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DO THE SECONDARY MARKETS BELIEVE IN LIFE AFTER DEBT

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Do the Secondary Markets Believe in Life After Debt?

by

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0. Abstract

This paper employs panel-data econometric techniques to explore the relations between measures of creditworthiness and the debt discounts on the secondary market. It investigates empirically whether the secondary market discounts reflect a history of past repayments problems or whether they anticipate future debt crises. The answer to this question has implications about the desirability of debt relief. The main finding is that the secondary markets do not seem rapidly to absorb economic information, which suggests that they are still in their evolutionary stage and are not yet very efficient. The estimated models are also used to analyze other issues in the international finance literature, such as whether large surpluses by the oil-exporting nations affected significantly the international lending markets after the first major oil-shock, the question of "liquidity vs. solvency," the degree to which discrepancies between official and black market exchange rates can predict future financing problems, and the importance of world factors exogenous to a country in causing debt crises. Finally, the models are used to investigate the stability over time of the processes that determine external debt repayments problems.

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1. Introduction

The recent literature on external debt repayments problems of LDC's places primary emphasis on the issue of "debt overhang" (see *inter alia* Krugman (1987), Sachs (1986)). This term refers to outstanding external debt amassed in the past that exceeds a country's expected ability to repay it. These authors build theoretical models that highlight the importance of debt overhang and derive policy implications about the desirability of forgiving or refinancing such debt. Figures 1 to 3 illustrate that the external financing problems of the developing nations have indeed been worsening steadily since the first major oil shock of 1973 and have also been affected adversely by the second major oil shock in 1978. Moreover, the figures suggest that we may now be experiencing a substantial world debt crisis, since the problems have been accelerating.

Figure 1 contrasts the rapidly mounting outstanding external debt of the countries under investigation with the only mildly rising quantity of debt actually serviced. The gap between obligations and repayments is widening alarmingly. Figure 2 makes the same point by showing the fraction of debt–servicing obligations that are in arrears in each year. Figure 3 presents a similarly bleak picture, by showing that the proportion of countries under analysis that are experiencing a repayments problem of some type (for example, obligations in arrears, or a need to request IMF assistance or a rescheduling of repayments) exhibits the same deteriorating pattern.

There remains, however, a clear need for an empirical investigation of the mounting external financing problems of the LDC's and of the theoretical propositions of the debt overhang literature regarding such problems, in order to shed some light on the relative merits of the various arguments and policy implications concerning the desirability of debt forgiveness or refinancing. This paper attempts to meet such a need by employing panel–data econometric techniques. One specific issue it examines is whether a case for external debt relief can be made by exploring the relations between measures of creditworthiness and the debt discounts on the secondary

market. It investigates empirically whether the discounts on the secondary market reflect a history of past repayments problems or whether they anticipate future debt crises. The answer to this question has implications about the desirability of debt relief. For example, a situation of debt overhang is commonly referred to as being "on the wrong side of the Laffer curve." This implies that forgiving part of the outstanding debt will eventually lead to a higher value of debt being repaid by a country. The precise way this may happen is typically left unspecified. One possible mechanism that may make partial forgiveness appealing to the international lenders is the following. If the secondary market discount is a good predictor of future debt problems and not merely a reflector of such problems of the past, then debt relief, in possibly averting anticipated problems, may reduce the secondary market discounts and thus increase the value of the debt held by the international lenders.[1/]

The fact that the secondary markets have been in operation for less than three years constrains severely the type of econometric analysis that is feasible in attempting empirically to investigate these questions.[2/] The approach we develop here is to employ the econometric creditworthiness methodology in Feder and Just (1977), McFadden et al. (1985), and Hajivassiliou (1987). The constructed indicators of creditworthiness are then used to investigate whether the secondary market discounts anticipate or follow economic performance measures.

Section 2 presents descriptive econometric models of creditworthiness that serve as the basic framework for the empirical analysis of the paper, and it summarizes the key empirical results of these models. Several issues in

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[1] The issue of whether a case for debt relief can be made through the secondary market discounts is also investigated by Cohen (1989).

[2] It is not possible, for example, to use direct "reduced form" econometric models and try to explain statistically the discounts as a function of economic performance variables.

international finance are investigated, such as the question of "liquidity vs. solvency," the degree to which discrepancies between official and black market exchange rates can predict future financing problems, and the importance of world factors exogenous to a country in causing debt crises. We also investigate whether large surpluses run by the oil–exporting nations significantly affect the international credit markets. These models are then tested for structural breaks following major external events, like the 1973 oil shock and institutional changes in meeting the debt crisis in the early 1980's. In the same section, we construct indices of exchange rate over–valuation, based on discrepancies between black market and official exchange rates, and examine whether overvaluation acts as one of the precursors of debt crises. Econometric methodological issues are discussed in Appendix 1.

Section 3 discusses the estimation results and some of their implications for policy. We show that, as expected *a priori*, reliable econometric inferences on these issues requires explicit accounting for unobservable persistent heterogeneity among nations as well as for the impact on bankers' perceptions of a history of bad debt performance. Section 4 attempts to evaluate the significance of world economic factors, exogenous to developing countries, in precipitating crises. Examples of such factors include measures of imports by industrialized countries, inflation in the OECD nations, and world interest rates. The findings are important for policy–related questions that address the "adjustment efforts" by LDC's and the distinction between economic mismanagement and adverse world developments that are beyond the control of country administrators. Section 5 examines the econometric stability of the models after the major oil shocks of the 1970's and after 1981, the last year of observation of most past studies of creditworthiness in the literature.

Section 6 discusses the issues related to debt overhang and describes some of the characteristics of the recently developed secondary market for outstanding

LDC debt. I attempt to answer the question of whether the discounts observed on this market are routinely reflecting past debt problems or anticipating future crises. The implications of our findings are explored.

Section 7 offers some concluding remarks. Data sources, construction of variables, and descriptive statistics are presented in Appendix 2.

2. Econometric Models of Creditworthiness

Reduced–form descriptive econometric models were estimated in Feder and Just (1977) to quantify the determinants of LDC's external financing problems. In particular, binary logit models (McFadden (1973)) were employed to explain the dichotomous variable y_{it}

$$y_{it} = 1 \quad \text{if a debt problem occurs in country i in year t}$$
$$= 0 \quad \text{otherwise,}$$

as a (linear) stochastic function of k exogenous explanatory variables x_{it}, with the index $i=1,\ldots,I$ denoting country and $t=1,\ldots,T_i$ year of observation. McFadden et al. (1985) and Hajivassiliou (1987) present more structural credit–rationing models that incorporate refined measures of the degree of severity of debt crises. Moreover, these studies address important methodological issues arising from the fact that differing country characteristics, such as colonial histories and political, financial, and religious institutions, imply the presence of unobserved persistent country heterogeneity. Appendix 1 discusses these issues from an econometric perspective and presents econometric methodologies appropriate to address them (see also Hajivassiliou and McFadden (1988)).

Let us begin with an empirical motivation for the econometric models to be presented. Information on three primary indicators of debt repayments problems was compiled: (1) confidential data on external debt obligations in arrears; (2) the occurrence of a rescheduling agreement between the debtor nation and the international bankers; and (3) programs of IMF involvement, such as stand–by

agreements of a high tranche level. Table 1 presents the empirical evidence on transitions between these types of difficulties. Each transition from the state in the previous year to the one in the current year is given in three different ways. The actual number of country–years with such a transition is presented first; then in parentheses the column percentage appears, the percentage of transitions into a given current problem; lastly, in square brackets we give the row percentage, the percentage of all types of ensuing states that emanate from a specific type of problem in the previous year.

As can be seen from the table, arrears can be viewed as the mildest form of problem and seem to act as a reliable predictor of more severe crises. For example, we see that of the 952 country–years without a repayments problem in one period, nearly 5% had their obligations go into arrears in the following period, as opposed to a *combined* total of 7% that approached the bankers or the IMF for assistance. Moreover, more than 90% of countries with significant arrears in their obligations either maintain this situation the following year or experience a more severe multitude of repayments problems (a combination of arrears, IMF or reschedulings). In contrast, only 70% (60%) of countries currently having only an IMF agreement (rescheduling) in effect either maintain their status or have more than one type of repayments problems in the following year. These latter two types of problems thus seem to indicate a rather more severe type of debt crisis, as they are typically accompanied by more than one other type of repayments difficulty. Another way of highlighting these stylized facts is to note that of the 51 country–years exhibiting a severe crisis with all three types of difficulty present, 20% had only significant arrears in the previous period, 14% had significant arrears accompanied by an IMF agreement in effect, and 45% had a severe crisis in the previous period as well. In only 9 cases was a severe crisis preceded by a rescheduling or IMF involvement without any arrears present. These features of repayments difficulties will guide our econometric modelling below.

