A REAPPRAISAL OF THE METHODS OF STATISTICAL SOVEREIGN RISK ANALYSIS:

with special reference to the period 1967-1982

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ABSTRACT

Loans to sovereign governments or to ventures bearing the guarantee of host governments give rise to the special domain of sovereign risk evaluation systems. Country reports, checklists, and statistical models have long constituted the three major strands to these systems. The last has the special attraction of being able to provide (1) an objective means of testing the association of individual indicators with the observed incidence of debt problems and (2) the means of providing and testing forecasts in the most appropriate format of debt-problem probability predictions. It is these properties that is the subject of this study.

To begin with, however, five background discussions are reviewed over as many introductory chapters. The first of these is concerned with the precise meaning of the 'sovereign' and 'risk' elements of sovereign risk and with the way in which the first, in particular, leads on to the broader balance-of-payments and macroeconomic contexts of sovereign debt problems. The second reviews the history of international financial flows emphasising the place of loans and the way in which unexpected changes have brought about major disruptions in financial markets. Chapters 4 and 5 examine the linkages between domestic policies and the use of foreign savings in general and debt management in particular. Last, chapter 6 identifies the lessons for statistical sovereign risk models to be found in the two other major aspects of sovereign risk analysis, country reports and checklists.

A review of published accounts of the specifications, estimation and sample selection procedures, and forecast error evaluation methods of statistical models suggests these issues requiring further investigation. They are: (1) the heavy reliance on empirical evidence in selecting what has to be, for statistical reasons, a narrow range of explanatory variables; (2) a neglect of the implications of heterogeneities across countries, and of the way in which the time series dimension of the data evolves in practice; and (3) the inappropriateness of reducing forecast probabilities to a 'yes-no' binary in order to compare forecasts with 'yes-no' debt-problem realisations.

The thesis sets out to address these issues *via* a number of changes to the approaches used in previous studies. These variously relate to: (1) the rationales behind the selection and expression of explanatory variables; (2) different balances between debt-problem and problem-free countries; (3) year-by-year parameter re-estimations; and (4) the way in which forecast evaluations are used to judge the performance of estimated models. The empirical tests are geared to investigations of these suggestions. The data essentially relate to a basic, best-preferred, set of 40 developing countries and to a period of sixteen years (1967-82).

Four broad conclusions can be drawn from the empirical test results. First, totally revised specifications, using both three two-year lagged composites (*i.e.*, aggregations of policy variables, more immediate performance variables, and final performance variables) and a proxy for all that was known earlier in the form of the previous period's debt-problem forecast probability ($\hat{P}_{t-1}$), produces, despite its longer lags, both within-sample and out-of-sample performances that are comparable to conventional specifications.

Second, samples that omit all problem-free observations from countries that at some time or another have debt-problem observations, present somewhat better results generally. Furthermore, sample size expansions to add more and more problem-free country-year observations to any given, fixed, set of debt-problem observations produces results that show no great differences to those from strictly balanced samples.

Third, parameter re-estimation procedures on a year-by-year basis have important implications both for coping with structural breaks and for forecast results analyses, throwing a different light on the within-sample 'forecast' results obtained from the conventional 'one-off' estimations relied on by published statistical studies. The re-estimation procedures provide a more realistic view of what can be achieved over any given observation period.

Finally, the thesis examines more sensitive evaluations of the results of statistical sovereign risk analysis by using forecast probabilities ($\hat{P}$'s) to design loan portfolios, an essential objective of sovereign risk analysis in practice. Comparisons of such results and hindsight-optimal portfolios provide a means of evaluating forecast performance in terms of broader and more realistic perspectives.

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CHAPTER I

1-1. BACKGROUND AND OBJECTIVES OF THE STUDY

Ever since Mexico's inability to service its external debts triggered a rapid succession of similar moratoria by other debtor countries and led to what has come to be known as the debt crisis, a great deal of attention has been focused on ways in which these debts might be reduced, transformed into other kinds of assets, or otherwise made more manageable by, in particular, improvements in the economic performances of debtor economies. A part of the ensuing literature has naturally also taken the form of retrospective inquiries into the nature and causes of the debt problems. As may be anticipated, it seems that in general a combination of the influences of various external and domestic factors contributed to the debt crisis starting from the early 1980s. Some of these studies have gone on to consider the questions as to whether creditors overextended themselves without taking appropriate care of monitoring and assessing the debt situation of borrowing countries. This leads directly to the methods used to evaluate circumstances and to allocate loans, the subject of the inquiries presented here, which has received, perhaps surprisingly, little attention in the debt-crisis literature.

The rapid growth of international private bank lending to developing countries since the early 1970s was accompanied by significant changes in the nature as well as the relative magnitudes of this business from the standpoints of both borrowers and lenders. Developing countries resorted to overseas borrowing on a unprecedented scale both to cushion the impact of adverse external circumstances, largely by *ad hoc* and flexible fundings of balance-of-payments deficits, and as well as to finance on-going development programmes. Additionally, the risk-sharing implications of extensions of private commercial credits across national borders increased concerns about conventional country risk assessment methods. Many commercial banks began to establish more structured country risk evaluation systems. Three major strands of them (*i.e.*, country reports, checklists, and statistical models) can be largely indicated.

Their preferences centred on the country reports. This has the advantage of allowing wide-ranging and detailed inquiries into an individual economy. The problem is that the results are difficult to apply when it is the *relative* merits of prospective debtors that are required in deciding how to allocate business, essentially, in the form of loan portfolios. Additionally, notwithstanding the peculiar circumstances that surround most debt problems, there is much to be gained in referring to the experiences of different countries.

These needs for comparative evidence and evaluations have usually been met by practising country assessors by the use of the checklists. The different economic variables that go together to form the 'list' usually take the form of the kind of economic and social indicators that feature in the statistical appendices of most country reports. A country's performance for any one indicator can be turned into a country score, usually just by a simple ranking, which can then be added up across indicators to produce an overall rating for any one country. The results therefore offer also the advantages of summary and quantitative evaluations.

While the checklists potentially have a further advantage in allowing evaluations to be compared with realisations, statistical methods have a special advantage in this respect. These have tended to retain much the same features across a number of studies. The uncontroversial aspects have included the use of a 0, 1 binary to produce a quantitative dependent variable out of the 'yes-no' incidence of debt problems in practice and the use of logit or discriminant analysis as a means of appropriately relating this variable to explanatory variables. Much more uncertainty has surrounded the choice of the last. Each alternative suggestion has tended to be argued individually on *ad hoc* grounds leaving it to tests of statistical significance to decide which collections of variables are considered to be acceptable. Perhaps, not surprisingly, no consensus has emerged as to which variables produce the best fits to past experience. Other ambiguities and problems have included whether to use lagged or contemporaneous indicators, how to deal with problems of multicollinearity and serial correlation, how to

distinguish between reschedulings that are not a response to debt problems and between manifestations of debt problems other than reschedulings, what to do about multiple reschedulings and problem-free years between reschedulings, and how to detect and cope with structural breaks when preparing forecasts.

