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Economic Indicators and Country Risk Appraisal

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The current debate over commercial-bank lending to less-developed countries (LDCs) has primarily centered on the question of whether private banks have extended too much credit to the group of non-oil exporting developing countries. Despite the considerable attention given to the subject in the financial press, the major international banks by and large dismiss the possibility of widespread defaults or reschedulings on developing-country loans as being highly remote. A more likely scenario, according to the banks, is that individual countries occasionally may experience repayment difficulties requiring some refinancing or rescheduling. Most banks, therefore, believe that the crucial problem is to be able to detect in advance which countries are likely to experience repayment problems and when these difficulties may arise.

The banking community has recently shown great interest in the utilization of analytical techniques to detect potential default or rescheduling situations. Relatively little information is currently available to appraise the various techniques now in use, and, as a result, it is often difficult for bankers to judge the adequacy of their own internal rating systems as compared with those employed by other institutions, public or private.

The difficulty is illustrated by a recent Export-Import Bank survey on bank practices in assessing country risk.[1] That study found that a large percentage of the 37 U.S. banks surveyed are dissatisfied with their present country-appraisal methods and are actively seeking new procedures. From the survey responses, though, it is not possible to determine how much of their dissatisfaction relates to their own procedures, and how much has to do with limitations in the current state of the art in assessing country risks.

This paper is designed to facilitate appraisal of existing procedures by comparing techniques commonly used by commercial banks and official institutions, along with techniques that have been developed in the economic literature. The scope of the paper is limited to only one aspect of country-risk appraisal—namely, the use of economic indicators to rank countries according to the probability of default. The analysis addresses the following questions: (1) What are the economic causes of debt reschedulings? (2) Which set of economic indicators does the best job of distinguishing between rescheduling countries and non-rescheduling countries? (3) How reliable are econometric techniques in predicting debt reschedulings?

Section I briefly reviews the experience with LDC debt reschedulings since the late 1950's, and describes techniques employed by commercial banks and official institutions for assessing country risk. Section II compares two conceptual approaches used in the analysis of debt reschedulings. The first approach views reschedulings as resulting from fluctuations in prices of primary products which then lead to a rapid accumulation of external debt relative to export earnings. The second approach treats debt reschedulings as a monetary phenomenon, in which domestic inflation and an overvalued exchange rate contribute to increased demand for imports and to export stagnation, and consequently to a rapid build-up of external debts. Section III employs a statistical procedure—discriminant analysis—to identify the set of economic indicators which best distinguish rescheduling countries from non-rescheduling countries. (A brief discussion of the

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statistical procedure is included for interested readers.) The final section assesses the relevance of the empirical findings to country-risk appraisal and the desirability of using statistical procedures for this purpose.

Our analysis suggests the importance of distinguishing "liquidity" reschedulings from long-term debt reschedulings. The first type is associated with a bunching of short-term commercial credits (typical of most Latin American reschedulings), and the second type of rescheduling is identified with long-term debt relief on official credits (e.g. reschedulings for South Asian countries and Ghana). In the "liquidity" cases, monetary (and fiscal) factors appear to be at the root of the problem, and the inflation rate turns out to be the most imporant explanatory variable. Cases of chronic-debt relief, on the other hand, appear less amenable to a monetary framework of analysis, and it is necessary to include the debt-service ratio to explain these reschedulings.

I. Assessing Country Risk

Commercial banks encounter two types of repayment risk in international-lending operations which do not arise in domestic-banking operations. The first type of risk, commonly referred to as "sovereign risk," occurs when a national government refuses to permit foreign loans to be repaid, or when a government seizes bank assets without adequate compensation. The second type of risk, often called "transfer risk," is associated with foreign borrowers' problems in converting domestic currency into foreign exchange. Credits extended to foreign borrowers by banks in the U.S. market or in the Euro-currency market are typically denominated in U.S. dollars (or in a key currency), and government foreign-exchange restrictions sometimes make it difficult for borrowers to acquire sufficient foreign exchange to repay their loans.[2] Foreign-exchange controls are particularly common in developing countries, where fixed exchange-rate policies are still prevalent.

Commercial banks assess both types of risk in their country-risk appraisals. Cases of expropriation or outright default on bank loans have been quite rare in the postwar period, however, and have been confined mostly to Communist takeovers in Cuba or Southeast Asia. The more common case has been the formal restructuring or refinancing of external-debt obligations in the wake of foreign-exchange crises. Restructuring has usually involved a stretching of principal payments on a previous credit, while refinancing has involved new credits.

Close to 40 such instances have occurred since 1956, involving about a dozen developing countries which formally negotiated with creditor countries to postpone payments of their interest or principal. The total amount of debt service rescheduled was on the order of $7.7 billion, of

Table 1
International Debt Reschedulings 1960-76[1]
(Millions of U.S. $)

Country	Year	Total Amount Rescheduled	Amount of U.S. Debt Rescheduled
Argentina*	1962	240	0
	1965	76	18
Brazil*	1961	300	0
	1964	200	44.5
Chile*	1965	96	43
	1972	160	65
	1974-75	597	231
Egypt	1966	N.A.	N.A.
	1971	145	145
Ghana*	1966-70	295	0.7
	1974	290	0
India*	1968-72	545	65
	1973-76	688	74
Indonesia*	1965-68	427	96
	1970	2100	215
Pakistan*	1971-74	987	270
Peru*	1968-69	128	0
Philippines	1970	N.A.	N.A.
Turkey*	1965	220	15
	1972	114	0
Uruguay	1965	N.A.	N.A.
Yugoslavia	1965	N.A.	N.A.
	1972	59	59
Zaire	1976	N.A.	N.A.

* Denotes countries which have experienced multilateral debt reschedulings.

[1]Note: Information on debt reschedulings was compiled from a variety of sources including Bitterman [6], Cohen [7], Feder-Just [11], Frank-Cline [12], IMF [17] [18], OECD [22].

which roughly $1.3 billion constituted debt owed to the U.S. government or to U.S. nationals (Table 1). However, the economic cost of debt reschedulings—measured as the difference between the present discounted value of the repayments stream before and after rescheduling—was considerably smaller.[3]

Most multilateral debt reschedulings have either involved suppliers' credits (which frequently carry government guarantees) or official credits. Many of the Latin American reschedulings, for example, have involved short-and medium-term commercial debt, so that negotiations were arranged through ad hoc meetings of major private creditors (the so-called "Paris Club" or "Hague Club" meetings). Debt-relief negotiations for Ghana, India, Indonesia, Pakistan, and Turkey, on the other hand, have been arranged through government consortia which were responsible for coordinating flows of financial assistance to those countries. Private debts usually have not been rescheduled in these contexts, in part because the amounts involved were relatively small compared with official claims.

LDC workouts of debt to private bank creditors have been much more infrequent and have tended to take the form of refinancing, rather than rescheduling of existing debt. The principal cases in earlier years involved Argentina and Brazil (early 1960's), Peru (1965), and the Philippines (1970).[4] Because of rapid expansion in international lending, however, banks since 1975 have become even more heavily engaged in negotiations with developing countries, as in the recent negotiations with the governments of Chile and Zaire on debt-relief issues. In additions, they have provided balance-of-payments financing for Argentina and Peru to ease potential debt problems of these countries. In this situation , banks and regulators alike have become concerned about the need to improve methods for assessing individual country risks.