To explain the basic models we will use in this paper to quantify creditworthiness, denote by y^*_{it} the latent (unobserved) propensity of country i to have a debt problem in period t. We model this as a linear, stochastic function of observable country characteristics, past history, world conditions, and other relevant factors, measured by a vector x_{it}:

$$(2.1) \qquad y^*_{it} = x'_{it}\beta + \epsilon_{it} .$$

In the credit rationing models of Eaton and Gersovitz (1981), McFadden et al. (1985), and Hajivassiliou (1987), y^*_{it} is directly related to the gap between notional demand for and supply of new funds to the economy. When the debt–crisis propensity exceeds some threshold, normalized to 0, we observe the realization of an external financing problem, which I indicate by

$$(2.2) \qquad \begin{aligned} y_{it} &= 1 \quad \text{iff } y^*_{it} > 0 \\ &= 0 \quad \text{otherwise.} \end{aligned}$$

This is the threshold crossing model.

Denoting the cumulative distribution function of the error term ϵ_{it} by $F_\epsilon(.)$, we can calculate the probability of a financing crisis as

$$(2.3) \qquad P(y_{it}=1) = F_\epsilon(x'_{it}\beta) .$$

Under the specific distributional assumption of normality for the error term ϵ_{it}, we have what is known as the *probit* binary response model. Expression (2.3) will serve as a simple indicator of lack of creditworthiness of country i in period t. In the sequel, we will define our binary variable indicating the presence of repayments problem, y_{it}, by a combination of one or more of the following types of

difficulties: "significant" arrears in the debt repayments obligations, an IMF stand–by agreement of a high tranche level or an extended–fund–facility agreement, or procedures to implement an agreement of a rescheduling of debt obligation initiated by a country and its international creditors.[3]/

An alternative measure of creditworthiness that relies on a 3–regime rationing model developed in McFadden et al. (1985) and in Hajivassiliou (1987) is defined as follows: Two distinct thresholds, θ_0 and θ_1, on the range of the debt crisis propensity, y^*_{it}, determine the regime for economy i in year t. Define an indicator variable y_{it} by:

$$(2.4) \qquad \begin{aligned} y_{it} &= 0 \quad \text{if} \quad y^*_{it} < \theta_0 \\ &= 1 \quad \text{if } \theta_0 \leq y^*_{it} < \theta_1 \\ &= 2 \quad \text{if } \theta_1 \leq y^*_{it} \ . \end{aligned}$$

This model, known as a model of ordered response, will be estimated by imposing necessary assumptions about the distribution of the error term. Assuming normality as above, we will have the *ordered probit* model. This model is used to capture some of the features identified in the transition matrix of Table 1, by defining y_{it}=0 to indicate a "no crisis" situation, y_{it}=1 to stand for a "mild" crisis, and y_{it}=2 to represent a "severe crisis". For example, recognizing the importance of significant arrears as a precursor of more severe repayment crises, we define a "mild crisis" as the presence of only significant arrears in a county's obligations, and characterize a severe crisis as one with IMF involvement or rescheduling.[4]/

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[3] See the data appendix for precise definitions of these variables.

[4] Another generalization we also investigated was a four–regime model, where the severity of a repayment crisis is described by the number of different types of external financing difficulty a country experiences. The results are qualitatively similar to the ones of the 3–regime models and are not reported separately.

A third measure of creditworthiness based on even more information can also be obtained by using censored regression models. Again suppose that (2.1) measures the propensity of a country to experience a debt–repayments problem with y^*_{it} measuring the excess demand gap for external funds. Suppose further that a strictly positive excess demand gap will manifest itself in the country's letting repayments obligations go into arrears, whereas no arrears will be observed for a country that is experiencing no repayments problem.[5/] In this vein, if y_{it} denotes observed arrears, we have the censored regression model

$$(2.5) \qquad \begin{aligned} y_{it} &= y^*_{it} && \text{if } y^*_{it} > 0 \\ &= 0 && \text{otherwise.} \end{aligned}$$

Since in this model the full extent of the crisis is observed in the form of the level of arrears when these are strictly positive, more information is utilized here than in the threshold crossing model (2.2). As a result, the creditworthiness indicator based on (2.5) will be more accurate than the analogous indicator based on (2.3). We will impose normality assumptions on the censored regression model, and hence we will be estimating a *Tobit* model.

Versions of all three types of models are estimated for a panel set of data of 109 developing countries observed through the years 1970–1986. The preferred specifications are then used to construct creditworthiness indicators. The final step is to investigate whether such creditworthiness indicators exhibit any links to secondary market discounts as discussed in Section 6 below.[6/]

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[5] Some qualifications to this modelling are set out in Hajivassiliou (1987).

[6] Note that the more structural credit–rationing econometric model developed in Hajivassiliou (1987) will not be employed in this paper, because our main objective will be to examine any predictive links between creditworthiness indicators and secondary market discounts, for which the "reduced form" approach taken here will suffice. Identifying the specific parameters of demand and supply functions is not of primary interest in this study.

In the econometric implementation of these models, it is important to allow explicitly for unobservable, persistent heterogeneity among nations, as well as for the impact on bankers' perceptions of a history of bad debt performance. This is done by using the so–called "random–effects" panel–data methodology. See Appendix 1 for details. As we will see below, our expectation that such heterogeneity is important is strongly confirmed by our findings.

3. Empirical Results

The main results of the basic creditworthiness analysis appear in Tables 2 and 3 and can be summarized as follows. In all versions of the 3 models estimated, binary probit, 3–regime ordered probit, and tobit, the signs of the coefficients of the explanatory variables exhibit considerable stability and are mostly as expected, when the estimated coefficients are statistically significant.[7]/

Our results are uniformly strong with respect to the importance of information on past repayments problems. All types of variables that signal past problems (presence of significant arrears in interest, presence of significant arrears in principal, presence of either rescheduling agreement or IMF involvement [8]/) are positive and significant in each of the models in predicting future repayments problems. This importance of history of past bad debt performance, though somewhat weakened, is still preserved by the introduction of persistent unobserved heterogeneity among countries.

Our prior expectations of the importance of both unobservable persistent

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[7] Some versions of the 3–regime ordered probit model were also attempted, with the "mild crisis" case defined by the sole presence of an IMF involvement. The results of these trials were uniformly less strong compared to the specifications we report here in which arrears characterize the middle regime.

[8] One may find the positive effect of past IMF involvement to be rather surprising since one would expect the financial discipline imposed on a country through a conditionality–related IMF arrangement to be considered valuable by international lenders. The puzzle may be resolved, however, once one recognizes that our reduced–form specifications cannot separately identify banker from country behaviour.

heterogeneity among nations, and the impact on bankers' perceptions of a history of bad debt performance, are strongly confirmed. This can be seen throughout Tables 2 and 3. These tables show that allowing for heterogeneity does not eliminate the effect of history, though it predictably reduces history's significance somewhat. This also corroborates previous findings by McFadden et al. (1985), Hajivassiliou (1987), and Hajivassiliou and McFadden (1988). One other interesting related finding is that once we condition on information about repayments problems in the immediately preceding period, the cumulated number of past problems is not statistically very important.

The coefficient of the ratio of reserves to imports is generally small, negative as expected, and statistically significant. The coefficient on the debt–to–exports ratio is small but has the expected positive sign. The ratio of interest service due to exports has a significant and positive effect on the propensity to encounter debt repayments problems, while the ratio of principal service due to exports, even though generally less significant, has a negative sign. This evidence mildly favours the "solvency" hypothesis. Since the ratio of total outstanding debt relative to exports appears strongly significant, the liquidity hypothesis would predict positive coefficients for both interest and principal due, because of the implied deleterious effect of shortening average maturities. That we typically find a *negative* effect of principal due lends weak support to the "solvency" view by rejecting the liquidity view. It is interesting to note that attempting to pool interest and principal repayments due into a single debt–service–due variable is statistically very strongly rejected; debt service due appears to be insignificant.

The estimated models in Table 2 can shed some light on another important policy issue: Is an overvalued exchange rate[9]/ one of the fundamental causes of

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[9] possibly leading to a capital flight in anticipation of an imminent devaluation

external financing problems, or is overvaluation a very costly distortion that *arises from* very high levels of external indebtedness? One way to investigate this issue is to construct a measure of overvaluation and test whether it exhibits any predictive power in our models of (lack of) creditworthiness. Our over–valuation measure is based on a discrepancy between official and black market exchange rates. Simple econometric causality tests are carried out to test statistically whether overvaluation precedes or follows external debt problems. Such tests are not conclusive and hence are not able reliably to distinguish between the competing claims. With these caveats, note that we were never able to obtain any statistically significant predictive power of the overvaluation index in anticipating future crises nor did we find any effect in the reverse direction. The level of the overvaluation index neither Granger–causes debt crises, nor is it caused by them. Since these findings may be a direct result of inadequacies in the constructed overvaluation measure, the issue is still open.

4. Adjustment Efforts vs. Exogenous Causes of Debt Crises

Another issue I analyze using the estimated models is the importance of world economic factors, which are exogenous to a developing country, in explaining the occurrence of external debt repayments problems. Such factors include the volume of import demand by industrialized countries, inflation in the OECD nations, and world interest rates. The findings have important policy implications on LDC "adjustment efforts" to stave off external financing crises. It is important to distinguish between economic mismanagement and unwillingness to implement policies that would ease the external financing requirements and adverse world developments that are beyond the control of country administrators and for which it is deemed unfair to penalize the country.