The object of this thesis is to address these problems anew *via* a number of changes to the approaches used in previous studies. These include the rationales behind the selection and expression of explanatory variables, the balance between debt-problem and problem-free countries, parameter re-estimation procedures on a year-by-year basis, and the way in which forecast evaluations are used to judge the performance of estimated models.

1-2. THE STRUCTURE OF THE THESIS

In first further discussing and later pursuing the objectives set out above, the thesis is arranged in ten chapters. Chapter 2 deals with the major contexts of debt problems and thereby sovereign risk analysis. Care is taken to distinguish first between country and sovereign aspects of loans to debtor economies and second between risk and uncertainty. The first of these questions of definition is seen to highlight the broader balance-of-payments, and thereby macroeconomic, contexts of sovereign debt problems given that the guarantees of governments mean that the ability to meet servicing charges extends beyond the fortunes of the purposes supported by the loans themselves. It follows that sovereign risk analysis should relate to much the same issues as those encountered in evaluating macroeconomic performance in general. The second distinction, between risk and uncertainty, is seen as emphasising the special role of unforeseeable events in the causes of debt problems. Again this is seen to support a different way of selecting and expressing indicators of debt problems so as to focus on the

problems so as to focus on the way in which debtor economics are run, in general, and the sustainabilities of current policies and performances in particular.

In chapter 3 historical perspectives of foreign capital inflows are reviewed. It identifies the continuously changing world economic environment that has shaped the size, scope, and structure of international financial markets since the late nineteenth century. In reviewing the origins of the debt crisis in the early 1980s, in particular, the impact of various external shocks and borrowing countries' reactions are emphasised. The characteristics and limitations of official financial flows and commercial bank lending in relation to the economic development ambitions and debt problems of developing countries are also reviewed.

Attention is later turned to theoretical considerations underlying the role of foreign capital inflows in developing countries. Thus, chapter 4 starts with a review of 'two-gap theory'. It also looks at the relationship between foreign and domestic savings particularly so far as this relates to the interpretation of the results of empirical analysis. The chapter concludes with a discussion of the practicalities of the ways in which external changes and debtor-economy policies determine the purposes served by foreign resource transfers and the success or otherwise of those purposes.

Chapter 5 is concerned with the question as to whether some rules could be devised for designing debt management policies, especially in determining levels of optimal or sustainable borrowing. Conventional theory leads first to the 'debt cycle hypothesis'. in order to establish conditions enabling a debtor economy to make the transition between increasing and declining, or at least stable, debt accumulations. Reviews of considerations having a bearing on sustainable debt situations in practice draw the conclusion that it is impossible to summarise all these conditions in the form of a 'rule of thumb' as to what constitutes a sustainable debt situation.

Reviews of published sovereign risk assessment procedures are set out over chapters 6 and 7. Summaries of the findings of four surveys of the techniques used and preferred by banks provide a convenient introduction at the start of chapter 6. Among the three main methods, the country reports and checklist systems are then dealt with over the remainder of chapter 6. The focus of this part of chapter 6 is therefore on the kinds of sovereign risk analysis used by risk assessors in practice. Chapter 7 examines the scope and style of statistical sovereign risk models with reference to ten major studies in the field. There are four broad aspects to this. These include the rationales behind the selection of variables thought to be associated with debt problems, model specifications used to relate them to the observed incidence of problems, the evidence and the procedures used to estimate the resulting models, and the method used in preparing forecast and evaluating forecast error.

In chapter 8 attention is drawn to what are considered to be the crucial issues raised by the reviews of the currently available methodologies examined over chapters 6 and 7. These include the ways in which the wider contexts of sovereign risk analysis suggest a revised approach to the specification of statistical models. They also incorporate a reconsideration of the evidence and the procedures that should be used to estimate the parameters of sovereign risk models and a revised approach to the evaluation of forecast performance based on the way in which forecasts answer the most important question that has to be answered in reality, *i.e.*, how best to allocate loans between borrowers.

Chapter 9 describes how these suggestions are tested empirically and reviews the results obtained. This analysis is undertaken in two stages. First, the specifications used are essentially confined to (1) the kinds of explanatory variables found by previous studies to be statistically associated with the incidence of debt problems and (2) the two broad alternatives relied on in these studies in the timings of explanatory variables in relation to the dependent variable. The principle object of the analysis here is thus to use essentially conventional

specifications to investigate changes in the data and procedures used to estimate parameters and a change in the way in which forecast performance is evaluated. These include (1) the use of a balanced sample between debt-problem and problem-free countries, (2) year-by-year re-estimations of parameters through the observation period, and (3) the 'forecast-based' portfolio loan allocations which are then compared with 'hindsight-optimal' and actual observed allocations.

The observation period reaches as far back (1967) as the availabilities of the required data allow and ends in 1982. It thereby covers the two oil-price hikes of the 1970s and is in accord, for comparative purposes, with the kind of time periods to be found in previous statistical sovereign risk studies, while aiming to see if new light might perhaps be thrown on the lead up to the start of what has come to be called the debt crisis.

The second stage of this analysis is then essentially concerned with a switch of specifications in order to investigate empirically selections and expressions of explanatory variables based on a response to the broader macroeconomic contexts of sovereign debt problems and the influence of unforeseeable events. This is attempted by focusing on the ways of measuring how successful the management of debtor economies has been and the sustainabilities of current policies and performance. The result is the use of both composite variables, that aggregate all latest available information having a bearing on these issues, and a proxy for all that was known earlier, in the form of the previous period's debt-problem forecast probability.

Finally, chapter 10 summarises the crucial points raised through the inquiries described here and highlights the major results and conclusions. The last section reviews what are considered to be the implications for further research.

CHAPTER 2. CONTEXTS OF SOVEREIGN RISK ANALYSIS

2-1. DEFINITION AND CONTEXTS OF SOVEREIGN RISK

In moving first to define and explore concepts central to this study it is necessary to start with the term of sovereign risk. The two component words, *i.e.*, ***sovereign*** and ***risk***, can best be considered separately before going on to review the special analytical implications of sovereign risk itself.