Methods for assessing risk

Country appraisal can come into play at two different stages. One phase involves the approval of individual credits, and thus requires a report by the bank's economics department on the borrowing country's general political and economic situation. The second phase involves the setting of country targets or limits, for the use of bank management in overseeing the bank's international portfolio. The latter process involves making country comparisons about the risk of nonrepayment, and so subjective judgments play an important role.

Most banks are reluctant to assign formal credit ratings to individual countries when setting country guidelines. In the Eximbank survey, for example, only about a fourth of the banks surveyed (8 out of 37) translated their country evaluations into a country rating (usually with a five-grade letter system A to E). Five of the banks which rated countries utilized a weighted checklist system, with economic and political indicators being used to measure a country's repayment prospects. The summary score, or country rating, in each case was obtained by assigning weights to individual indicators and then summing the value of individual indicators.

The checklist approach can be criticized for failing to provide a conceptual framework for selecting individual indicators, and also for its arbitrary selection of weights. However, statistical procedures are currently being developed to circumvent some of these problems, by such agencies as the U.S. Treasury Department and the U.S. Export-Import Bank. Their statistical debt-monitoring systems use a single predictive equation, based on information about past debt reschedulings, to screen "high risk" countries from those with low probabilities of rescheduling. (The methodology underlying the Treasury and Eximbank systems is described in Section III.) Countries singled out as possible rescheduling candidates are then subjected to in-depth economic and political analyses.

The econometric approach provides a means for identifying statistically significant variables and for assigning weights which are not completely subjective. From a commercial-bank standpoint, though, the central issue is whether econometric techniques provide a more reliable means of detecting defaults or debt reschedulings than present procedures. A direct comparison of the two approaches is not possible, since banks which make country ratings do not publicly test their rankings against experience. Published studies which employ econometric techniques, on the other hand, report low error

rates in explaining past reschedulings, although they have been far less successful in anticipating reschedulings than in explaining most reschedulings.[5]

The problems can be traced to the conceptual framework used to explain debt reschedulings (Section II) and to methodological difficulties encountered in applying statistical procedures to a small sample of rescheduling countries (Section III).

II. Conceptual Approaches to Debt Reschedulings

Part of the difficulty faced by commercial banks and regulatory agencies in assessing risks can be traced to the absence of a well-developed conceptual framework for analyzing debt problems of developing countries. Economic models of "optimal" foreign borrowing largely have been concerned with the effect of foreign borrowing on economic growth and with conditions necessary to ensure an efficient allocation of resources over time.[6] These studies generally conclude that repayment of external debt is not a problem, provided that the rate of return on domestic investment equals or exceeds the cost of foreign borrowing.[7] Such models, however, do not allow for the fact that foreign borrowing must be repaid in foreign exchange, and that foreign-exchange receipts may be temporarily scarce. Second, they typically assume that domestic and international capital markets are perfectly competitive—assumptions which are highly unrealistic for most developing countries.

The two approaches presented in this section explicitly deal with the foreign-exchange problems which surround most debt reschedulings. The *debt-service approach* traces the LDC's foreign-exchange problems to their heavy reliance on exports of primary products and to the high volatility of these products on world markets. Financial ratios derived from individual balance-of-payments components hence are used to measure a country's ability to service its external debt in the event of a shortfall of export receipts. The *monetary approach,* on the other hand, is primarily concerned with the overall determination of a country's balance of payments, and thus focuses attention on that country's monetary-fiscal policy and exchange-rate policy. From this perspective, the underlying causes of debt reschedulings are internally, rather than externally, generated.

Debt-service approach

The analytic approach used in most statistical debt-monitoring systems is based on the financial-ratio analysis pioneered by Avramovic and associates at the World Bank [3]. The approach views reschedulings as a problem of external debt management, and thus focuses attention on the determinants of a country's "debt-service capacity". We are concerned here with that approach's underlying assumptions and their implications for the analysis of LDC debt problems.

In the Avramovic study, one type of debt problem involves the near-term bunching of debt-service payments, while a second involves debt rescheduling over a longer time interval.[8] The Latin American reschedulings typified the first type of problem: debt-service payments on short- and medium-term commercial debt were rescheduled over a fairly short time span—e.g., one to five years. But in the case of the consortia creditors to Ghana, India, Indonesia, and Pakistan, long-term official lending formed a significant portion of debt-service payments. In these cases, the reschedulings covered such a long time-span—up to 30 years in the case of Indonesia— that they had a noticeable impact on debt-service burdens.

Avramovic analyzes the short-run debt problem as if the developing country were a firm facing a cash-flow or liquidity squeeze. The liquidity problem in this case reflects a temporary shortfall in foreign-exchange receipts, brought about by an exogenous decline in the world price of the LDC's principal export product. Under these circumstances, the country can try to cover payments abroad by expanding its export volume, by curtailing imports, by further borrowing or by drawing down foreign-exchange reserves. Avramovic's analysis, however, assumes that most LDC's cannot expand export proceeds easily in the short run, and that they cannot easily "roll-over" debt by borrowing from private capital markets. Under these assumptions, a developing country has only two viable options available in

the short run—namely, to draw down reserves (including drawings from the International Monetary Fund) or to reduce its import volume.

The Avramovic approach attempts to measure a country's ability to withstand an export shortfall (or a situation of capital flight) by constructing financial ratios from individual balance-of-payments components. The principal measure of "reserve adequacy," for example, is the ratio of foreign-exchange reserves to annual imports of goods and services. The higher the ratio, the better equipped the country is to cover imports by temporarily drawing down foreign-exchange reserves.

The traditional indicator of debt-service capacity, on the other hand, is the debt-service ratio—the proportion of foreign-exchange earnings on current account (exports of goods and services) absorbed by interest payments and amortization on external debt. Those analysts using this indicator do so because debt-service payments represent contractually fixed obligations which cannot be easily adjusted; hence, a higher ratio implies a larger relative burden on import reduction for a given shortfall in export receipts. The reasoning behind this traditional indicator is that there is a limit on a country's ability to tolerate a reduction in its import volume.[9]

One of the principal conclusions of the Avramovic study is that the debt-service ratio is a relevant indicator of potential "cash squeeze" problems associated with foreign-exchange crises, but that it is less useful for analyzing debt problems of a long-run nature. The reason is that domestic savings rates normally rise during the process of economic development, in which case foreign-borrowing requirements needed to sustain a given target growth rate will diminish through time. A country's debt-service ratio thus will tend to rise in the early stages of development, when domestic saving rates are low, but will tend to level off or decline with the later rise in domestic savings. The ability to repay external debt over the long run, therefore, hinges on the difference between the marginal savings rate and the initial savings rate, as well as on the relationship between the rate of return on investment and the cost of foreign borrowing.[10]

The usefulness of the debt-service approach as an analytical tool hinges critically on the existence of assumed balance-of-payments rigidities and on the nature of foreign-exchange bottlenecks. In Avramovic's analysis, the foreign-exchange constraint reflects two factors: (1) limited possibilities for short-run expansion for export production, and (2) inelastic demand for a country's major export product. It is assumed that if a country attempts to expand its export volume by increasing export production or by reducing domestic consumption, the increased export volume will lead to a deterioration in the country's terms of trade; so that export receipts are not increased.[11] But if the "small-country assumption" is applicable—if the country's share of the world market is so small as to leave the world price unaffected—the foreign-exchange bottleneck disappears. That is, the country can increase its export volume (and its export receipts) through increased domestic savings or through expanded production.