After controlling for a country's flow of exports and the amount of interest repayments, we find that such world factors do not have any significant additional

explanatory power. To be more specific, neither the 3–month nor the 6–month LIBOR is statistically significant in the estimations. The same holds true in general for the oil–exporting countries' current account surplus and their level of international reserves, as well as for the current account surplus of industrialized countries. The only notable exception is inflation in the industrialized countries, which in some estimated versions of the models marginally *reduces* the likelihood of future problems. This finding, albeit statistically weak, may be explained if this inflation is associated with a loosened monetary policy by the authorities in the industrialized countries, which leads to an easing of the credit conditions in international markets. Similarly, one might expect a higher LIBOR to increase financing problems for LDC's even after controlling for the implied higher interest repayments obligations, if higher LIBOR signifies restricted world liquidity. The presence of such an effect was not confirmed by our estimations.

5. Stability of Creditworthiness Models over Time

Table 4 presents the results of investigating whether structural breaks occurred in the processes determining repayment problems over time. One popular view attributes part of the blame for the LDC repayments problems to the glut of "petrodollars" after the first 1973 major oil–shock. We find only weak evidence that such a structural break occurred in the estimated relationships. Similar tests were carried out to examine the importance of the second major oil shock of the late 1970's in causing structural instability of the econometric models. The evidence strongly rejects this hypothesis.

Another possibility we investigate is that a structural break occurred after the much greater institutional involvement that followed the onset of defaults beginning in 1982. We find that the probabilities of repayments problems seem to have worsened after 1981. See the significantly positive POST1981 dummy variable

in Table 4 and the marginally significant likelihood ratio, which suggests a structural break after 1981. This year also coincides with the last period of observation of most previous studies of creditworthiness. Hence, it may be misleading to attempt to extrapolate the findings of such studies to cover recent developments without incorporating recent data in the estimations.

6. The Secondary Market for LDC Debt

Several authors have recently explored the theoretical and policy implications of debt overhang, a situation in which external debt amassed in the past exceeds the normal abilities of a country to repay.[10]/ Krugman (1987) builds models showing that it may be in the interest of international lenders to keep refinancing such loans at higher interest rates to reflect the increased risk of basic underlying insolvency. The creditor's hope is that the debtor's fortunes may unexpectedly turn dramatically for the better, in which case the loans will be repaid. This is a formalization of Keynes' famous dictum that "if you owe your banker one hundred pounds you are at his mercy; if you owe him a million, *he* is at *your* mercy."

A conflicting consideration, however, is that the interest rate on the refinanced loans should not rise to discouragingly high levels. Amassed external debt that exceeds by far the ability of a country to repay has been blamed by several authors for introducing possibly severe distortions in the operation of a country's domestic economy. For example, according to Sachs (1986), a very serious consequence of debt overhang is that it discourages domestic investment. Public investment declines because of the bad state of governmental finances, and private investment is then caught in a vicious circle with dwindling public investment causing a deterioration of infrastructure necessary for private

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[10] See primarily Krugman (1987) and Sachs (1986).

enterprise. For these reasons a debt overhang situation is commonly referred to as a country lying on the "wrong side of the Laffer curve." Partial debt relief may be a sensible option for creditors in such a case, because the total value of the debt they will eventually recover may be higher than in the absence of relief.

To investigate this issue, we can employ the econometric framework developed in the preceding sections and relate it to information on discounts at which external debt trades on the secondary markets. Part of our maintained hypothesis will be that the econometric indicators of creditworthiness we have constructed reflect the relevant actual repayments profiles of countries and therefore can be used to predict future repayments problems. If the secondary markets are backward looking and only reflect past performance, then their economic efficiency is rejected. Today's conditions would then not feed into secondary market discounts right away, even though such events clearly may have implications about future creditworthiness. In such a case, an incentive would exist for a debt facility to buy back debt and forgive part of it, because the operator of the facility might believe that investment will respond favourably to forgiveness and alleviate the overhang. Alternatively, if the secondary market discounts can successfully anticipate future repayments problems, the bankers might find partial debt relief to be an attractive option. Then partial relief may reduce the likelihood of a future debt crisis and hence possibly raise the value of the debt held by the bankers, if it leads to sufficiently lower discounts.

To complete the argument, suppose now that we change our maintained hypothesis and take for granted that the markets are efficient; they are able to incorporate quickly new information. Given this maintained hypothesis, i.e., that they price the assets to reflect rapidly the relevant economic information, one should expect the secondary market discount also to be able to anticipate future repayment performance. Then correlating creditworthiness indicators and discounts would be implicitly testing whether the indicators we constructed are good

proxies, and just how well they do in anticipating future debt–servicing capacity. The structural stability and high predictive ability of our models, reported in the previous sections, give some hope that the power in being able to separate the two hypotheses is relatively high. Therefore finding that the secondary market discounts are only weakly correlated with measures of the probability of future repayments crises would suggest significant inefficiencies in these markets in absorbing information. This might then suggest, of course, that countries would have an incentive to buy back their own debt because they can realize that debt is undervalued and that the markets do not appropriately value their true creditworthiness.

A problem we want to acknowledge directly is that our reduced form indicators may reflect an incipient liquidity problem or a more fundamental long–term insolvency problem.[11]/ Since the secondary market is pricing an asset, it ideally will reflect the anticipated lifetime stream of income of the asset and not necessarily short–term adverse income effects. Given the large information set used in constructing the indicators, however, I am confident that they are able to reflect long–term problems as well.

The recent burgeoning of unilateral debt actions by major LDC borrowers helps to explain much of the significant discounts at which LDC debt is valued on the secondary markets.[12]/ Some descriptive statistics on secondary market discounting of the outstanding debt of 35 nations appear in Figure 4 for 1986 and 1987. The range is quite dramatic, with the debt of "bad risks" like Nicaragua and Sudan commanding less than 5 cents for each dollar, while the debt of financially

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[11] Recall that our findings were not able to resolve this issue unambiguously.

[12] Although the secondary market price of LDC debt held by international banks is not a perfect guide to more general market sentiments concerning LDC debt, Sachs (1987) finds that stock market prices of the commercial banks closely reflect the secondary market valuation of their LDC exposure. As a result, a careful analysis of the secondary market valuations seems important.

more sound economies like Turkey suffers only a small discount. Note that in some cases the discounts vary quite substantially over the two years of observation. The discounted price for Nigerian debt, for example, falls from 55% in 1986 to 29% in 1987, while in the case of Colombia the discounted price *rises* from 64% to 84% over the same period.

What relation, if any, exists between the discounts observed for outstanding LDC debt on the secondary market, and the measures of country creditworthiness and propensity to encounter a debt problem constructed using our econometric estimates? Table 6 presents the main evidence on the central question of whether the discounts reflect a history of past repayments problems or instead primarily anticipate future debt crises. Our findings support the conclusion that the secondary market discounts are correlated in the expected direction[13]/ with the econometric measures of creditworthiness we construct as well as with direct indicators of past repayments problems. But these correlations are not very strong. Their weakness is confirmed by the low explanatory power of the estimated regressions in the last part of Table 6, which try to explain the discounts by past, future, and current creditworthiness indicators. Moreover, these regressions suggest that the secondary market evaluations anticipate only rather imperfectly future external financing difficulties.[14]/

Hence, the evidence casts doubt on a case for debt relief that is built on the argument that such relief would cause secondary market discounts to fall and hence possibly the value of outstanding debt to rise. Our findings suggest that the secondary markets, being still in an early stage of development, may be relatively "thin" and hence not able to exploit efficiently and rapidly all the available creditworthiness information. The large information set used in estimating the

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[13] There is, however, one statistically insignificant exception.

[14] Indicators of current and *anticipated* creditworthiness correlate less strongly with secondary market discounted prices, than do such indicators of current and *past* creditworthiness.

econometric models in this paper makes it unlikely that this finding can be explained by the inability of the constructed indicators of creditworthiness to capture both upcoming short–term liquidity as well as longer term solvency problems. Nor can this finding be explained by predictive inadequacies of the estimated models on which the creditworthiness indicators were based, since as can be seen from Tables 4 and 5, only mild structural breaks occur in the models and moreover the models exhibit a relatively high ability of predicting future repayments problems. Instead, this result seems due to the fact that the secondary markets are dominated by exogenous institutional factors. An interesting question that remains is whether these markets will eventually become more efficient.[15]/

7. Conclusion

In this paper, I employed panel–data econometric techniques to draw some inferences about a possible case for external debt relief by exploring whether secondary market discounts for external debt efficiently reflect important economic performance information and underlying creditworthiness. I investigated empirically whether the discounts on the secondary market reflect a history of past repayments problems or whether they anticipate future debt crises. The answer to this question carries with it implications for the desirability of debt relief. If the secondary market discount is a good predictor of future debt problems and not merely a reflector of such past problems, then debt relief, by possibly averting anticipated problems, may reduce the secondary market discounts and therefore increase the value of the debt held by the international lenders. The main finding here that the secondary markets do not seem to absorb rapidly

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[15] Another interesting question that arises here is an elasticity issue: in assessing the desirability of debt relief international bankers clearly care about the value of the debt and not just its price. See Cohen (1989) for an analysis of this question. By concentrating on price only, I have attempted to focus on the question of the efficiency of the secondary markets.

economic information, suggests that they are still in an early evolutionary stage and not yet very efficient.