2-1-1. THE MEANING OF 'SOVEREIGN'

2-1-1-1. DEFINING OF THE SOVEREIGN ASPECT OF SOVEREIGN RISK

To begin with the ***sovereign*** bit of sovereign risk first, the reference is to sovereign borrowers, either in the form of foreign governments or foreign enterprises where loan servicing payments are guaranteed by the borrowing economy's government. Such contexts seem to raise no great conflict among authors regardless of whether they provide an explicit explanation about this term or not. For example, Friedman (1983) considers (p. 201) sovereign as concerning

> **... the foreign borrower as a national government (or one of its subdivisions) or ... other loans fully and unconditionally guaranteed by that government ... [and, thus, referring to] claims held by banks against governments and government agencies or enterprises which are backed by the full faith and credit of the foreign government.**

Heffernan (1986) also considers sovereign debt to consist of " ... all publicly guaranteed loans granted to a foreign firm by a private bank or loans made directly to a foreign government."

Such a definition has important implications. In particular, Wynn (1989) argues (p. 193) that a government's agreement or guarantee on repayments for the loans means that

> ... debt-servicing prospects are ... dependent on the political will of government and on the availability of sufficient public sector savings. Interest centres on the economy as a whole and ... [hence] its balance of payments, rather than on the fortunes of the various enterprises financed by foreign savings.

Friedman (1983) similarly goes on to identify much the same analytical contexts of sovereign lending in saying (p. 201):

> Methodologies suitable for normal credit evaluations for borrowing by private entities are helpful but inadequate for borrowing by governments. As long as the borrower can be evaluated on the capability of servicing a particular loan, the credit process can work reasonably well. In the case of loans to governments, however, it is the entire performance of the government that are [*sic.*, is] being evaluated.

It therefore follows that, on the one hand, sovereign lending requires reference to different and broader perspectives in credit assessment than those found in normal domestic lending. These concern a sovereign borrower's overall performance and policies, and particularly macroeconomic variables relating to its balance of payments. On the other hand, these perspectives need to be understood also in the contrasts between 'sovereign' risk and 'country' risk.

2-1-1-2. SOVEREIGN AND COUNTRY RISK

The terms of sovereign and country risk tend to be used interchangeably in the literature with little attention to precise definitions. However, the distinction between sovereign and country risk relates mainly to whether the servicing of loans is guaranteed by government or not. Friedman (1983) considers this distinction at length. Country risk is defined (P. 202) by him as a generic term which

> ... refers to elements of risk inherent in doing business in ... another country ... These risks are incurred from corporate activities undertaken in a foreign country and are distinct from the more traditional concerns about the creditworthiness of individual firms. Thus, country risk refers to a spectrum of risks arising from the economic, social, and political environments of a given foreign country (including government policies framed in response to trends in these environments) having potential favorable or adverse consequences for foreigners' debt or equity investments in that country.

He goes on to note that the multidimensional contexts and implications of country risk are perhaps best explained by simply listing various types of country risk. On the one hand, events which may adversely affect the profitability or the recovery of equity investments in a given foreign country include, as he explains (pp. 202-3), " ... Confiscation, Nationalisation, [and] Restrictions on earnings remittances ... " Meanwhile, events which affect profitability of debt investments in a given foreign country cover " ... Certain types of foreign exchange controls, including government-imposed restrictions on the liquidation of public-private sector external obligations ... [and] Domestic policies which may be imposed in a sudden, unpredictable manner which affect clients' ability to generate the necessary cash flow to repay loans. Examples: fiscal policy (increase in taxes), restrictive monetary policy or price/wage controls, and exchange rate changes."

'Transfer risk' is something that receives special attention from Friedman. A separate statement notes (p. 203) that

> Among the continuing risks in lending abroad is the so-called transfer risk arising from balance-of-payments difficulties. This is the risk which dominates nearly all discussions on country evaluation. Transfer risk describes the potential that an unguaranteed private borrower will not be able to make timely and full repayment of the loan in accordance with contractual schedule due to host government policies which make foreign exchange unavailable. This can happen through exchange controls or other means, irrespective of the causes of such policies, including developments external to the borrowing country.

Sargen (1977) also takes special care to define (p. 20) transfer risk and in particular distinguishes it from sovereign risk as follows:

> Commercial banks encounter two types of repayment risk ... 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. 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.

It therefore seems that if we follow a broad definition of country risk, sovereign risk could be regarded to be a part, or a specific form, of country risk related to, or similar to, transfer risk. Sovereign risk particularly associates with loans where the servicing is publicly guaranteed. In this respect, Friedman (1983) asserts (p. 202) that " In ... [the] case of sovereign risk, country evaluations play a comparable role to the traditional credit review of the private or individual corporate borrower. Thus, it may be called credit assessment of countries." More explicitly Wynn (1993) notes (p. 3) that

> Although there have been some confusions in the past, [country risk] ... is now conventionally used to refer to the additional risks, in general, of doing business in a foreign country as opposed to a domestic economy. These are typically associated with the terms on which foreign enterprises are allowed to operate, such as managerial control and rights should a business get into difficulties, fail, or be taken over, as well as exchange rate changes, and differences in markets for goods and services, in environmental conditions, etc. They also include what are often referred to as transfer risks, ie, the possibility that foreign debts cannot be serviced (and profits cannot be repatriated) because of foreign exchange shortages. To this extent, then, sovereign risk could be said to be a part of the more general coverage of country risk.

2-1-2. THE MEANING OF 'RISK'

On the second count, the *risk* bit of sovereign risk can be seen to have been approached with two different emphases in the literature. The first concentrates on the distinction between 'risk' and 'uncertainty'. The other refers to the question as to just what it is that is 'at risk'.

2-1-2-1. RISK AND UNCERTAINTY

As a less than technically conventional example of the first, Friedman (1983) discusses the distinction between risk and uncertainty in terms of the amount of information known to the observer. He suggests (p. 201) that

> **Risk implies that the observer has firm knowledge about three separate things: 1. More than one possible outcome is associated with a particular event 2. In what form each of these outcomes is likely to manifest itself 3. The approximate probability of each identified contingency actually arising.**

On the other hand, uncertainty concerns the situation where there might be an absence of information on the probabilities associated with each specific outcome. More precisely, however, risk refers to random events that have stable probability distributions. If additionally sufficient information is available, in the from of observations from past experience, the parameter of the probability distribution can be estimated. This then allows the possibility of designing a scheme of insurance. So insurability may act as a test of the distinction. Uncertain events can not be the subject of insurance because they have no stable probability distribution.