The assumption of limited (or zero) capital mobility is also critical to the analysis. If a country is able to borrow from world capital markets (including commercial banks) to cover a temporary shortage of foreign exchange, the concepts of "reserve adequacy" or "debt service capacity" become much more difficult to define. Under these circumstances, it is not the country's lack of foreign-exchange reserves or the country's export earnings *per se* which are important, but rather the country's ability to acquire foreign exchange.[12] In this case, the country must decide whether the cost of foreign borrowing exceeds the cost of adjusting to an export shortfall through import reductions—i.e., profitability considerations are relevant even in the short run.

The main limitation of the approach, however, is that it focuses on the events immediately surrounding a rescheduling, rather than on the underlying causes. It provides few clues to explain why countries borrow heavily, and it allows little scope for domestic policies to influence foreign borrowings or repayment prospects. Avramovic's analysis, for example, completely ignores the role which the domestic price level, the exchange rate, and interest rates play in the process of balance-of-payments adjustment. The key variables—the debt-service ratio, the reserves-import ratio, the export growth rate, or the domestic savings rate—are either exogenous or

structurally determined. As a result, the scope for balance-of-payments adjustment appears quite limited.

Monetary approach

The alternative approach uses a monetary framework of analysis to study the problem of debt-reschedulings. The monetary approach (like the debt-service approach) treats reschedulings as consequences of foreign-exchange shortages. However, it is primarily concerned with the overall determination of the balance of payments, rather than with individual balance-of-payments components. The scarcity of foreign exchange in this case results from: (1) rapid money-supply expansion (associated with the financing of fiscal deficits) and consequent increase in domestic inflationary pressures, and (2) maintenance of an overvalued fixed exchange rate. From this perspective, the underlying causes of debt reschedulings are rooted in domestic economic policies.

An analysis of this monetary framework involves: (1) the effects of domestic inflation and an overvalued exchange rate on the supply and demand for foreign funds, and (2) the implications of exchange-rate flexibility for debt reschedulings. Consider first the case of a developing country which maintains a fixed exchange rate and which suffers from a higher inflation rate than the rest of the world.

Inflation can influence the demand for foreign funds in such a case through its adverse impact on the trade accounts. That is, inflation would tend to cause export demand to fall and import demand to rise, and the growing trade deficit, in turn, would increase trade-financing requirements. A second type of inflation impact, noted by Friedrich Lutz [19], concerns the effect of an over-valued exchange rate on the cost of borrowing funds from abroad. Lutz's analysis assumes that nominal interest rates in the domestic economy (i_d) and abroad (i_f) reflect the real rate of return on capital (r) and the expected inflation rate ($\dot{p}$):

$$i_d = r_d + \dot{p}_d \text{ , and} \qquad (1)$$
$$i_f = r_f + \dot{p}_f \text{ .}$$

In financing domestic investment, borrowers compare the real cost of borrowing in the domestic capital market (r_d) with the real cost of borrowing foreign currency from abroad (r'):

$$r' = i_f - \dot{p}_d + \dot{e} \text{ ,} \qquad (2)$$

where: $\dot{e}$ = expected appreciation of foreign currency.

Real borrowing costs in the two markets (and real rates of return on capital in the two countries) will be equated only if the expected exchange-rate change is equal to the expected inflation-rate differential at home and abroad:

$$\dot{e} = \dot{p}_d - \dot{p}_f \text{ .} \qquad (3)$$

If investors believe authorities can maintain a fixed exchange rate temporarily (despite a higher domestic rate of inflation), incentives will exist to borrow more heavily from abroad, since real borrowing costs are then perceived to be lower in the foreign market than in the domestic market.[13]

A more common situation, however, is one in which authorities impose interest-rate ceilings to keep domestic borrowing costs low. Such a policy tends to lower domestic saving and to ration potential borrowers out of the domestic market. The imposition of interest ceilings, therefore, may also create incentives resulting in increased demand for foreign funds.

The amount of foreign borrowing, however, also depends on lenders' expectations about repayment prospects. In a highly competitive market, such as the Eurocurrency market, loans to developing countries include an interest premium—the spread over the London inter-bank offer rate—which reflects the higher risk of repayment. An increased demand for foreign funds associated with an over-valued exchange rate, therefore, need not result in an increased volume of foreign borrowing—provided that there is a contraction (leftward shift) in the supply schedule of foreign funds to offset that increased demand.

While economic theory provides no clear-cut reasons for expecting domestic inflation to lead to an increased volume of foreign borrowing, the effect may not be completely neutral, judging from the experience of those LDC's which have rescheduled suppliers' credits. For instance, most of the Latin American countries of this type were able to obtain ample suppliers' credits (usually government-guaranteed) in the early stages of inflation, but fewer such credits as the inflation progressed. In these cases, domestic inflation re-

sulted in rapid growth of debt-service payments in the early stages of inflation, but then in subsequent export stagnation, which contributed to rising debt-service ratios.

Thus far, we have assumed that authorities in developing countries maintain fixed exchange rates. Actually, most LDC's today continue to peg their exchange rates to some key currency, although a growing number of them have experimented with some form of exchange-rate flexibility in recent years. Under a freely-floating exchange rate, a country cannot experience a shortage of foreign exchange, since there is no official intervention in the foreign-exchange market. The absence of a "foreign-exchange problem," however, does not imply a smaller burden of transferring real resources abroad to service external debt. Rather, exchange-rate flexibility is relevant to debt reschedulings because exchange-rate movements are part of the overall adjustment process, whether the resource-transfer problem is "real" or monetary. Currency depreciation resulting from a price decline for some major export product, for example, will create incentives towards increased export production. Similarly, depreciation resulting from domestic inflation will offset the adverse effects of inflation on the trade accounts. In this sense, exchange-rate flexibility can help reduce the necessity for debt rescheduling. Therefore, one would probably expect fewer debt reschedulings under flexible exchange rates, although not necessarily so in every case.

III. Empirical Evidence on Debt Reschedulings

This section presents empirical evidence on the determinants of debt rescheduling, with emphasis on the characteristics distinguishing those countries which have rescheduled their debt from those which have not—previous empirical studies have largely concentrated on variables suggested in the Avramovic study. The statistical results confirm that reschedulings are associated with a high debt-service ratio and a bunching of external-debt obligations, but there is disagreement about the importance of other economic variables.

