is higher for those creditors expecting "full" repayment out of future reserves (creditors holding old claims) than for those who are already being partially repaid (creditors holding newly created debt).

The historical foreign debt settlements analysed in this paper closely resemble those of today. These all boil down to converting old (originally contracted) debt into new debt, thereby making the former junior to the latter. We have shown that as long as such conversion schemes continue, creditors will attach the same value to both types of claims, that is junior and senior debt prices will be the same. However, this will no longer be true when a country decides to stop issuing new debt. Such a decision has been modeled in this paper as a "hidden" default decision; i.e. the country can no longer afford to honour its debt repayment offer and therefore decides to end the conversion scheme.

To the extent that open defaults may embody prohibitive costs which are shared by both the creditors and the LDC debtors, it is important to know whether there is scope for hidden defaults to occur under the conversion schemes of current debt-relief programmes. Do Brady-type conversion schemes leave sufficient room for manoeuvre for LDC governments to adopt hidden default policies?

Another issue raised in the analysis is the behaviour of debt prices at maturity. We have pointed out that such prices will overshoot at maturity, and, this too is a phenomenon related to the informational content of a country's repayment policy. A "hidden" default policy, in particular, boils down to postponing debt repayments. However, at future dates the country in question will be able to compensate the creditors. This result

contrasts sharply with the option-pricing approach to LDC debt valuation in which prices of sovereign debt fall at maturity because at that date the country concerned must make a "bullet" payment out of current reserves.

A last comment concerns this paper's emphasis on decision making by countries on the timing of debt reimbursement. In order to develop a reasonable model, we have assumed creditors are homogeneous and abstracted ourselves from the creditors' decision-making, which will of course depend on their different degrees of impatience. If we allow for heterogeneity among creditors the problem is how different elements, such as the pattern of agreements, can be fitted into the valuation framework we have presented here.

NOTES

1. See, for example, Gennotte, Kharas, and Sadeq (1987), Bulow and Rogoff (1988), Dooley (1989), Krugman (1989), Cohen (1989), and Cohen and Portes (1990)

2. The Council's full name is The Bondholders Protective Council, Inc., a private institution created in the early 1930s under the auspices of the US Secretary of State. It was inspired by the Corporation of Foreign Bondholders, the London-based institution which had been representing the British creditors since the 1830s. (For more details see Eichengreen and Portes, 1988b.)

3. See Armendariz de Aghion (1990a).

4. Unless the amount $\theta+R_1$ is so large that no matter what the amount of new debt X_0 is, the country regains access to the capital market with probability one, which we *a priori* exclude in this section.

5. We have:

$$p = \begin{cases} 1, \text{ if } \bar{R} + \theta - b_1 X_0 - b_1 X_1 - \delta b_2 X_0 - \delta b_2 X_1 - \underline{C} > D - X_0 - X_1 \\ 0, \quad \text{otherwise}. \end{cases}$$

Given that $b_1+\delta b_2 \leq p_1^o \leq 1$, the above probability is more likely to be equal to 1 if X_1 is maximal. The model can easily be extended to the case where θ is a random variable continuously distributed on some interval, $(\underline{\theta}, \theta)$. In that case the probability p can be shown to be increasing in X_1. This in turn implies that for W sufficiently large, the country will choose $X_1 = \bar{X}_1$ in period 1 if $R = \bar{R}$.

6. Had we assumed the second-period revenue θ to be random and, for example, continuously distributed over some interval $[\underline{\theta},\bar{\theta}]$, then for W sufficiently large we would automatically have: $u(\bar{X}_1,\bar{R}) > u(0,\bar{R})$, due to the probability p being increasing in X_1 in that case.

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