It appears that in many studies there is a failure to make any attempt to distinguish between risk and uncertainty. The usual result is that the first word is used indiscriminately. In practice, there seems to be little or no discussion of the issue formally in sovereign risk analysis (SRA), *i.e.*, discussions of whether probability distributions exist or whether their parameters can be estimated. However, Friedman observes (p. 201):

> **These semantic distinctions can have an important operational impact. Analysts feel compelled to assign probabilities when doing risk analysis—how else? But in many country situations, there are no bases for assigning probabilities, not even logically or historically. They are guesses which, like any other guesses, lead to misleading precision. They can give rise to a false sense of security and confidence in the country judgments derived from these arbitrarily assigned probabilities. Incredible errors have been made in reaching conclusions on countries based on probabilities that simply should**

> not be used. Perhaps the use of the word risk strengthens the tendency to use these often dubious analytical techniques.

Friedman cites as "A case in point ... the great uncertainties surrounding so-called political risks like revolutions." He could have used a whole alternative process which would have been much more apposite, however, in making reference to the uncertainties surrounding business activities. The risk here relates to variable profits and dividends and even capital losses should share-prices fall or should an enterprise fail. Such event possibilities will depend on the skills with which the enterprise is managed and the success with which product and factor markets evolve as well as other external forces such as the tax or legal framework and nationalisation. These events are sufficiently unique as to the subject to unstable probabilities. The illustration is one which has a direct bearing on the scope of SRA where the business in question is the whole economy and the serviceability of foreign debt depends ultimately on whether an economy's management produces a balance-of-payments situation capable of generating sufficient foreign exchange.

Heffernan (1986) also discusses this distinction between risk and uncertainty. She appears to share much the same standpoint as Friedman. But she differentiates risk from uncertainty in a somewhat curious way to explain the difference between sovereign and country risk. It is argued that the reason for interchangeable references between sovereign risk and country risk among authors " ... probably stems from the confusion over the terms 'risk' and 'uncertainty'. An economist defines risk as being any event to which a measurable probability can be attached, but uncertainty is not measurable either because the 'event' is not easily defined and/or does not occur often enough to permit probabilities to be estimated." Differences in practical attitudes between academic analysts and practitioners are additionally alluded to (p. xv):

> Academics ... have tended to equate country risk with sovereign risk because this is the only aspect of country risk analysis to which truly measurable probabilities can be attached. On the other hand,

> practitioners in the field of finance who use the terms risk and uncertainty interchangeably would be critical of the narrow interpretation given to it by academics. There is nothing wrong with either approach, but a problem arises because two conventions are being used.

As in the case of Friedman (1983), a special example of uncertainty in the context of SRA is cited in political risk, however. She says (p. xv) that

> ... A good example of [uncertainty] lies in the area of political 'risk' analysis, where the definition of the event has been unsatisfactory and there are serious measurement problems associated with the political event ... [And] the political dimension is an important part of sovereign risk analysis. Decisions to borrow on international capital markets, to repudiate external debt repayments, and to undertake certain economic programmes will be derivatives of the political process in the borrowing country.

In ignoring these political uncertainties, Wynn (1993) draws much broader conclusions as to the implications for SRA in noting (pp. 2-3) that

> ... risks relate to events ... [that] can ... be the subject of various schemes of insurance. In the case of loans, these would take the form of properly designed loan portfolios in which the prospect of difficulties with any one loan are balanced by what might be expected in respect of other loans. So far as risks are concerned therefore, the terms and distributions of loans could be so arranged that while 'problems' may arise in respect of any one loan, their effects can be offset against what happens elsewhere in respect of others. In contrast, uncertainties relate to unforeseeable events and it's coping with these that presents the main challenge for SRA.

As a practical issue, Wynn (1993) additionally observes (p. 1):

> Of course hindsight may well lead us to discover that which we might convince ourselves the discerning observer *should* have been able to see in advance ... More generally, however, we should realise just how difficult and expensive it is to come by information, how it is simply impossible always to see each piece of information in its proper perspective, and how it is often just one last event, added to a mass of other circumstances, that 'suddenly' changes a whole situation.

This unforeseeable element leads on the question as to the forecastability of sovereign risk. This is something that it will be necessary to return in detail later.

2-1-2-2. WHAT IS AT RISK

One approach to formalising what is meant by sovereign risk has been to review just what it is that is 'at risk'. The 1985 edition of *World Development Report* (*WDR*) of the World Bank underlines two major problems for sovereign lending. These are the limited enforceability of contractual agreements and the limited control that creditors have over the management of a borrower's economy. It is explained (p. 92) that

> When a government borrows from abroad or guarantees a loan, the legal status of the contract is unlike that between two private companies. It is much harder to enforce, since a sovereign borrower may reject a claim against it within its own territory. The problems arising from this limited enforceability are complicated by the fact that governments have considerable discretion over policy choices that affect their own ability to fulfil a contract. Many of these polices—shifts in monetary policy, limits on exchange remittances, changes in competition policy, changes in taxes—could not be deemed a breach of contract, even though their effect might be to negate the substance of the loan.

Such limits to a sovereign lender's ability to impose legal sanctions in the event of problems and the inability of a sovereign lender to influence economic outcomes can encourage a borrower not to honour a contractual obligation when it suffers from balance-of-payment problems. The *WDR* (1985) reference explains this further in saying (p. 92) that

> ... contracts between developing countries and the private market have little economic value unless both parties feel it is in their long-term interest to honor their obligations ... In short, the countries that are most likely to service their debts are those that would suffer most if they did not do so.[1]

The possibility of special relationships between international banks and sovereign governments, and the prospect that the latter would not wish to jeopardise such relationships, are considered in the report to present banks with special opportunities in taking on sovereign risks.

Burton and Inoue (1983) also stress (p. 41) similar issues in saying that sovereign lenders

> ... exercise negligible control over the total process of loan utilisation and debt management within a borrowing country yet they face what amounts to an infinite financial commitment should a sovereign loan be defaulted upon. In the foreseeable future, at least, this 'gap' between overall control and individual commitment can be expected to widen.

And the implications of 'what is at risk' has been used earlier by Sargen (1977) in defining (p. 20) sovereign risk as the risk of what " ... occurs when a national government refuses to permit foreign loans to be repaid, or when a government seizes bank assets without adequate compensation." Similarly, McDonald (1982) notes (p. 614) that

> ... in any financial market situation, be it domestic or international, the lender must ... view the policies (of the borrowers) as sustainable. Indeed, in the international context, there is the additional complication of ... sovereign risk, that is, the possibility that the borrower will repudiate debts while maintaining control of the assets.