Frank and Cline [12] used discriminant analysis to investigate the importance of eight indicators for the period 1960-68. They found only three variables to be important: the debt-service ratio, the debt-amortization ratio, and the ratio of imports to reserves. Feder and Just [11], using a similar set of explanatory variables, applied logit analysis to explain reschedulings during the 1965-72 period. Their results showed the importance of the three variables identified by Frank and Cline, but three other indicators as well—the export growth rate, the level of per capita income, and the ratio of capital inflows to debt-service payments.

Both studies report low error rates in identifying past reschedulings.[14] Nonetheless, questions arise about the availability of data for testing the two basic (debt-service and monetary) approaches. For example, the debt-service approach is difficult to use in any "early-warning" system, at least partly because World Bank data on external debt are available only after a two- or three-year lag for most countries. The U.S. Treasury Department actually discontinued use of its debt-monitoring system because of the problem of obtaining up-to-date, accurate information on LDC external debt.

With respect to the monetary approach, however, inflation rates and exchange rates are generally available with relatively short time lags. Hence, an indicator system relying on the monetary approach is more likely than one based on debt information to detect likely candidates for debt rescheduling. To date, however, there has been little empirical work on the relationship between monetary variables and debt reschedulings, so this study attempts to establish whether such a relationship exists.

Inflation and debt rescheduling

A clear relationship between inflation and debt rescheduling is apparent for the 1960-76 period (Table 2).[15] Altogether, 70 percent of the countries with long-term inflation rates above 10 percent (measured by wholesale prices) rescheduled their debts at some time during that period. Moreover, all six countries in the "high inflation" group had to reschedule at least once between 1960 and 1976.

Other data suggest the important contribu-

tion of currency overvaluation—as well as inflation—to balance-of-payments difficulties prior to debt reschedulings (Table 3). In every case cited, except Egypt and Turkey, a major currency devaluation was undertaken around the period when debt was rescheduled. Yet with frequent exchange-rate adjustments, countries such as Colombia, Israel, Korea, Chile (1965-70 and 1975-76) and Brazil (1965-76) have successfully avoided repayment difficulties despite their relatively high inflation. These countries at times have pursued "crawling peg" policies, where exchange-rate changes are linked to the difference between their own inflation rate and those of their principal trading partners. Their experience suggests that increased exchange-rate flexibility may help mitigate the adverse effects of inflation on export and import performance, on borrowing incentives, and thus on debt reschedulings.

Exchange-rate depreciation, however, may not always be successful in avoiding rescheduling. Four of the five countries which experienced very high inflation, for example, allowed the exchange rate to depreciate on more than one occasion in the period preceding rescheduling. The depreciation, however, was insufficient in each case to offset the adverse effects of sustained high inflation on the trade account.

Application of discriminant analysis

The evidence presented above suggests that monetary factors may be important for understanding previous debt renegotiations. The question still remains, however, as to whether indicators utilized in the monetary approach can perform as well or better than those utilized in the debt-service approach. To answer this question we applied a statistical technique (discriminant analysis) to data on two groups of developing countries—those which rescheduled their debt at least once in the 1960-76 period, and those which did not. The statistical procedure is the same as that employed in the Frank-Cline study and in the debt-monitoring systems used by the U.S. Treasury Department and the U.S. Export-Import Bank.

Discriminant analysis[16] provides a rule (or discriminant function) for classifying observations

Table 2
Inflation and Debt Reschedulings: 1960-1976[1]

Very High Inflation Group (above 20% p.a.)		High-Inflation Group (10-20% p.a.)		Middle-Inflation Group (5-10% p.a.)		Low-Inflation[2] Group (less than 5% p.a.)	
1. Argentina*	(33%)	1. Bolivia	(10.2%)	1. Afghanistan	(8.4%)	1. Algeria	(2.8%)
2. Brazil*	(35%)	2. Colombia	(14.6%)	2. Burma	(7.9%)	2. Egypt*	(3.9%)
3. Chile*	(161%)	3. Ghana*	(11.3%)	3. Costa Rica	(7.3%)	3. El Salvador	(3.2%)
4. Indonesia*	(186%)	4. Israel	(11.0%)	4. Dominican Repub.	(5.1%)	4. Ethiopia	(4.0%)
5. Uruguay*	(53%)	5. Peru*	(10.4%)	5. Ecuador	(7.3%)	5. Guatemala	(3.9%)
6. Zaire*	(25%)	6. Philippines*	(10.5%)	6. Greece	(6.2%)	6. Guyana	(4.0%)
		7. South Korea	(14.6%)	7. India*	(7.7%)	7. Honduras	(3.6%)
		8. Yugoslavia*	(14.6%)	8. Ivory Coast	(5.1%)	8. Iran	(3.6%)
				9. Jamaica	(7.2%)	9. Iraq	(3.0%)
				10. Mexico	(5.1%)	10. Jordan	(4.4%)
				11. Pakistan*	(7.0%)	11. Malaysia	(3.0%)
				12. Paraguay	(9.1%)	12. Sri Lanka	(4.4%)
				13. Spain	(5.8%)	13. Syria	(4.5%)
				14. Thailand	(5.5%)	14. Venezuela	(4.4%)
				15. Tunisia	(5.5%)		
				16. Turkey*	(9.5%)		

[1] Figures in parentheses represent annual compound (WPI) inflation rates over the period 1960-1975. Asterisks denote debt reschedulings in the period 1960-76. (See Table 1). Data from *International Financial Statistics.*

[2] U.S. annual compound WPI inflation rate is 4.2% for 1960-75.

(e.g., countries) into two or more groups (e.g., "rescheduling country" vs. "non-rescheduling country"). The rule is selected so as to minimize the expected cost of making two types of errors in classifying observations. In our analysis, Type I error occurs when a rescheduling country is classified as a non-rescheduling country, and Type II error results when a non-rescheduling country is classified as a rescheduling country.

Suppose, for example, that the only difference between rescheduling countries and non-rescheduling countries is that the inflation rate is higher on average in the first group than in the second group. Under these circumstances a simple way to classify countries would be to select some cut-off inflation rate, say 10 percent, and to categorize countries with inflation rates above this value in the rescheduling group, and to categorize countries with lower inflation rates in the non-rescheduling group. Applying the "10 percent cut-off rule" to the countries listed in Table 2 yields the following set of results:

	Inflation Rate > 10%	Inflation Rate ≤ 10%
Rescheduling group (14 countries)	71% (classified correctly)	29% (Type I error rate)
Non-Rescheduling group (30 countries)	13% (Type II error rate)	87% (Classified correctly)

Table 3
Debt Reschedulings and Exchange Rate Devaluations[1]