Descriptive econometric models of creditworthiness served as the basic framework for the empirical analysis of the paper. Our results strongly confirm prior expectations of the importance of both unobservable persistent heterogeneity among nations, and the impact on bankers' perceptions of a history of bad debt performance. We discussed issues related to debt overhang and formulated in an empirically testable way several propositions from the theoretical literature pertaining to policy questions. The estimated models were also used to analyze several other issues in the international finance literature. For example, indices of exchange rate over–valuation were constructed, based on discrepancies between black market and official exchange rates, and were used to examine whether overvaluation is a precursor of debt crises. Little evidence was found for this proposition, nor did we find evidence for causality in the reverse direction.

Next, the possibility of structural breaks in the processes determining repayments problems over time was also explored, after the major oil shocks of the 1970's and after 1981, when a much greater institutional involvement in the international financial markets took place. No strong evidence for structural breaks after the two major oil shocks was detected. It does appear, however, that analyses using only information prior to 1981 cannot be safely extrapolated to the 1980's. The considerably greater amount of information available to us in this study, covering 6 more years of observation, seems to offer significant statistical efficiency gains in estimation, which result in more robust models.

Finally, attempts were made to evaluate the significance of world economic factors, exogenous to developing countries, in precipitating crises. Examples of such factors include measures of imports by industrialized countries, inflation in the OECD nations, the OPEC balance of payments, and world interest rates. The findings are important for policy–related questions that address the "adjustment

efforts" by LDC's and the distinction between economic mismanagement and adverse world developments that are beyond the control of country administrators. Conditional on the volume of exports and amount of interest repayments due, these world economic factors were generally found to be statistically insignificant as predictors of LDC repayments problems.

Appendix 1:

Econometric Methods for Limited Dependent Variables Models for Panel Data

The canonical panel data limited dependent variable (LDV) model is

$$(A.1.1) \qquad y^*_{it} = x'_{it}\beta + \epsilon_{it} \qquad i=1,\ldots,I\ ,\ t=1,\ldots,T_i$$
$$y_{it} = \tau(y^*_{it})\ ,$$

where the function $\tau(.)$ specifies the rule that relates the unobserved latent variable y^*_{it} to the observed limited dependent variable y_{it}. This is the sense in which the models have "limited dependent" variables: the underlying latent variable y* on which our economic theorizing is mostly concentrated is only partially observed through some indicator y. For example, in the threshold crossing model

$$(A.1.2) \qquad \tau(.): \qquad y_{it} = \text{sign}(y^*_{it})\ ,$$

y* may indicate the net utility of country i choosing alternative 1 over alternative 0 in year t, but the observed information is only in terms of the actual choice made. Similarly, the ordered response model is defined as follows:

$$(A.1.3) \qquad \tau(.): \qquad y_{it} = 0 \quad \text{if } y^*_{it} < \theta_0$$
$$= 1 \quad \text{if } \theta_0 \le y^*_{it} < \theta_1$$
$$= 2 \quad \text{if } \theta_1 \le y^*_{it}\ ,$$

where θ_0 is normalized to 0 and θ_1 is estimated as an additional unknown parameter. For example, the utility value of choosing a particular (continuous) level of a commodity or activity, may be given by y*, but due to some exogenous (possibly) institutional reason, only integer values of the commodity can be acquired. In

case these possible values are 0, 1, or 2, the 3–way ordered response model (A.1.3) is a natural characterization. For further discussion, see McKelvey and Zavoina (1975).

The third limited dependent variable model we employ is the censored regression model

$$(A.1.4) \qquad \tau(.): \qquad y_{it} = \max(y^*_{it}, 0).$$

This situation arises when some exogenous market characteristic imposes a censoring level or threshold on the ideally desired level of a commodity or activity.

These models are non–linear through the $\tau(.)$ function that characterizes the specific LDV nature of the model in question. This has very important implications for econometric analysis given the panel nature of our data. Country–specific factors like colonial histories, political and religious institutions, imply persistence in the stochastic structure of unobservables in these models. One simple way to model the unobserved persistent country heterogeneity *a priori* explained as important in the text, is through the one–factor error–components model

$$(A.1.5) \qquad \epsilon_{it} = \alpha_i + \nu_{it} \qquad \alpha_i \sim \text{i.i.d.} N(0, \sigma^2_\alpha),\ \nu_{it} \sim \text{i.i.d.} N(0, \sigma^2_\nu).$$

Let the density of y_{it} implied by either (A.1.2), (A.1.3), or (A.1.4) conditional on α_i be $f(y_{it}|\alpha_i)$. Then the log–likelihood function for these models involves I univariate integrals

$$(A.1.6) \qquad L(\beta,\Sigma_\epsilon) = \sum_{i=1}^{I} \ln \left[\int_{-\infty}^{\infty} \{ \prod_{t=1}^{T_i} f(y_{it}|\alpha_i) \} g(\alpha_i)\, d\alpha_i \right] .$$

Maximizing this likelihood function yields consistent, asymptotically normal and efficient estimates $\hat{\beta}$, $\hat{\Sigma}_\epsilon$ that are reported in the tables.

The one–factor scheme (A.1.4) can be generalized to allow for additional serial correlation of the autoregression of order 1 type (AR(1))

$$(A.1.7) \qquad \epsilon_{it} = \alpha_i + \nu_{it}\,, \qquad \nu_{it} = \rho\nu_{it-1} + \eta_{it},$$
$$\alpha_i \sim \text{i.i.d.N}(0,\sigma_a^2),\ \eta_{it} \sim \text{i.i.d.N}(0,\sigma_\eta^2) .$$

This generalization is beyond the scope of this paper, however, as it implies a series of I T–dimensional integrals which necessitate the use of very novel econometric techniques not yet fully developed (see Hajivassiliou and McFadden (1988)).

Our desire to allow for the past state of repayments problems by a country in modelling current and future financial crisis probabilities, that arises because of learning mechanisms by bankers, introduces the so called problem of initial conditions. The reader is referred to Heckman (1981) and Hajivassiliou (1987) for detailed presentations of this issue and discussions of possible econometric solutions.

The final issue that is addressed in our estimations is the possibility that the distributional assumptions of normality made in (A.1.5) and (A.1.7) are incorrect, in which case our estimates would lose their desirable statistical properties. To investigate the robustness of our results with respect to the normality assumptions, we also derived *maximum score estimates* (Manski (1985)) for model (A.1.2) and *least absolute deviations estimates* (Powell (1984)) for model (A.1.4)

that retain their consistency even when the distributional assumption of normality is violated. The findings are quite similar to the ones obtained under the parametric distributional assumption of normality, and are thus not reported in detail. Moreover, the distribution free maximum score binary–response estimator only achieved a predictive accuracy of 73% , compared to about 85% for the normal binary probit model. Since ability to predict ensuing external financing problems is at the heart of our argument, our preferred specifications impose the parametric normality assumptions.

Appendix 2:
Data Sources, Construction of Variables, and Descriptive Statistics

Abbreviations for Data Sources (Computer Tapes)

BOP World Bank, World Tables, economic data sheet 2, balance of payments (1987)
ERP U.S. Council of Economic Advisers, 1985 Economic Report of the President
IMF IMF Annual Reports of the Director, various issues.
IFS International Monetary Fund, International Financial Statistics (1987)
WB World Bank, World Tables, economic data sheet 1 (1987)
WDT World Bank, World Debt Tables (1987)
WCY World Currency Yearbook, various issues.

All series consist of 1853 country–year observations, on 109 countries over the 1970–1986 period. All conversions between dollar and local currency values employed the period average exchange rate from IFS.

Indicators of Repayments Problems

PSARI
Presence of "Significant" Arrears in Interest, 1970–1986, WB. "Significant" defined as greater than .001 of Total External Debt.

PSARP
Presence of "Significant" Arrears in Principal, 1970–1986, WB. "Significant" defined as greater than .01 of Total External Debt.

PRSSIMF
Occurrence of a Rescheduling Arrangement and/or IMF involvement, 1970–1986, IMF. IMF involvement defined as IMF support. IMF support is defined by an IMF standby agreement of second or higher tranche or use of the IMF Extended Fund Facility. Reschedulings include Paris Club, commercial banks, and aid–consortia renegotiations. This information was compiled from our own country–by–country investigations, and from published and unpublished IMF sources. The date of rescheduling was selected to reflect the key economic developments precipitating the rescheduling.

SARI
Level of "Significant" Arrears in Interest, 1970–1986, WB. "Significant" defined as greater than .001 of Total External Debt.

SARP
Level of "Significant" Arrears in Principal, 1970–1986, WB. "Significant" defined as greater than .01 of Total External Debt.