Technically, as Eaton and Gersovitz (1981) report, a loan is not legally in default until the lender declares that the borrower has failed to honour the terms of the loan. Such action has rarely been taken with respect to sovereign loans in the post-World War II period. For instance, as Heffernan (1986) explains (p. xiv), " ... in 1949 China repudiated its external debt obligations, but no lender could declare the country insolvent in the way it might an individual or firm." Sargen (1977) also acknowledges (p. 20) that

> ... outright default on bank loans 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.

In practice, instances of repayment arrears and reschedulings are frequently referred to in the literature as the means of identifying sovereign loan problems. This in effect leads on to the implied meaning of 'debt-servicing capacity', *i.e.*, the ability to avoid, as Frank and Cline (1971) indicate, being one of those countries which experience such severe difficulties in meeting contractual servicing arrangements that they have to postpone payments of interest or principal. And

in case of Feder and Just (1977), they define (p. 30), from the beginning, the concept of 'default' " ... as any case in which public or publicly guaranteed payments to lending institutions are delayed or rescheduled with or without the consent of creditors."

The term debt-servicing capacity, incidentally, is borrowed from Avramovic *et. al.* (1964)[2] who appear to define it as (p. 13) " ... the size and gravity of the payments problem which debtor countries may encounter if their external receipts suddenly fall, while they have to maintain their fixed, contractual service instalments." By implication most studies seem content to have the concept of debt-servicing capacity as something established simply with reference to empirical evidence. For example, Feder, Just, and Ross (1981) say (pp. 651-52; no more than:

> **... debt service difficulties experienced by sovereign borrowers in the near and distant past are well documented ... but the magnitude of funds involved at present has focused attention on the topic of the measuring and forecasting of debt servicing capacity.**

The study thus proceeds assuming this capability is simply distinguished in terms of whether a country encounters debt problems or not. A binary dependent variable (0, or 1) over the observation period is then converted *via* logit analysis into a forecast probability over a forecast interval. It is this forecast variable that apparently constitutes a country's creditworthiness, debt-servicing capacity, or sovereign risk. The terms are evidently used interchangeably among SRA studies.

Such devices admit considerable ambiguity, however, so that, for example, the range of economies having 'no' debt problems extends from near-miss escapes to others that are as far away from encountering debt problems as can be imagined. And so far as debt problem countries are concerned, there are a variety of ways in which debt-servicing difficulties can manifest themselves including outright repudiation, formal rescheduling agreements, informal reschedulings in the form of debt refinancing and restructuring, major balance-of-payments support loans,

and arrears in debt servicing. And whether these 'problems' amount to 'risks' bring us to back to the question as to 'what is at risk?' again. What should be noted is that since rescheduling is a form of new loan agreement, it may not be a 'bad' event for the lender. This would depend upon the net present value of the rescheduled loan compared with the original debt. Thus, the lender in fact can gain as a result of the rescheduling of sovereign debt. Additionally, there is the problem for observation that there may be 'debt problems' that go unregistered. As pointed out by Feder, Just, and Ross (1981), many cases of debt rescheduling might be rearranged or deferred for some length of time without publicity, to the benefit of both the debtor and the creditors. And there are yet other reschedulings that are more properly seen as aid devices.[3]

2-2. WIDER CONTEXTS OF SOVEREIGN RISK ANALYSIS

2-2-1. POSSIBLE ORIGINS OF DEBT PROBLEMS

It is argued here that a more appropriate focus for understanding the implications of the concept of sovereign risk is to say that government guarantees are likely to be reneged on for political and economic reasons which essentially have to do with the unwillingness, or varying degrees of 'inability', to find funds with which to service foreign debts. This has to do, in particular, with the fact that foreign borrowing must be repaid in foreign exchange and it may be scarce.

This leads on to the question as to why such a situation should arise. Foreign exchange can be provided by the largely three sources: (1) net export earnings, net factor payments abroad, and net unrequited transfers; (2) foreign savings; and (3) changes in international reserves. All feature as different components of a balance of payments. They correspond to current account, capital account, and residual

overall balancing item respectively. This in turn implies that shortages of foreign exchange to repay debts could arise out of a wide variety of the balance-of-payments events. Thus, borrowing countries could get into debt-servicing difficulties for an equally wide variety of reasons.

This suggests that the thrust of SRA not be confined to explanations of immediately surrounding circumstances associated with a borrower's debt-servicing difficulties. It thus should have a broader and further perspective in evaluating the nature and causes of debt problems. In this sense, it is noteworthy to see an early pointer tc underlying processes in Frank and Cline's (1971) statement (p. 329) that " Behind the composite index which we derive is an economic story which takes place in terms of stochastic money flows and accounting balances and surpluses." Even though many statistical sovereign risk studies provide no comprehensive underlying framework, there can be found various hints at the wider contexts of SRA in their analyses. Sargen (1977) for example considers the wider (*i.e.*, monetary) implications of debt problems. In case of Cline (1984), he recognises the interactions of supply and demand factors in the international financial market. An interesting attempt is made by Kharas (1984) who bases empirical analysis of rescheduling on a rather theoretical framework of modelling longer-term sustainable paths of debt accumulation.

In particular, McFadden *et.al.* (1985) indicate that the sources of debt-servicing difficulties come from current account deficits, which should be financed by foreign exchange inflows. Variables affecting such deficits involve the potential factors related to repayment problems. They list (p. 186) these factors under three headings: (1) factors in the world economy; (2) factors in debtor countries; (3) factors affecting the supply of credit. The first includes price and volume shifts in trading conditions largely beyond the control of both borrowers and creditors while the third gathers together much the same kind of exogenous changes to borrowers in international capital markets. The second set of factors refers to shocks to the productive capacity of a debtor economy, poor economic management, financially

unworkable investment programmes, unsustainable growth targets and development plans, speculation and capital flight and, last, the potential threat of default on sovereign debt and the use of this threat to extract concessions from creditors. Those factors can not be exhaustive and even mutually exclusive thereby might include overlaps.[4] However, they may be categorised explicitly into two broad divisions between external changes and the effectiveness of managing a debtor economy.

One of the accounts with respects to explanation of the origins of debt-servicing difficulties can be seen in the *WDR* (1979). It points out (p.30) both external and internal factors of debt problems as follows:

> **Liquidity crises occur when a country's external debt situation worsens as a result of external factors or domestic policy failure or a combination of both, which can then lead to reactions that compound this problem ... Various sources of instability can spark the initial worsening of a debt situation. These include a decline or slackening in the growth of foreign exchange earnings ... Sharp increases in foreign exchange expenditures [and] ... Domestic economic measures such as overly ambitious government expenditure programs, or excessive recourse to short-term foreign borrowings to finance medium- and long-term development needs.**

And the IMF and the World Bank (1983) also suggests much the same directions. It covers four points: (1) inadequate macroeconomic policies; (2) excessive borrowing; (3) borrowing under unfavourable terms; (4) exogenous shocks in the form of higher interest charges on loans or reduced foreign exchange earnings. Again external shocks and domestic policy inadequacies therefore correspond to crucial areas of debt problem sources. These rather comprehensive causes of the developing countries' debt-servicing difficulties are frequently dealt with among the authors such as Donovan (1982, 83, 84), and Krueger (1987).