Debt Reschedulings		3 year CPI Inflation Rate (%)	3 year Money-Supply (M_1) Growth Rate (%)	Exchange Rate Devaluation
Very High Inflation Group				
Argentina	1962	23.3	9.9	1962
	1965	24.7	31.1	1964, 1965
Brazil	1961	31.6	43.9	1961
	1964	69.7	70.5	1962-65
Chile	1965	37.3	48.8	1962-65
	1974	43.2	110.3	1972-76
Indonesia	1965	173.8	386.2	1966-68
	1970	185.0	73.3	1970
Uruguay	1965	40.3	58.8	1965
Zaire	1976	24.6	25.5	1976
High Inflation Group				
Ghana	1966	12.6	14.0	1967
	1974	16.0	29.9	none
Peru	1968	12.6	14.4	1967
Philippines	1970	6.2	10.9	1970
Yugoslavia	1965	16.3	16.1	1965
	1972	11.4	15.8	1971
Middle or Low Inflation Groups				
India	1968	9.4	7.8	1966
	1973	8.8	14.5	1972
Pakistan	1971	5.0	14.3	1971
Egypt	1966	9.2	10.1	none
Turkey	1965	3.3	14.5	none
	1972	11.4	21.6	none

[1] Data from *International Financial Statistics.*

Thus, four of fourteen countries (29 percent) which rescheduled their debt had long-term inflation rates less than 10 percent, so that use of a 10 percent cut-off value caused those four to be classified incorrectly (Type I error). Four of the thirty countries (13 percent) which did not reschedule, on the other hand, had a long-term inflation rate above 10 percent, resulting in Type II error.

The same principle applies to a situation in which there are a number of variables which differentiate the two groups. In this case, a discriminant "score" (or composite variable) is computed as a weighted average of the individual variables for purposes of classifying individual observations. The weights of the composite variable are selected so as to maximize the difference in mean values for the two groups, given the specified set of variables.

The ability to classify countries correctly depends on how close the group means are relative to the group dispersions. This point is illustrated in Figures 1a and 1b, which assume normal "bell-shaped" distributions for the two-group case and a cutoff inflation value, c. The probability of Type II error (i.e., of misclassifying an observation from the nonrescheduling group) with a value of $\dot{p} > c$ (= 10 percent), thus, is the shaded area under the bell-shaped function for group I to the right of c, while the probability of misclassifying an observation from group 2 (Type I error) is the shaded area to the left of c under the density function for group 2. Error rates in classifying observations (i.e., the percentage of observations misclassified) will be much greater when there is considerable group overlap (Figure 1a) than if there is only a small degree of group overlap (Figure 1b). Differences in group means, therefore, do not always guarantee that the rules will yield a useful classification scheme in which the errors are small.

Finally, the proportion of Type I and Type II errors depends on the particular cutoff point selected for classifying countries. Moving the cutoff value, c, to the right in Figure 1, for example, increases the probability of Type I error and reduces the probability of Type II error, while the opposite is true if the cutoff value is moved to the left. Selection of the cutoff point hinges on an assessment of the cost of making each type of error (which may entail a subjective judgment) and on the frequency of reschedulings relative to non-reschedulings.[17]

Methodological issues

The main problem encountered in applying discriminant analysis (or other statistical procedures) to debt-rescheduling data arises from the small number of obervations of this type. Pooled time series and cross-section data are typically used to increase the number of rescheduling observations, and this procedure is adopted here. Each observation thus corresponds to a country and a year. The Argentine multilateral rescheduling of 1962, for example, is treated as a separate observation from the Argentine rescheduling of 1965.

The procedure of pooling time series and cross-section data leads to further complications, however, which must be considered in interpreting our results (and those of other published studies):

1. The number of rescheduling cases (24) is still small in comparison with the non-rescheduling cases (442).[18] Plots of variables for the rescheduling group, moreover, suggest that the data are not normally distributed. Thus, one of the theoretical assumptions underlying discriminant analysis is violated.[19]

2. The individual observations are "serially correlated." A country which exhibits a high (or low) inflation rate or debt-service ratio in one year, for instance, tends to exhibit the same characteristic in other years. This will affect the error rates, since a country which is misclassified (or correctly classified) in one year will tend to be misclassified (or correctly classified) in other years.[20]

3. A problem arises with countries which have rescheduled debt more than once. Ghana and India, for example, have had debt rescheduled in a number of years since 1966 and 1968, respectively, in the process of coordinating aid flows to those countries. Thus, do those reschedulings represent "new events" or extensions of the original reschedulings?[21] A question also arises regarding the treatment of observations of rescheduling countries in non-rescheduling years. The results reported here delete such observation, since we are primarily interested in

identifying characteristics which distinguish rescheduling from non-rescheduling countries, rather than identifying the times of rescheduling.[22]

4. The implicit assumption is that the factors contributing to reschedulings are the same in one period as in other periods—i.e., there are no "structural" changes affecting reschedulings (or distributions) during the sample period. It is difficult to test this proposition because of the limited number of reschedulings, although the discriminant rule appears to explain recent cases as well as earlier cases.

Several further pitfalls are often encountered in interpreting results from discriminant analysis. One of the most widely misunderstood aspects relates to the problem of determining the importance of individual variables. Unlike the

Chart 1A

NORMAL DISTRIBUTION WITH LARGE GROUP OVERLAP

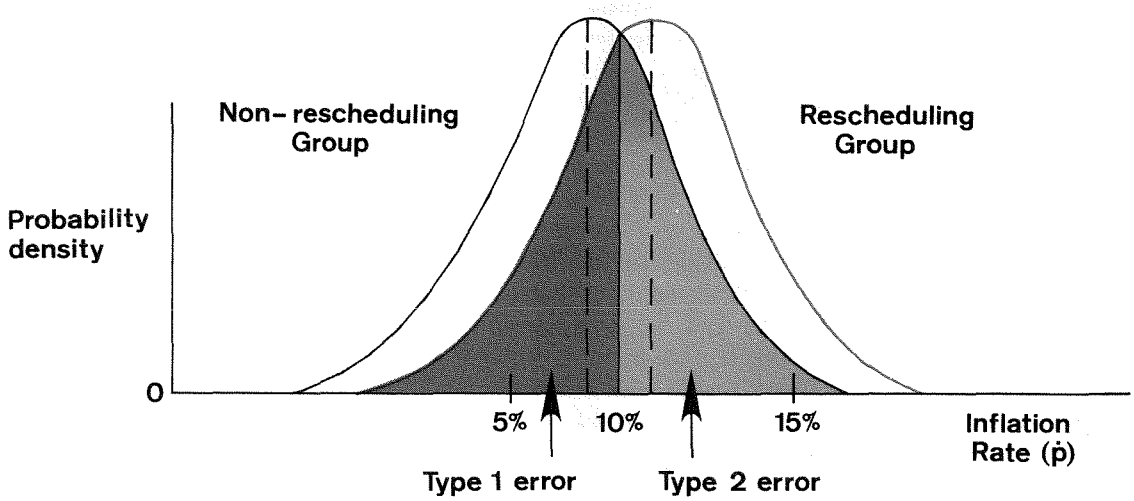
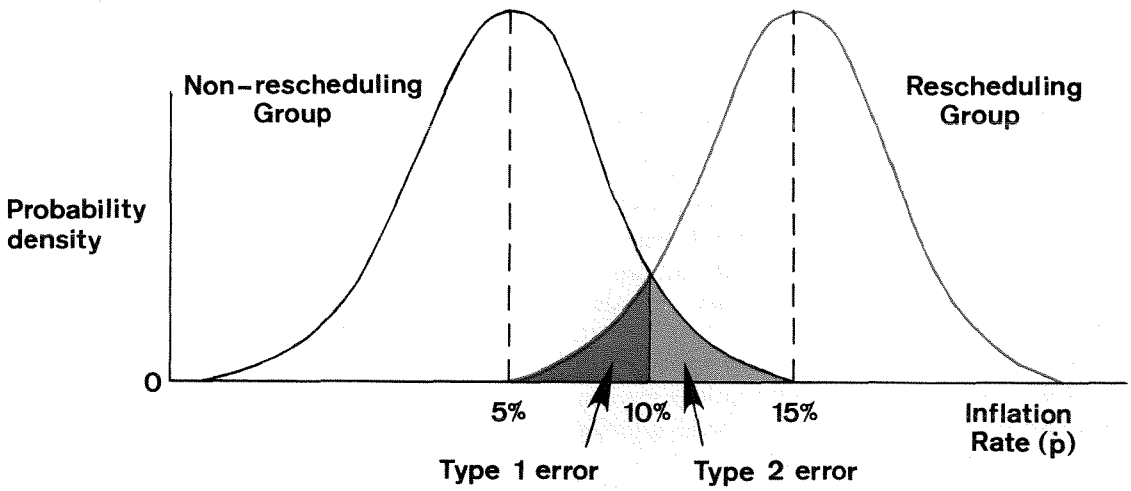