SAR
"Significant" Total Arrears in Principal and Interest, 1970–1986, WB. See above.

CRISIS3F
"Severity of Crisis" Indicator: 0=no repayments problem, 1=significant arrears only, 2=IMF or RSS, 1971–1987.

PARIF
Binary Indicator, 0=no repayments problem, 1=significant arrears, IMF involvement, or rescheduling agreement, 1971–1987.

SARF
"Significant" Total Arrears in Principal and Interest, 1971–1987, WB. See above.

CUMPSARI
Cumulated number of past years with significant arrears in interest present.

CUMPSARP
Cumulated number of past years with significant arrears in principal present.

CUMRORI
Cumulated number of past years with a rescheduling or an IMF agreement in effect.

Explanatory Variables

SECDPRC
Secondary Market Discounted Price. Percentage of its nominal value at which a claim on a country's external debt obligations trades on the secondary markets. Years 1986 and 1987 available.
Source: Salomon Brothers Inc., New York

IMFHIST
Cumulated number of years since 1970 with IMF involvement.

RSSHIST
Cumulated count of reschedulings since 1970.

PCGDP80
Per Capita GDP, 1980 US$, 1970–1986, WB.

DBTTOEXP
Total External Debt Relative to Exports, 1970–1986, WDT, IFS. Total debt includes public and private debt outstanding and disbursed, short–term debt, and use of IMF credit.

RESTOIMP
International Reserves (Excl. Gold) Relative to Imports, 1970–1986, WDT.

DSDTOEXP
Total Debt Service Due Relative to Exports, 1970–1986, WDT, WB. Debt service due defined as interest and principal paid (TDS from WDT) plus outstanding interest and principal arrears.

ISDTOEXP
Interest Service Due Relative to Exports, 1970–1986, WDT, WB. Interest service due defined as interest paid (INT from WDT) plus outstanding interest arrears.

PSDTOEXP
Principal Service Due Relative to Exports, 1970–1986, WDT, WB. Principal service due defined as principal paid plus outstanding principal arrears.

DSPTOEXP
Total Debt Service Paid Relative to Exports, 1970–1986, WDT.

ISPTOEXP
Total Interest Service Paid Relative to Exports, 1970–1986, WDT.

PSPTOEXP
Total Principal Service Paid Relative to Exports, 1970–1986, WDT.

IMPTOGNP
Imports Relative to GNP, 1970–1986, WDT.

EXPTOGNP
Exports Relative to GNP, 1970–1986, WDT.

CATOGNP
Current Account Balance (Exports – Imports) Relative to GNP, 1970–1986, WDT.

LIBOR3MO
London Interbank Offer Rate for 3 month loans, 1970–1986, IFS.

LIBOR6MO
London Interbank Offer Rate for 6 months, 1970–1986, IFS.

OPECRES
OPEC International Reserves (in SDR's), 1970–1986, IFS.

OPECCA
OPEC Current Account (Exports – Imports), US$ billions, 1970–1986, IFS.

INDCINFL
Average CPI Inflation in Industrial Countries, 1970–1986, IFS.

INDCCA
Current Account (Exports – Imports) of Industrial Countries, US$ billions, 1970–1986, IFS.

OVERVAL
Black Market Exchange Rate from WCY/IFS Exchange Rate Period Average, 1970–1986, WCY, IFS. Both in units of national currency per US dollar.

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Table 1

Patterns of Transitions between Repayments Problems

Count (Column %) [Row %]		Type of Problem in Year t								Row Total
		N	A	R	I	AR	AI	RI	ARI	
Type of Problem in Year t–1	N	821 (90.8) [86.2]	44 (23.0) [4.6]	9 (40.9) [0.9]	61 (27.5) [6.4]	0 (0.0) [0.0]	2 (4.0) [0.2]	13 (21.3) [1.4]	2 (3.9) [0.2]	952 63.0
	A	15 (1.7) [9.5]	119 (62.3) [75.3]	0 (0.0) [0.0]	1 (0.5) [0.6]	5 (45.5) [3.2]	4 (8.0) [2.5]	4 (6.6) [2.5]	10 (19.6) [6.3]	158 10.4
	R	5 (0.6) [26.3]	4 (2.1) [21.1]	7 (31.8) [36.8]	0 (0.0) [0.0]	0 (0.0) [0.0]	0 (0.0) [0.0]	2 (3.3) [10.5]	1 (2.0) [5.3]	19 1.3
	I	59 (6.5) [25.5]	6 (3.1) [2.6]	1 (4.5) [0.4]	138 (62.2) [59.7]	0 (0.0) [0.0]	11 (22.0) [4.8]	15 (24.6) [6.5]	1 (2.0) [0.4]	231 15.3
	AR	2 (0.2) [20.0]	4 (2.1) [40.0]	0 (0.0) [0.0]	0 (0.0) [0.0]	4 (36.4) [40.0]	0 (0.0) [0.0]	0 (0.0) [0.0]	0 (0.0) [0.0]	10 0.7
	AI	0 (0.0) [0.0]	8 (4.2) [20.0]	2 (9.1) [5.0]	3 (1.4) [7.5]	0 (0.0) [0.0]	17 (34.0) [42.5]	3 (4.9) [7.5]	7 (13.7) [17.5]	40 2.6
	RI	2 (0.2) [3.1]	3 (1.6) [4.7]	3 (13.6) [4.7]	18 (8.1) [28.1]	1 (9.1) [1.6]	9 (18.0) [14.1]	21 (34.4) [32.8]	7 (13.7) [10.9]	64 4.2
	ARI	0 (0.0) [0.0]	3 (1.6) [7.9]	0 (0.0) [0.0]	1 (0.5) [2.6]	1 (9.1) [2.6]	7 (14.0) [18.4]	3 (4.9) [7.9]	23 (45.1) [60.5]	38 2.5
Column Total		904 59.8	191 12.6	22 1.5	222 14.7	11 0.7	50 3.3	61 4.0	51 3.4	1512 100.0

Notes:

1. Column Percentages in parentheses, Row Percentages in square brackets

2. 1512 valid country/year observations

3. N = No Repayments Problem
   A = Significant Arrears
   R = Rescheduling Occurrence
   I = IMF Involvement
   AR = A and R
   AI = A and I
   RI = R and I
   ARI = A and R and I

Table 2
Binary Response Estimation Results

Explanatory Variable	Probit Model	Probit Model with Random Effects	Probit Model	Probit Model with Random Effects
const	−1.16	−1.23	−0.84	−0.91
	[−10.17]	[−11.27]	[−2.52]	[−2.02]
pcgdp80	−5.39e−4	−5.57e−4	−2.82e−2	−2.44e−2
	[−1.45e−2]	[−1.27e−2]	[−0.64]	[−0.52]
dbttoexp	1.46e−3	1.59e−3	2.16e−3	2.39e−3
	[2.76]	[2.33]	[3.37]	[2.99]
restoimp	−7.92e−2	−7.81e−2	−9.88e−2	−9.01e−2
	[−4.21]	[−3.88]	[−4.35]	[−4.01]
isdtoexp	6.94e−2	5.77e−2	6.14e−2	6.22e−2
	[4.43]	[4.99]	[3.30]	[3.22]
psdtoexp	−2.37e−2	−2.52e−2	−2.52e−2	−2.07e−2
	[−2.35]	[−2.59]	[−2.21]	[−2.44]
catognp	4.40e−2	4.56e−2	0.59	0.91
	[0.11]	[0.29]	[1.21]	[1.27]
libor6mo	—	—	4.64e−3	4.01e−3
			[0.22]	[0.18]
opecres	—	—	−2.03e−3	−2.82e−3
			[−0.49]	[−0.38]
opecca	—	—	9.54e−4	8.92e−4
			[0.24]	[0.33]
indcinfl	—	—	−3.50e−2	−4.00e−2
			[−0.71]	[−0.67]
indcca	—	—	−2.60e−3	−2.83e−3
			[−0.66]	[−0.57]
overval	—	—	−0.32	−0.29
			[−1.26]	[−1.03]
psari	1.91	1.95	1.71	1.64
	[7.02]	[7.59]	[6.10]	[6.07]
psarp	1.59	1.21	1.12	1.06
	[5.34]	[5.27]	[2.74]	[2.49]
prssimf	1.45	1.01	1.36	1.17
	[12.05]	[10.11]	[10.04]	[9.33]
cumpsari	3.00e−2	2.77e−2	4.78e−2	3.98e−2
	[0.62]	[0.53]	[0.96]	[0.56]
cumpsarp	6.12e−2	6.55e−2	−3.32e−3	−3.52e−3
	[0.79]	[0.88]	[−4.09e−2]	[−4.99e−2]
cumrori	4.27e−2	4.01e−2	9.48e−3	8.92e−3
	[1.73]	[1.12]	[0.31]	[0.21]
σ_η	—	0.32	—	0.29
		[3.26]		[3.02]
loglikelihood at convergence	−498.54	−497.61	−410.65	−409.22
constrained	−927.43	−927.43	−739.59	−739.59
Pseudo R^2	0.463	0.469	0.442	0.447
number of obs	1338	1338	1067	1067
% correctly pred	84.60	84.60	83.97	83.97