2-2-2. DEBT PROBLEMS AND BALANCE-OF-PAYMENTS PERSPECTIVES

2-2-2-1. BALANCE-OF-PAYMENTS CONTEXTS OF DEBT PROBLEMS

Given the definition of sovereign risk set out earlier, the key point in evaluating a country's creditworthiness is the consideration on its ability in the future to generate enough foreign exchange to service its existing and expected future debt. Thus, it involves an analysis of the present economic situation in the country together with a forecast of likely developments in the future with particular emphasis on export earnings, import expenditures, and other items included in the balance of payments. In other words, debt problems are essentially seen in terms of balance-of-payments considerations.

Several authors have acknowledged and expanded on these issues with different degrees of emphasis. For example, Sargen (1977) refers to two conceptual approaches to debt reschedulings, *i.e.*, a "debt-service approach" and a "monetary approach". In particular, he broadens the scope of his approach to SRA by considering some indicators of internal macroeconomic monetary policies, such as the rate of inflation, in his monetary approach, which eventually has balance-of-payments implications and thereby debt-servicing difficulties. In this sense, it is additionally suggested that poor economic management lies behind debt crises. Sargen acknowledges this point in writing (p. 24):

> **The scarcity of foreign exchange ... results from: (1) rapid monetary-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.**

However, various external and domestic influences combine to produce the evolution of a balance of payments. It follows that origins of balance-of-payments difficulties are different across countries and over time. Thus while McFadden *et.al.* (1985) note (p. 187) that " ... the proximate "cause" of repayment difficulties,

inadequate foreign exchange inflows to finance current account deficits, is the same for [every borrower] ... ", the ambition to forecast these circumstances further into the future constitutes a considerable challenge. Friedman (1983) reviews a number of aspects of this in noting (pp. 215-16):

> **The comprehensive and integrated approach of analyzing country risk usually involves the following [two] analytical layers. The *first* is the likelihood of balance-of-payments difficulties. Is the country likely to have balance-of-payments difficulties over the next five years? Many factors (external and domestic) must be looked as to answer this question.... The *second* layer is likely governmental responses to such difficulties. Does the country have the political, social, and institutional ability or willingness to introduce balance-of-payments stabilization measures (exchange rate change, export promotion, import and service payments restrictions) to ward off an impending balance-of-payments crisis? Is the country likely to meet its balance-of-payments difficulties with an interruption or delay in debt service, default, repudiation or a formal moratorium, or rescheduling?**

Other influences on a balance of payments in this same context of debt problems have been reviewed by Robinson (1981, p. 73):

> **... when evaluating country risk and monitoring economic developments in the country, information is needed on the current account balance of payments, together with some indicators of the causes and likely development of the balance, such as government budget deficit, domestic savings, domestic investment and the supply potential of the economy.**

2-2-2-2. MAJOR APPROACHES TO BALANCE OF PAYMENTS

The balance of payments can be defined, as in Stern (1973, p. 1), as "a summary statement of all economic transactions between the residents of one country and the rest of the world, covering some given period of time." It is constructed on the principle of double-entry book-keeping. The financial transactions recorded include payments and receipts for physical goods (imports and exports) and services and short- and long-term capital transactions. The balance of payments thus refers to the balancing of foreign exchange earnings with foreign exchange expenditures. Changes in a country's net foreign exchange reserves, along with long- and short-term capital transfer, ultimately offset deficits and surpluses registered on the current accounts.

CHAPTER 2

In an open economy a country's balance of payments is integrated into its national accounts. Thus, it is generally recognised that a balance of payments is an aggregate phenomenon. However, there have been various views as to what contributes to balance-of-payments deficits or surpluses and how adjustments to a balance-of-payments disequilibrium are accomplished. Among them three major different approaches to the theory of balance of payments have been distinctive. They are the 'elasticity', 'absorption' and 'monetary' approaches.

The first elasticity approach is concerned with three questions: (1) What are the conditions for currency depreciation to improve a country's balance of payments on current account? (2) What will be the effect of currency depreciation on the level of domestic activity, and how will this affect the balance of payments and the conditions for depreciation to be successful? (3) Finally, what will be the effect of devaluation on the terms of trade of the devaluing country? The question of whether devaluation will rectify a balance-of-payments deficit is conducted within the framework of partial equilibrium analysis focusing on the price elasticities of demand for exports and imports. However, the elasticity approach has a weakness on the grounds that such a partial equilibrium analysis confines attention to the effect of exchange rate changes within the markets for exports and imports alone. It overlooks that price changes in these two markets would have gradually spreading effects throughout the whole economic system which would feed back to the export and import markets.

The response to this limitation leads to the development of the absorption approach to a balance of payments. This approach understands a balance of payments in an aggregate framework of the national accounts. It is based on the accounting identity,

$$B = X - M = Y - E,$$

where B denotes a balance-of-payments outcome, X exports, M imports, Y income, and E total expenditure. Thus, the absorption approach views a balance of

payments as the outcome of the difference between a country's expenditure and its income, and states that balance-of-payments policy will only improve it if expenditure is reduced relative to income (or income is raised relative to expenditure). Since this approach deals with above accounting identity, evaluations of economic policies to adjust a balance-of-payments disequilibrium associate with consideration of the relation between external trades and the functioning of domestic economy as a whole.

While the absorption approach formulates the problem of a balance of payments as a residual difference between real flows determined by other flows and real relative prices, the monetary approach views it as a monetary phenomenon to be analysed with the tools of monetary theory. The focus of the monetary approach is on a balance of payments as a whole (the current and the capital account) so that a balance-of-payments disequilibrium is equivalent to a change in the level of international reserves and must be considered as the outcome of stock disequilibrium between the supply of and demand for money. Therefore, an excess demand for money leads to an inflow of international reserves and thereby a balance-of-payments surplus while an excess supply of money causes a loss of reserves and a balance-of-payments deficit. In this monetary framework, all the economic policies related to a balance of payments should be evaluated in terms of their effect on reducing monetary disequilibrium. Thus, for instance, the effect of devaluation does not depend directly on the elasticities of demand for exports and imports but on whether the price effects of devaluation produce a reduction in real expenditure relative income by increasing the nominal demand for money. In this sense, it may be argued that the effects of balance-of-payments policies, as well as a balance-of-payments disequilibrium itself, must be transient in nature, unless stock disequilibrium between the supply of and demand for money within a country is continually re-created by domestic credit changes.