Chart 1B

NORMAL DISTRIBUTION WITH SMALL GROUP OVERLAP



coefficients in the linear-regression model, the discriminant-function coefficients are not unique. (However, the ratios of those coefficients are unique.) Consequently, no test can be made for the *absolute* importance of a particular variable (i.e., setting a particular coefficient equal to zero or to some other value), although a number of methods have been proposed to determine the relative importance of individual variables.[23]

Empirical results

Two sets of explanatory variables were used to differentiate rescheduling and non-rescheduling cases in the 1960-75 period. The first set included variables identified in previous empirical studies: (1) the debt-service ratio; (2) the reserve-import ratio; (3) the export growth rate (in U.S. dollars); (4) the growth rate of real GNP and (5) the level of per capita GNP (in 1970 U.S. dollars). The second set contained variables suggested by the monetary approach, and also (6) the (consumer-price) inflation rate; (7) the growth rate of the M_1 money supply; and (8) a measure of relative purchasing-power parity (the difference between the domestic and U.S. inflation rates, on a wholesale-price basis, less the rate of domestic currency depreciation vis-a-vis the U.S. dollar). All explanatory variables were expressed as three-year annual averages, with the explanatory variables lagging the dependent variable an average of one year—e.g., with the 1960-62 average inflation rate distinguishing rescheduling and non-rescheduling cases in 1962. The debt-service ratio was also adjusted to include *scheduled* (rather than actual) debt-service payments.[24]

A forward step-wise regression procedure was used to obtain a measure of the relative importance of each variable, prior to applying the discriminant sub-routine.[25] The results suggested that the inflation rate and the adjusted debt-service ratio were the most important explanatory variables (Table 4). The inflation rate and the money-supply growth rate were highly correlated, however, so that the relative importance of the money-supply variable increased considerably when the inflation rate was excluded. Two of the variables, the reserve-import ratio and the level of per capita income, added little in the way of explanatory power, and thus were omitted from the discriminant sub-routine.

The mean inflation rate for the rescheduling group was nearly seven times larger than the non-rescheduling group; the money-supply growth rate was nearly four times larger, and the adjusted debt-service ratio was about three times greater. The standard deviation of the inflation rate and money-supply growth rate for the rescheduling group, however, were also considerably larger than for the non-rescheduling group, owing to the incidence of hyper-inflation and the small sample size. As a result, differences in the coefficients of variation (i.e., the standard deviation divided by the mean) for the two groups were much smaller than the differences in group means.

Tests for equality of the multivariate group means and variance-covariance matrices indicated that group differences were statistically significant.[26] Under these circumstances, the appropriate rule for classifying countries would be a quadratic (rather than linear) function. In most cases tested, however, the linear function yielded comparable results to the quadratic function. The linear rule also had the advantage of being easier to interpret, because of the smaller number of terms involved.

Two separate linear functions were obtained:

(1) *Inflation Rate Included*

$$8.72 - .21(CPI) - .01(MS) + .04(EX) - .35(DSA) + .03(PP) + .07(GNP)$$

(2) *Inflation Rate Excluded*

$$7.72 - .10(MS) + .05(EX) - .36(DSA) - .05(PP) + .11(GNP)$$

where:

CPI = average annual rate of consumer price inflation over three-year period

MS = average annual rate of M_1 growth over three-year period

EX = average annual rate of growth of exports (in U.S. dollars) over three-year period

DSA = average debt-service ratio over three-year period (adjusted to include *scheduled* debt-service payments for rescheduling countries)

PP = purchasing-power parity (i.e., a three-year average of the difference between the domestic and the U.S. WPI inflation rates, less the rate of domestic currency depreciation vis-a-vis the $).

GNP = average annual rate of growth of real output over three-year period.

The functions were constructed so that the

more the negative value, the more likely the country would be classified in the rescheduling group. The prominence of the inflation rate in equation 1 (or money-supply growth rate in equation 2) and the adjusted debt-service ratio is apparent from the weights of these variables in the discriminant functions, which corroborates the finding from the step-wise regression procedure. In addition, the negative signs of the coefficients of these variables are consistent with the hypothesis that the probability of rescheduling increases as their value increases.

The percentage of countries classified incorrectly with these functions ranges from 3 percent to 11 percent, depending on the cutoff value selected. (The cutoff value for the results reported assumes the expected cost of Type I error is three times the expected cost of Type II error.) The overall error rate is not very meaningful, however, in view of the large difference in sample size for the two groups of countries. The percentage of rescheduling cases in the sample is roughly 5 percent; hence, a rule which classifies all countries as non-rescheduling cases will have an overall error rate of 5 percent. For this reason, it is important to examine the incidence of Type I and Type II errors and to see how they vary with the cutoff point.

Type I error rates vary from 15 to 54 percent, while Type II error rates range from less than 1

Table 4
Sample Characteristics of Rescheduling and Non-Rescheduling Groups *

Variable	Non-Rescheduling Group			Rescheduling Group		
	Mean	Standard Deviation	Coefficient of Variation[1]	Mean	Standard Deviation	Coefficient of Variation[1]
Inflation(CPI) Rate	5.6	5.7	1.02	36.7	48.5	1.32
				(23.8)[2]	(21.5)[2]	(0.9)[2]
M_1 Growth Rate	13.9	8.2	0.59	49.6	78.0	1.57
				(33.2)[2]	(31.2)[2]	(0.94)[2]
Export Growth Rate	16.3	18.1	1.11	9.7	13.3	1.37
Debt Service Ratio	7.6	5.8	0.76	21.1	8.5	0.40
Real GNP Per Capita Growth Rate	3.7	3.9	1.05	2.3	2.6	1.13
Purchasing Power Parity	4.3	7.2	1.67	8.1	15.0	1.85

Measure of Relative Importance
(Percent of explanatory power accounted for by each variable)

Variable	Inflation rate included	Inflation rate excluded
Inflation(CPI) Rate	42.7%	
M_1 Growth Rate	2.0	33.0%
Export Growth Rate	11.3	14.5
Debt Service Ratio	35.5	37.9
Real GNP Per Capita Growth Rate	4.6	7.3
Purchasing Power Parity	3.9	7.2

[1] Standard deviation ÷ mean

[2] These figures are affected by the experience of hyper-inflation surrounding the Indonesian reschedulings. Values excluding data for Indonesia are in parentheses.