Notes: 1. Dependent variable: PARIF
2. σ_η = stand dev of random effect

Table 3

Explanatory Variable	OrderedProbit Model	OrderedProbit REModel	TobitModel	TobitModel withRE
const	−0.91	−0.81	−2.40e−2	−2.53e−2
	[−8.93]	[−8.44]	[−11.99]	[−8.08]
pcgdp80	−1.28e−2	−1.38e−2	8.01e−4	9.70e−4
	[−0.38]	[−0.35]	[1.64]	[1.69]
dbttoexp	8.87e−4	8.36e−4	6.65e−6	8.53e−6
	[2.14]	[2.88]	[1.56]	[1.73]
restoimp	−7.72e−2	−7.42e−2	−3.35e−4	−2.99e−4
	[−4.63]	[−4.01]	[−1.64]	[−1.35]
isdtoexp	4.65e−2	4.48e−2	2.05e−4	2.53e−4
	[2.82]	[2.27]	[1.56]	[1.61]
psdtoexp	−6.63e−3	−6.28e−3	−2.90e−5	−1.80e−5
	[−0.70]	[−0.33]	[−0.26]	[−0.16]
catognp	0.12	0.22	−1.46e−2	−1.39e−2
	[0.36]	[0.18]	[−2.86]	[−2.03]
psari	0.83	0.93	1.04e−2	8.98e−3
	[5.90]	[5.37]	[5.41]	[5.12]
psarp	0.36	0.26	8.82e−3	8.24e−3
	[2.56]	[2.06]	[4.02]	[3.83]
prssimf	1.55	1.59	1.76e−3	1.24e−3
	[14.22]	[14.16]	[1.25]	[0.81]
cumpsari	−3.00e−2	−3.50e−2	1.06e−3	9.33e−4
	[−1.14]	[−1.02]	[3.25]	[2.89]
cumpsarp	9.13e−2	9.63e−2	−9.57e−4	−1.27e−3
	[1.84]	[1.72]	[−1.54]	[−2.03]
cumrori	2.16e−2	2.08e−2	9.93e−4	1.31e−3
	[1.08]	[0.73]	[3.81]	[4.16]
sari	—	—	1.68	1.82
			[3.14]	[3.13]
sarp	—	—	0.84	0.80
			[8.80]	[8.32]
θ_1	0.51	0.57	—	—
	[10.41]	[9.28]		
σ_ν	—	—	1.26e−2	1.20e−2
			[93.00]	[14.96]
σ_η	—	0.43	—	3.96e−3
		[3.68]		[4.37]
loglikelihood:				
at convergence	−863.97	−861.04	554.880	556.399
constrained	−1273.13	−1273.13	227.560	227.560
Pseudo R^2	0.321	0.326	0.732	0.746
number of obs.	1338	1338	1338	1338
% correctly pred.	76.31	76.31		

Notes:

1. θ_1 = threshold level between regimes 1 and 2 in ordered probit model ($\theta_0 = 0$)
   σ_ν = stand. dev. of i.i.d. error, σ_η = stand. dev. of random effect error
2. Dependent variable for ordered probit models is CRISIS3F and SARF for tobit.

Table 4

Structural Stability of Creditworthiness Models

Model		Probit	Ordered Probit	Tobit
A. Complete Sample				
log likelihood		–497.61	–861.04	556.40
B. Tests for 1973 Break				
Dummy variable test:				
	post1973	0.20	0.28	0.13
	t–statistic	1.63	1.59	1.13
LR test:				
	post1973 – 1066 obs			
	loglik	–400.20	–706.81	451.24
	% correct	84.43	75.33	77.43
	pre1973 – 272 obs			
	loglik	–83.66	–135.38	115.64
	% correct	87.87	76.73	78.26
value of LR statistic		27.52*	19.70	20.96
C. Tests for 1981 Break				
Dummy variable test:				
	post1981	0.23	0.11	0.24
	t-statistic	1.97**	1.07	1.82*
LR test:				
	post1981 – 420 obs			
	log lik	–134.55	–251.76	177.21
	% correct	86.67	70.24	72.54
	pre1981 – 918 obs			
	loglik	–341.65	–597.26	389.98
	% correct	85.29	76.24	77.24
value of LR statistic		42.82**	24.04	21.58

Notes:

* = Significant at 5% level

** = Significant at 1% level

Significance levels of the χ^2 distribution:

d.f.	14	15	17
at 5% level	23.69	25.00	27.59
at 1% level	29.14	30.56	33.41

Table 5

Prediction Ability of Creditworthiness Models

Correlations

A: All available data (1338 observations)

	predp	predop	predt	parif	sarf	crisis3f
predp	1.					
predop	0.95	1.				
predt	0.63	0.72	1.			
parif	0.73	0.69	0.52	1.		
sarf	0.28	0.27	0.73	0.26	1.	
crisis3f	0.69	0.71	0.61	0.95	0.20	1.

B: Year 1985 (28 observations)

	predp	predop	predt	parif	sarf	crisis3f
predp	1.					
predop	0.85	1.				
predt	0.42	0.52	1.			
parif	0.30	0.21	0.52	1.		
sarf	0.21	0.25	0.80	0.16	1.	
crisis3f	0.12	0.23	0.66	0.75	0.10	1.

C: Year 1986 (24 observations)

	predp	predop	predt	parif	sarf	crisis3f
predp	1.					
predop	0.87	1.				
predt	0.33	0.43	1.			
parif	0.96	0.83	0.41	1.		
sarf	0.22	0.23	0.39	0.18	1.	
crisis3f	0.81	0.94	0.27	0.83	0.17	1.

Notes:

Actual Data:

parif = presence of a repayments problem
sarf = level of significant arrears
crisis3f = classifying dummy variable: "no problem, "mild crisis," and "severe crisis" regimes

Predicted probabilities of a repayments problem:

predp = prediction from the probit model
predop = prediction from the ordered probit model
predt = prediction from the tobit model

Table 6

Explaining the Secondary Market Discounted Prices Using Indicators of Creditworthiness

Legend

secdprc = secondary market discounted price
credp = probit model creditworthiness indicator
credop = ordered probit model creditworthiness indicator
credt = tobit model creditworthiness indicator

* = Data not available

Part A: Actual Series

Country	Year 1985				Year 1986			
	secdpr	credp	credop	credt	secdpr	credp	credop	credt
Algeria	*	*	*	*	94.0	89.25	78.40	44.02
Argentina	64.0	0.00	0.10	24.69	47.0	0.00	0.01	31.90
Bolivia	5.0	0.01	15.73	4.94	9.0	*	*	*
Brazil	75.0	0.01	1.94	18.88	61.0	0.68	2.29	43.85
Chile	66.0	1.60	4.82	66.14	69.0	0.84	3.31	55.73
Colombia	64.0	7.11	8.49	15.05	84.5	13.10	54.92	69.32
CostaRica	53.0	1.08	3.13	60.66	36.0	0.05	2.44	51.05
Dom.Rep.	45.0	0.06	2.67	25.28	45.0	0.00	0.65	81.43
Ecuador	65.5	1.98	4.33	95.37	49.0	0.95	2.80	14.18
Gabon	*	*	*	*	82.0	*	*	*
Guatemala	52.0	10.29	46.89	45.08	72.0	7.21	43.32	36.56
Honduras	40.0	3.10	31.20	12.92	38.0	0.02	15.95	18.45
Ivory Coast	74.0	2.92	4.60	39.47	62.0	0.02	1.64	12.03
Jamaica	45.0	4.90	6.04	14.85	37.0	0.04	2.05	8.08
Libya	13.0	0.00	1.06	0.24	5.0	0.06	22.10	24.35
Madagascar	64.0	0.00	0.35	64.68	55.0	*	*	*
Malawi	74.0	11.05	9.46	54.80	74.0	*	*	*
Mexico	60.0	0.97	2.59	88.92	56.0	0.55	2.06	85.74
Morocco	70.0	*	*	*	65.5	*	*	*
Nicaragua	4.0	*	*	*	5.0	*	*	*
Nigeria	55.0	80.23	72.57	50.78	29.0	22.96	16.36	59.75
Panama	69.0	20.58	16.82	13.51	66.0	*	*	*
Peru	20.0	0.00	2.33	70.01	11.0	0.07	27.46	49.93
Philippines	59.0	6.83	8.36	36.98	69.0	9.76	11.22	95.70
Poland	43.0	*	*	*	44.5	0.06	2.31	93.38
Romania	88.0	*	*	*	88.0	*	*	*
Senegal	70.0	12.44	11.66	40.83	64.0	*	*	*
Sudan	10.0	0.00	0.04	79.12	2.0	*	*	*
Togo	68.0	26.99	23.83	65.76	68.0	1.20	10.67	18.90
Turkey	97.5	14.71	11.53	97.35	97.0	59.49	60.95	28.21
Uruguay	63.0	6.54	11.01	73.26	73.5	0.48	11.65	67.98
Venezuela	76.0	40.93	39.11	85.49	70.0	72.26	78.00	69.81
Yugoslavia	79.0	20.24	17.56	45.09	75.0	0.60	8.02	86.10
Zaire	20.0	*	*	*	24.5	*	*	*
Zambia	18.0	0.00	0.60	54.86	18.0	0.00	0.93	68.47

Part B: Correlations between Discounted Prices and Creditworthiness Indicators

Year 1985

Correlations (28 observations)

	secdprc	credp	credop	credt	parif	crisis3f	sarf
secdprc	1.						
credp	0.29	1.					
credop	0.13	0.85	1.				
credt	0.60	0.42	0.52	1.			
parif	–0.39	–0.30	–0.21	–0.52	1.		
crisis3f	0.01	–0.12	–0.23	–0.66	0.75	1.	
sarf	–0.55	–0.21	–0.25	–0.80	0.16	0.10	1.