Being different from above three principal approaches to a balance of payments, Congdon (1982) puts an emphasis on fiscal policy as the key role to the

balance-of-payments problem. He breaks down the total current account deficit into two parts: the public and private sector deficit. And then it is argued (pp. 12-13) that

> **... the message of the new approach to the balance-of-payments is that only foreign debts incurred by the public sector constitute a balance-of-payments problem and that the only solution is the pursuit of more appropriate fiscal and debt management policies ... [And thus,] if bankers want to avoid some of the sovereign debt difficulties they are now facing, they should in future focus on fiscal variables to assess a government's ability to repay.**

Aside from theoretical approaches to a balance of payments, if we move on to examples of empirical studies aimed at quantifying the impact of different influences on the balance-of-payments outcomes, Khan and Knight (1983) separate out external and domestic factors in examining the evolution of the current accounts of non-oil developing countries during the 1970s. The first includes the deterioration in the terms of trade, the slowdown of economic activity in the industrial countries, and the sharp increase in the level of real interest rates in international financial markets, while domestic considerations refer to rising fiscal deficits, and the appreciation of real effective exchange rates. Although this list is not exhaustive as they themselves acknowledge, the distinction between external shocks and domestic macroeconomic variables leading to balance-of-payments difficulties and thereby debt problems may be considered to have general applicability as indicated earlier.

When referring to those theoretical and empirical studies, balance-of-payments difficulties can be said to link inextricably to a wide range of economic policies and institutional mechanisms in general. On the other hand, the balance of payments might be said equally to be a key determinant of policy successes in other respects. Thus, Thirlwall (1992) indicates the importance of the balance of payments with regards to overall macroeconomic management by saying (p. 2) that " ... it is impossible to understand the economic performance of nations without reference to the strength of their balance of payments ... "

Thus, given the relevance of these considerations, all the forces that determine a balance-of-payments outcome related to earnings and expenditure of foreign exchange must be mediated in considering a borrower's debt-servicing capacity. At this point, Bird (1986) underlines (p. 8) that "Important determinants of creditworthiness are ... those that influence foreign exchange earnings and expenditures." And to the extent that debt problems are necessarily related to balance-of-payments difficulties, evaluations of a borrower's debt-servicing capacity should be based on general macroeconomic policy and performance assessments.

2-2-3. BROADER MACROECONOMIC CONTEXTS OF DEBT PROBLEMS

Judgement on the aspects of the balance of payments involves not only evaluations for the components composing the balance of payments but also analyses for overall macroeconomic management policy and performance variables having relatively more fundamental impacts on the balance of payments. This is because the emphases given to different goals, and different policies in pursuit of their achievement, have implications for what can be obtained in respect of any one overall performance characteristic, such as a balance of payments. The implications for SRA have been summarised by Wynn (1993) in the statement (p. 3) that

> When it comes to deciding the terms and allocations of loans guaranteed by the (sovereign) governments of developing countries the guarantees mean that interest centres on situations when even governments cannot, or prefer not to, find the foreign exchange with which to service their foreign debt obligations. This will have to do with balance of payments difficulties. It follows that as many other macroeconomic goals and policies, and surprises from constantly changing world trade and international financial markets, that relate to a balance of payments will relate to 'debt' problems and therefore to the scope of SRA.

And McFadden *et.al.* (1985) also explicitly highlight the relationships among sovereign debt repayment problems, balance-of-payments difficulties, and the

wider perspectives of macroeconomic policy and performance variable by stating (p. 187) that

> **Case studies make clear that the circumstances of different developing countries vary considerably, and the apparent origins of repayment problems are quite heterogeneous. However, the proximate "cause" of repayment difficulties, inadequate foreign exchange inflows to finance current account deficits, is the same for everyone. It might be expected that difficulties arising from a variety of sources would all be mediated through the macroeconomic variables affecting the balance of payments accounts.**

Thus, balance-of-payments problems unseparably linked to debt problems can only be viewed in the broader framework of a borrowing country's overall macroeconomic policies and performances.

However, there could not be an unambiguously defined framework (or an unanimous view of a system) for evaluating macroeconomic policy and performance. This is mainly because optimal levels of the objectives of economic policy, like economic growth, inflation, and the balance of payments may be differ actually from country to country and over time depending on social preferences concerning the goals of policy and the feasible trade-offs between goals imposed by the characteristics of the particular economy. As against this, however, Williamson (1982) suggests (p. 695) that " ... in practice there is little reason to believe that [country] differences are important, at least at the level of generality ... "

Unexpectedly, not many studies to deal with the issues relating to overall macroeconomic policy and performance evaluation procedures can be referred to. They, even themselves, differ in the coverage of indicators set-up depending on their analytical purpose and emphasis. As one of them, for example, of which analytical target is to consider the characteristics of what a consensus might agree to be successful economic policies, Williamson argues that economic policy needs to be assessed in terms of its impact on at least five proximate objectives. They are the pressure of demand, the balance of payments, the rate of inflation, the expansion in supply capacity, and income distribution. These can be considered

as major goals of economic policy. On the other hand, this kind of analytical objectives might be contrasted with the conceptualisations that formulate an analysis to evaluate overall economic performances through the examination of macroeconomic indicators, which will be the main concern of the present study. In this respect, it would be interesting to note Donovan's (1983) statement (p. 2) that

> Quantitative indicators that measure such macroeconomic variables as the growth of national product, inflation, or the current account of the balance of payments have long been used to assess a country's overall economic performance. National policymakers use them to analyze, explain, and defend alternative courses of policy action while such indicators mold popular perceptions of economic performance and, consequently, the positions taken by various interest groups. Accurate, timely, and meaningful information or aggregate economic performance is also essential for the assessment of a country's creditworthiness by international commercial lenders and for the appropriate allocation of resources by multilateral lending institutions.