* Country data are from *International Financial Statistics* and from IBRD, *World Tables*.

Table 5
Discriminant Analysis Results:
Classification of Rescheduling Countries [1]

Results Including Debt-Service Ratio in Discriminant Function		Results Excluding Debt-Service Ratio in Discriminant Function	
Countries Correctly Classified		**Countries Correctly Classified**	
Argentina	(1965)	Argentina	(1965)
Argentina	(1976)	Argentina	(1976)
Brazil	(1961)	Brazil	(1961)
Brazil	(1964)	Brazil	(1964)
Chile	(1965)	Chile	(1965)
Chile	(1972)	Chile	(1972)
Ghana	(1966)		
India	(1968)		
India	(1973)		
Indonesia	(1966)	Indonesia	(1966)
Indonesia	(1970)	Indonesia	(1970)
Pakistan	(1971)		
Peru	(1975)		
Turkey	(1965)		
Turkey	(1972)		
Uruguay	(1965)	Uruguay	(1965)
Countries Incorrectly Classified		**Countries Incorrectly Classified**	
Argentina	(1962)	Argentina	(1962)
Egypt	(1966)	Egypt	(1966)
		Ghana	(1966)
Ghana	(1974)	Ghana	(1974)
		India	(1968)
		India	(1973)
		Pakistan	(1971)
Peru	(1968)	Peru	(1968)
		Peru	(1976)
Philippines	(1970)	Philippines	(1970)
		Turkey	(1965)
		Turkey	(1972)
Yugoslavia	(1965)	Yugoslavia	(1965)
Yugoslavia	(1971)	Yugoslavia	(1971)
Zaire	(1976)	Zaire	(1976)

[1] Results based on two sets of linear discriminant functions; assuming expected costs of Type I error is three times the expected cost of Type II error:

Debt Service Ratio Included

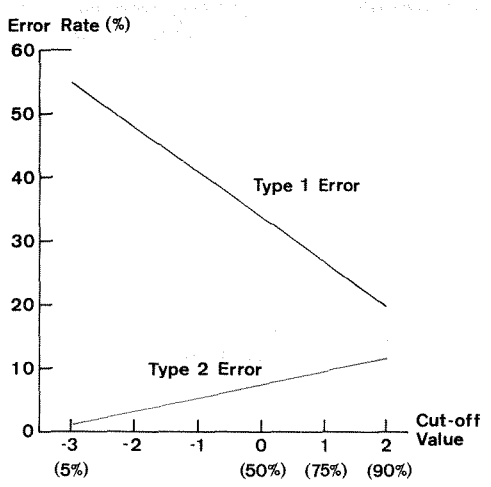
$$8.72 - .21\,(CPI) - .01\,(MS) + .04\,(EX) - .35\,(DSA) + .03\,(PP) + .07\,(GNP)$$

Debt Service Ratio Excluded

$$4.07 - .22\,(CPI) - .01\,(MS) + .04\,(EX) + .03\,(PP) + .03\,(GNP)$$

Chart 2

RELATION OF ERROR RATES TO VALUE OF CUT-OFF POINT
(Linear Discriminant Function)



percent to 11 percent (Figure 2). The ability to classify non-rescheduling cases more precisely than rescheduling cases reflects the absence of a "well-behaved" distribution for the rescheduling countries—i.e., the variables are highly skewed and exhibit large variances.

The discriminant rules perform best in explaining reschedulings in South American countries (Argentina, Brazil, Chile, Peru, Uruguay) and Indonesia, where 10 out of 12 cases are correctly classified (Table 5). Reschedulings in these countries are associated with high inflation and rapid money-supply growth, and the discriminant rule assigns a relatively large weight to these variables. These countries also tend to have high debt-service ratios, but that ratio need not be included to explain their reschedulings.

Reschedulings in South Asian countries, on the other hand, require some information on the adjusted debt-service ratio. India and Pakistan experienced relatively low inflation rates for the group of rescheduling countries (partly owing to the use of extensive price controls), but debt relief for these countries (and for Ghana) has become a means of supplementing aid flows. The debt-service ratio, in particular, has been used as an indicator of need for debt relief by the consortia of aid donors.

The results are somewhat paradoxical in the light of the traditional approach taken by Avramovic et al. On the one hand, the debt-service ratio is found to be an accurate—but largely redundant—indicator of those reschedulings associated with short-run balance of payments crises. On the other hand, the debt-service ratio is found to be a critical factor explaining those reschedulings associated with long-run debt problems. In the latter cases, the reasons are political as well as economic.

IV. Summary and Conclusions

This paper has examined two sets of issues involved in country-risk appraisal—the causes of past debt reschedulings, and the ability to anticipate future reschedulings. The evidence suggests, first, that there is a systematic pattern of debt reschedulings which is amenable to economic analysis. Reschedulings, in short, are not isolated or random events, even though their underlying causes are not the same for all countries.

The analysis distinguishes between "liquidity" reschedulings, which are associated with the bunching of short-term commercial credits, and other reschedulings, which are identified with long-term debt relief on official credits.

Monetary (and fiscal) factors appear to be closely involved in the "liquidity" cases. Inflation and over-valued exchange rates lead to excessive reliance on foreign borrowing and thence to export stagnation and over-importing—and generally to foreign-exchange crises. Cases of chronic debt relief, on the other hand, appear less amenable to a monetary framework of analysis. In particular, it becomes difficult to measure the extent of over-valuation on the basis of inflation-rate differentials, because of the LDC's tendency to resort to price controls, capital controls, exchange controls, and high tariff barriers.

Knowledge of the causes of past reschedulings does not necessarily imply an ability to anticipate future reschedulings. The latter is affected by the difficulty of correctly forecasting exogenous variables, by changes in structural parameters of estimating equations, and by problems caused by the small samples used in analyses of previous reschedulings. Even so, statistical procedures have an advantage over commercial-bank check-

list systems because they provide a systematic method for identifying variables and for explicitly considering trade-offs.

An understanding of past reschedulings, moreover, can be useful in delineating what is important for country-risk appraisal. The analysis in this paper suggests that banks should focus on the inflation rate (and its determinants) and the debt-service ratio as the key economic variables affecting a country's borrowings and its ability to repay.