Year 1986

Correlations (24 observations)

	secdprc	credp	credop	credt	parif	crisis3f	sarf
secdprc	1.						
credp	0.52	1.					
credop	0.49	0.87	1.				
credt	0.42	0.33	0.43	1.			
parif	–0.51	–0.96	–0.83	–0.41	1.		
crisis3f	–0.32	–0.81	–0.94	0.27	0.83	1.	
sarf	–0.48	–0.22	–0.23	0.39	0.18	0.17	1.

Part C: Discounted Prices Explained by Regressions with Creditworthiness Indicators

Current and Future

secdprc85	=	52.62	+ 0.48 * credp86	+ 0.11 * credp85
		[11.03]	[2.55]	[0.06]
		Nobs=22	R^2=0.21	DW=1.99
secdprc85	=	52.73	+ 0.20 * credop86	+ 0.47 * credop85
		[9.65]	[2.01]	[0.24]
		Nobs=22	R^2=0.16	DW=1.94
secdprc85	=	53.26	− 0.29 * credt86	+ 0.17 * credt85
		[5.65]	[−1.74]	[1.18]
		Nobs=22	R^2=0.19	DW=1.91

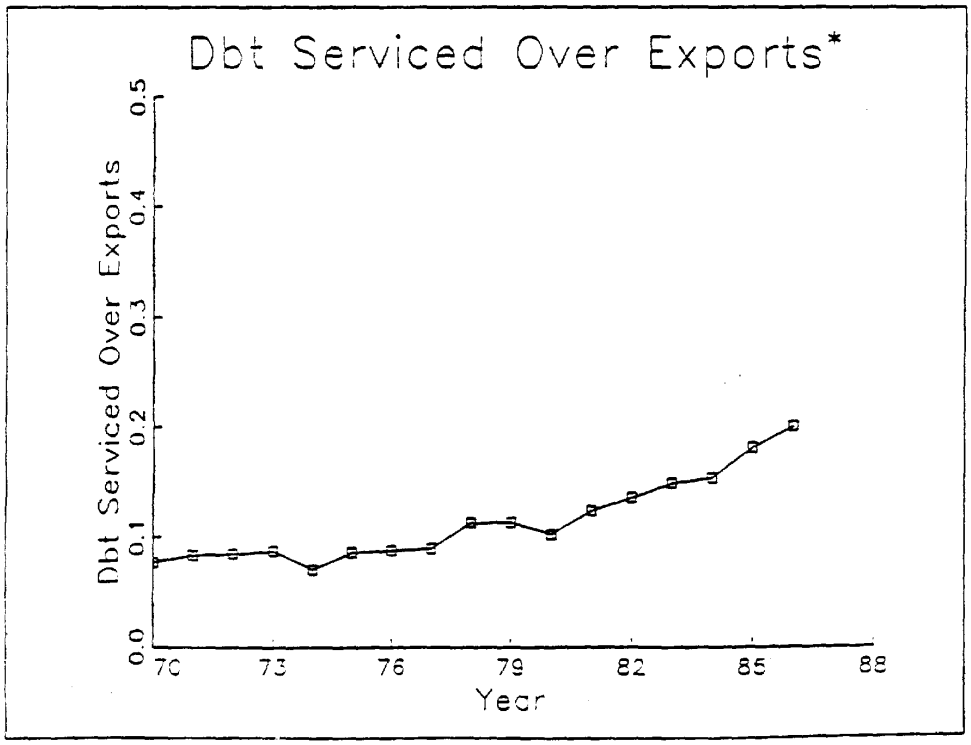
Current and Past

secdprc86	=	49.97	+ 0.64 * credp86	− 0.20 * credp85
		[9.72]	[3.03]	[−0.82]
		Nobs=23	R^2=0.28	DW=2.06
secdprc86	=	45.50	+ 0.48 * credop86	− 0.0002 * credop85
		[8.31]	[2.23]	[−0.0009]
		Nobs=23	R^2=0.24	DW=1.92
secdprc86	=	44.94	+ 0.33 * credt86	+ 0.19 * credt85
		[4.89]	[2.58]	[1.17]
		Nobs=23	R^2=0.26	DW=1.77

Notes:

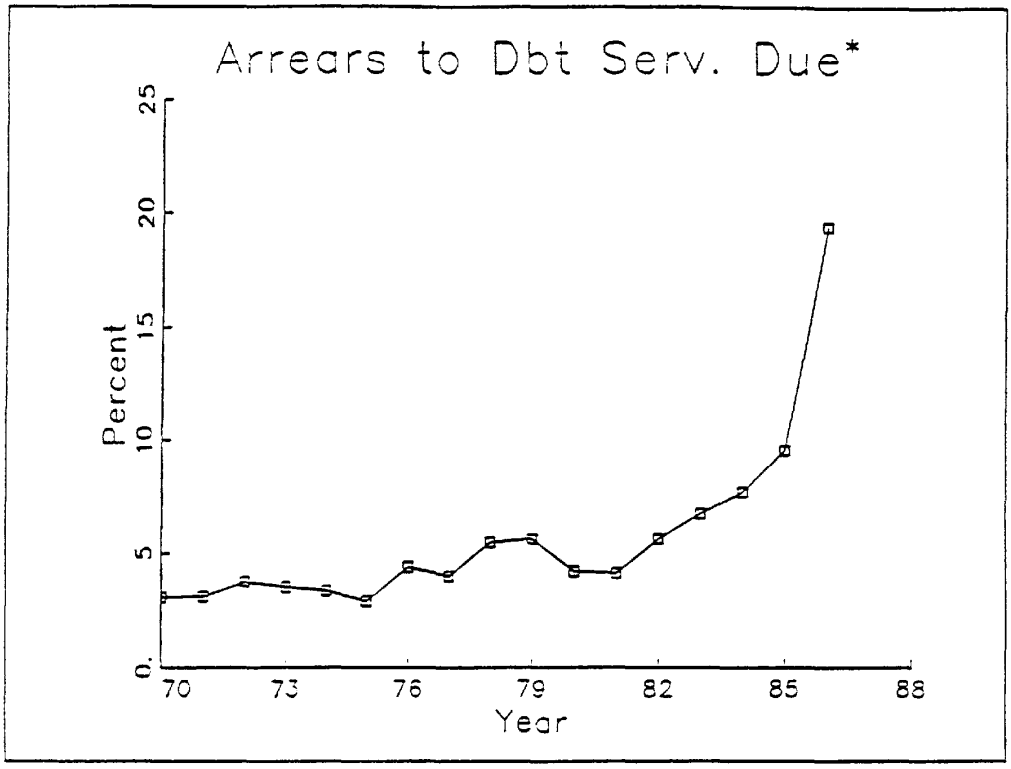
1. Last two digits of a variable name signify the year
2. Nobs = number of countries in regressions

Figure 1

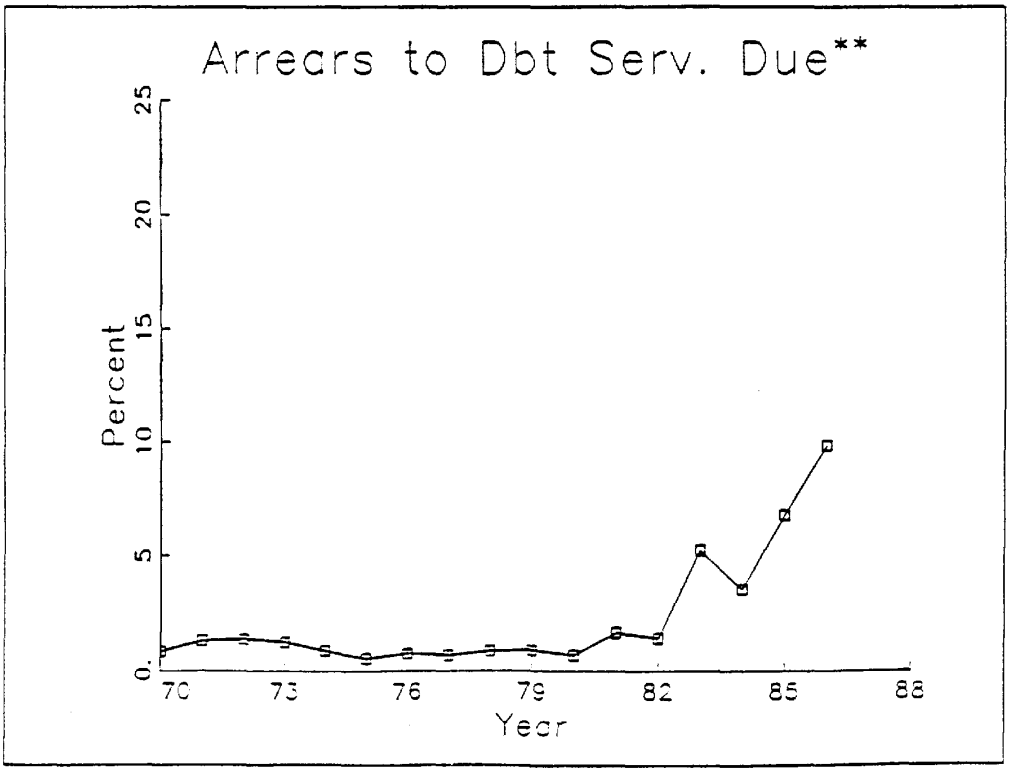


*Averaged over 93 countries reporting in all 17 years

Figure 2



* Unweighted; 93 countries reporting



** Weighted by Total Outstanding Debt; 93 countries reporting

Figure 3

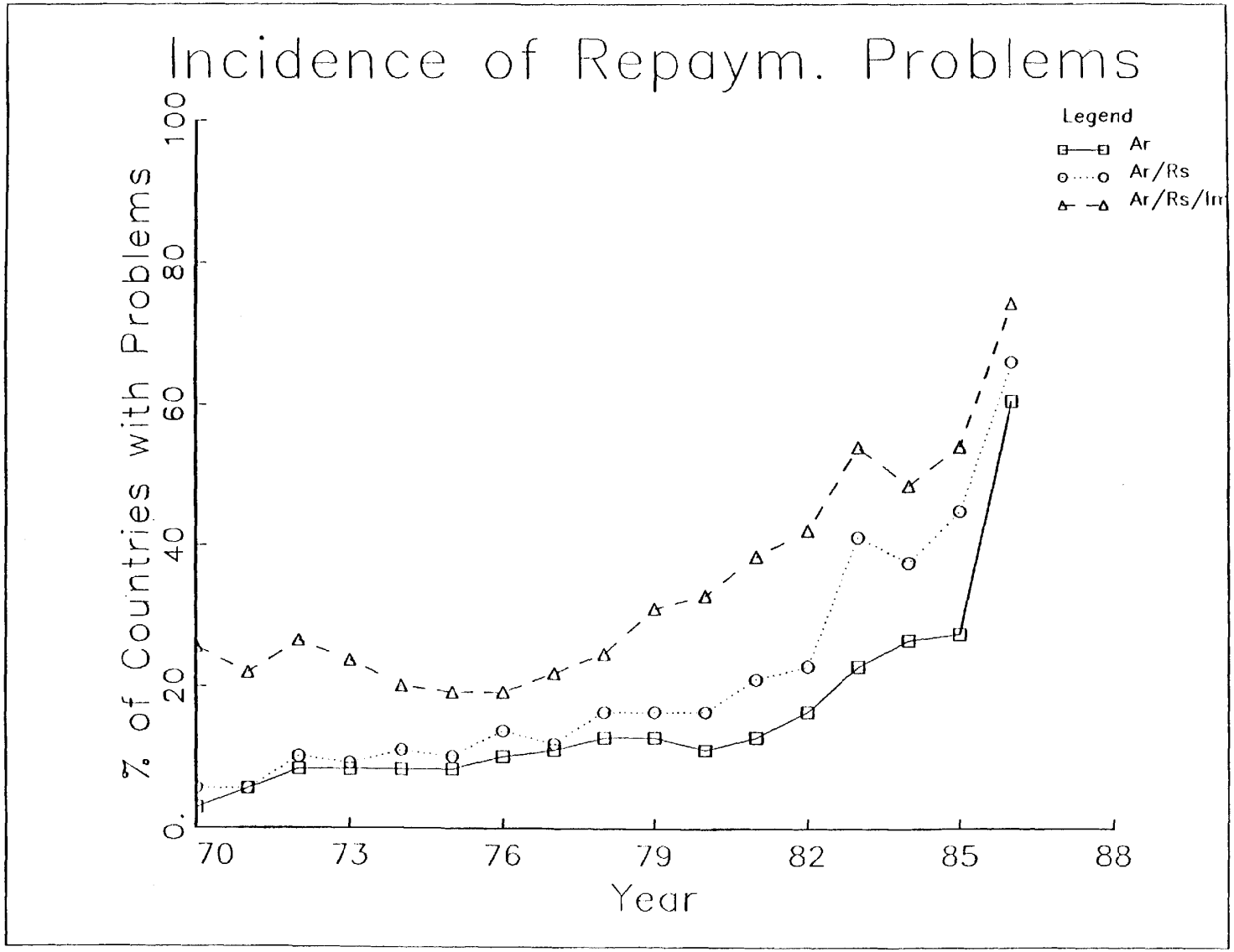
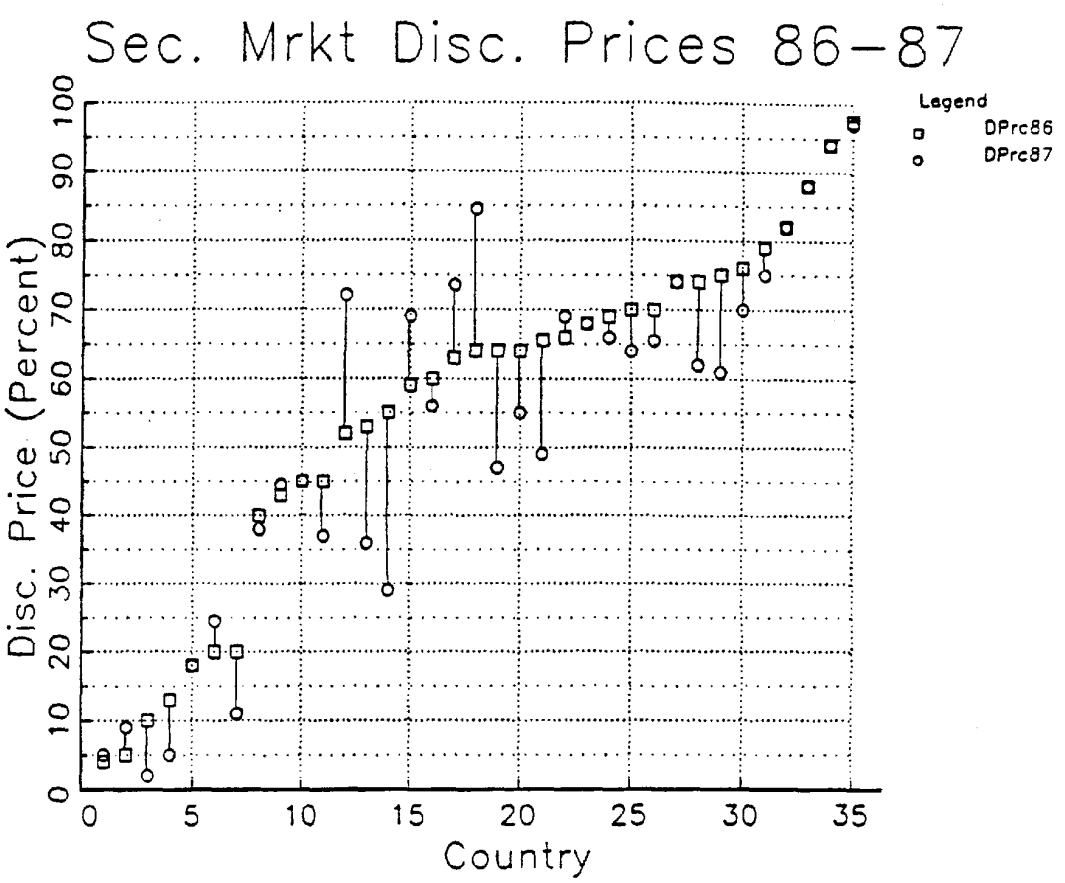

Incidence of Repaym. Problems
Legend
Ar
Ar/Rs
Ar/Rs/In
% of Countries with Problems
0.
20
40
60
80
100
70
73
76
79
82
85
88
Year

Figure 4



Observation Number	Country	Observation Number	Country
1	Nicaragua	19	Argentina
2	Bolivia	20	Madagascar
3	Sudan	21	Ecuador
4	Liberia	22	Chile
5	Zambia	23	Togo
6	Zaire	24	Panama
7	Peru	25	Senegal
8	Honduras	26	Morocco
9	Poland	27	Malawi
10	Dominican Republic	28	Cote d'Ivoire
11	Jamaica	29	Brazil
12	Guatemala	30	Venezuela
13	Costa Rica	31	Yugoslavia
14	Nigeria	32	Gabon
15	Philippines	33	Romania
16	Mexico	34	Algeria
17	Uruguay	35	Turkey
18	Colombia		