FOOTNOTES

1. See Goodman [13]. The Federal Reserve has also recently conducted an informal survey of bank practices in defining, monitoring, and controlling foreign lending exposure.
2. By denominating a loan to an LDC in a key currency, a commercial bank can avoid the risk of exchange rate depreciation of the LDC currency, but not the risk of non-repayment.
3. Estimates of the cost of rescheduling are difficult to obtain since fairly detailed information on the repayment stream is required to compute the present discounted values. In case of reschedulings of official credits it is customary to compute the "grant element" of the rescheduling—i.e., the value of the repayment stream after rescheduling as a fraction of the value of the repayment stream at commercial interest rates.
4. For purposes of this study, refinancings of individual bank credits are treated as a problem of **credit risk**, rather than as a problem of **country risk.** The distinction between refinancings and reschedulings in many cases is moot, although technically a refinancing involves an extension of new credit as compared to a "stretch-out" of an existing credit.
5. Forecasting precision is affected by the ability to forecast exogenous variables accurately and by changes in structural parameters, as well as by the standard error in the estimating equation.
6. See Bade [4], Bardhan [5], and McCabe and Sibley [20].
7. Aliber [1] discusses the analogy of the optimum indebtedness of the firm and that of developing countries. His paper examines whether bank lending to developing countries constitutes an efficient allocation of the world's resources and whether risk premiums on LDC loans are too large relative to the cost of rescheduling.
8. Avramovic uses a separate analytic framework to examine each type of problem. Our discussion is primarily concerned with debt problems associated with a foreign exchange crisis, rather than with problems stemming from slow economic growth.

The theoretical underpinnings for separating the two types of problems are the "two-gap" models of economic development, which assume that foreign exchange earnings are limited by inelastic export demand, and that technical substitution possibilities between foreign and domestically produced capital goods are fixed. Under these circumstances, the *ex-ante* condition for trade balance and for equality of domestic savings and investment are written separately, rather than in the usual fashion, $S-I = X-M$. The foreign exchange constraint is assumed to be binding in the short run, while the savings constraint is binding over the long run. For a critique of the two gap models, see Nelson [21].

9. The popularity of the debt-service ratios as a default indicator dates back to the 1930's, when a number of Latin American countries with high debt service ratios (15% or more) defaulted. See Avramovic [3], p.194. Primary producing countries experienced sharp declines in prices of their export products, increasing their real debt burden; at the same time, new credits were not forthcoming. On the other hand, there are several examples of countries with high debt-service ratios which have not experienced debt difficulties. These include Australia and Canada during the 1930's (with investment service-export earnings ratio above 30 percent) and Mexico, Brazil, and Israel in recent years.
10. Avramovic examines the properties of a model of foreign borrowing which assumes a Harrod-Domar (fixed coefficient) model of economic growth. The condition for equi-proportionate growth of debt and GNP is written:

$$i = \frac{r(s_0 - s')}{(s_0 - Kr)}$$

where i = average interest on foreign debt
s_0, s' = average and marginal savings rate
K = incremental capital-output ratio
r = growth rate of GNP

See Avramovic [3], Mathematical Appendix, pp. 188-192.

11. "Hitherto, the discussion has been in terms of 'domestic' growth variables, in particular the savings-investment balance. The savings-investment gap is equal to the foreign exchange gap, by definition. However, this is no more than an *ex-post* accounting equality. More interesting is the mechanism by which this equality is brought about. The capacity to transfer savings abroad may be undermined by a deterioration in terms of trade. The foreign exchange gap, allowing for the movement of export and import prices, may be much larger than the savings-investment gap at constant prices. The quality is restored *ex-post*, by a reduction in the 'international value' of domestic savings and, also, by an actual reduction in the domestic savings rate as income growth decelerates under the impact of the deterioration of the terms of trade." Avramovic [3], p. 50.
12. The fact that countries such as Brazil, Mexico, and Israel have ready access to international capital markets helps to explain why they are able to successfully sustain high debt-service ratios. In these countries debt can be "rolled-over" much more easily than in most other developing countries.
13. This situation existed in Korea in the period immediately following the financial reforms of 1964-65. For further discussion of this point, see Sargen [23].
14. Feder-Just report overall error rates in classifying countries (i.e., Type I and Type II errors as a percent of the total number of observations) ranging from 2 to 5 percent, while Frank-Cline report error rates between 8 and 18 percent of the sample.
15. Countries listed in Table 2 coincide with those used in our statistical analysis discussed in Section III. Countries were selected using two criteria: (1) whether they had a debt-service ratio above 5 percent; and (2) whether time series data on key series were available dating back to 1960. The main group of developing countries omitted from the sample are African nations.
16. For a description of the technique, see Eisenbeis and Avery [9].
17. The discriminant technique attempts to minimize the following "loss" function:

$$L = C_1 \cdot P(1/2)\, \pi_2 + C_2\, P(2/1)\, \pi_1,$$

where $P(1/2)$ is the probability of assigning an observation to group 1, given it arose from group 2; C_1 is the cost of misclassifying an observation to group 1, given it is from group 2; π_1 and π_2 are the a priori probabilities of an observation being drawn from groups 1 and 2 respectively.

The cutoff value corresponds to $\ln \frac{C_1\pi_1}{C_2\pi_2}$.

18. The countries in the sample are listed in Table 2. Most of the data cover the period 1960-1975. However, three countries which experienced debt difficulties in 1976 (Argentina, Peru, and Zaire) were also included as rescheduling cases. Information on rescheduling was obtained from Bitterman [6], IMF [17] [18] and OECD [22].

19. Non-normality does not necessarily imply that the results are invalid, but it may affect the error rate in ways that are not quantifiable. We are presently experimenting with transformations that more closely approximate a normal distribution.

20. The presence of serial correlation means that the number of *independent* observations is considerably smaller than the total number of observations. At present, there are no procedures to correct for serial correlation using discriminant analysis as there are with regression analysis. To get around the problem, one can use each country in the 1960-76 period as one observation, but the number of rescheduling cases is much smaller.

21. Reschedulings for India in 1973 and Ghana in 1974 have been treated as new events, because major decisions were reached on continuing long-term debt relief to these countries.

22. This procedure is used by Feder and Just in their study. If one is interested in identifying the year that a rescheduling occurs, one can follow the procedure of treating the observations as "holdouts" and seeing how they are classified by the discriminant rule. Alternatively, one may choose to assign observations to three groups, instead of two.

23. See Eisenbeis [10], pp. 13-14.

24. The differences in the adjusted debt service ratios and those reported by the IBRD (based on actual repayments) are especially large for Chile (1974), Ghana (1966), and Turkey (1966), (1971). Our revisions are based on information contained in Bitterman [6], IMF [17] [18], OECD [22].

25. See Eisenbeis and Avery [9], pp. 70-75, for a discussion of the procedure.

26. The test of quality of the dispersion matrix between the rescheduling and non-rescheduling groups yields an $F_{21,5646}$ statistic of 63.7, which is statistically significant (i.e. the variances for the two groups are unequal). Similarly, the test for equality of group means (based on the Mahalanobic D^2_1 yields an $F_{6,459}$ statistic of 43.5. The test, however, assures the dispersion matrices are equal; hence, the results may not be fully accurate.

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