In particular, given the broader definition of sovereign risk and the wider contexts of debt problems, sovereign risk analysis should be possible to monitor economic climate, policy and performance variables in such a way as to produce a wider picture of the events surrounding an occurrence of debt-servicing difficulties. This point seems to force SRA to bear in mind that a wide variety of events over time could contribute to what might eventually become a debt problem so that it should have a structured analysis framework to call for all relevant past and new information. In practice, Donovan (1984) refers to a wide range of both level and change in economic indicators of macroeconomic performance in his comparative empirical search for the "nature and origins of the debt-servicing difficulties." He illustrates (p. 22) four groups of indicators:

> ... the role of certain exogenous factors (namely, terms of trade changes, the world recession, and changes in concessional aid flows); aggregate macroeconomic variables (the external current account deficit, the volume of exports and imports, the rate of economic growth, and the domestic rate of inflation); major economic policy indicators (the growth of domestic credit and the money supply, some partial indicators of fiscal trends, and movements in the real effective exchange rate); and finally, variables relating to debt management policy (which included the rate of growth and maturity structure

> of outstanding debt, the composition of external borrowing, and—incorporating the effects of changes in world interest rates—trends in debt-service payments).

There remains the possibility that political considerations play a role in determining the line drawn by debtor-economy management teams between the goals represented by employment and productivity and the goal of avoiding having to use rescheduling as a response to foreign debt problems and their backgrounds in wider balance-of-payments difficulties. There is little evidence to suggest, however, that purely political influences had much of an influence on this balance over the years which are the main concern of this study. This is a view that is supported by others in the literature. Thus, Heffernan (1986) observes (p. 71) that "... countries with sovereign loan problems directly related to social and/or political difficulties are small in number. Most if not all of the recent debt-servicing difficulties can be traced back to economic factors." Similarly Ford and Mpuku (1991) explain (p. 14) that:

> We also ignore political risk, which is here defined as changes in government by legal or extralegal means or general political instability; this is because it is by no means clear that the political changes by themselves necessarily increase the likelihood of default. It may well reduce it if the government assumes a liberal policy stance. The upshot of this, in other words, is that political changes could either way, and it is, therefore, more useful for us to consider the objective economic conditions which make default or rescheduling inescapable regardless of the nature of political regime.

Even though the Ford and Mpuku observations period extends up to 1986 it might be argued, in contrast, that the situation may have changed following the debt crisis triggered by Mexico's problems of August 1982. The very frequency of reschedulings and debt-reduction in an ever increasing number of debtor countries might have encouraged any one sovereign borrower to be less inclined to impose sacrifices domestically in order to avoid having to reschedule. The possibility of changing influences on decisions on when to seek the help of creditors in tackling debt problems is alluded to (pp. 151-53) by Congdon (1988) in the view:

> The trouble is that debt repudiation is like a contagious disease. Unless it is stamped out as soon as it appears, it is liable to spread uncontrollably. If the industrialized creditor nations allow one or two financial invalids in the Third World to miss payments and no measures are taken against them, every debtor has a temptation to miss payments as well. It makes no difference to the need

to retaliate whether the bad debtors are feigning illness or are genuinely sick.

Assuming that the relative influences of economic factors remain otherwise unchanged, a shift in the point at which they lead to resort to reschedulings as a policy because of non-economic influences could be analysed empirically by testing the statistical significance of an intercept-shifting dummy variable between any two periods, say, before and after the 1982 watershed. This might be something that it would be especially worth investigating in any further work on sovereign risk, particularly for the post-1982 period.

2-2-4. OVERALL MACROECONOMIC EVALUATION PROCEDURES

On this account, country reports can provide considerable flexibilities for accommodating such all available information as will be discussed in detail later. This might be fairly contrasted with attempts in previous statistical sovereign risk models to search for a limited set of indicators to the total exclusion of all other valuable information. They seek to single out just a few indicators in order to forecast events for an individual country conditional on observations of the past circumstances of a number of other countries (*i.e.*, pooled time-series and cross-section data), given great differences among countries and big trade-offs between major objectives of economic policy even in a country. In this point, statistical models have exposed limitations of making it difficult to understand the circumstances surrounding debt problems.

Then, a question arises as to how such largely expanded information can be accommodated and organised. It follows the necessity of the exploration of ways of setting this information in its right context within a single-equation framework for relative comparisons among countries. One of the answers can be sought by referring to checklist procedures. The categorisations of variables featured by checklists can be utilised to structure and quantify enlarged information sets along lines suggested in the considerations of general macroeconomic performance evaluation procedure. This evaluation procedure can be formulised by referring to the sequences in which a debtor country faces external shocks, responds to them, and finally reveals the results. They may include, in a sequence, the impact of international markets for trade and finance, the more immediate effects of economic policy, long-term policy results and overall performance realisations.

The first signs of difficulties might be traced to some external events such as a change in the terms of trade, fluctuations of exchange rate and world interest rates, and the world recession. The impact of such adversity will depend on not only peculiar country circumstances, especially openness to the world market but also other distinguishing features such as economic size and structure, level of development, etc. As a result there may be considerable differences in rather immediate effects registered, say, in terms of lower growth rates and deteriorating current account balances.

The scope for further diversity rises sharply in moving on to consider policy reactions to changing circumstances. To begin with, the available options will depend on political susceptibilities, the availability of foreign exchange and other resources, and the sensitivities of market and pricing systems. Within these broad restrictions, adjustment opportunities will also depend on the split of current output and absorption between tradeable and non-tradeable goods, any spare production capacity in respect of tradeable goods, and dependencies on various categories of imports. Subject to these constraints, policy choices may range from doing nothing (and accepting consequences like reduced imports and slower growth), to avoiding such consequences by borrowing abroad, through to various kinds of adjustment, with or without the support of foreign borrowing, to restructure production in favour of tradeable goods for export or import substitution.

The effects of policies can be explored in a variety of ways but particularly *via* budget deficits, credit expansions, money growth, inflation, appreciation of exchange rate, and enlarged foreign debt. These more immediate effects will largely reflect budgetary and price flexibilities and especially attitudes to consumer subsidies and industrial protection. The successes or otherwise of adjustment, in contrast, will be registered later in domestic savings, the level and efficiency of investment, and trade performance. Last, the combined effects of shocks, vulnerabilities and policy reactions and adequacies will be evident in what are

often referred to as relatively basic indicators of economic performance. These may be reckoned in terms of growth and internal and external equilibria, if income distribution effects are ignored in this context.

These categorisations according to sequential procedures would allow for the ways in which variables must be related both contemporaneously *via* substitutability and complementariness and sequentially *via* cause and effect. In this respect, it is interesting to note Wynn's (1993) suggestions of using "composite variables" in order to accommodate "both the large amounts of information involved and the contexts in which it should be set." He considers the sequences where events actually occur and categorises the variables corresponding to each sequence into four groups. It is reported (p. 9) that

> **The first relates to changes in world markets for goods, services and finance and therefore includes terms of trade changes, the income terms of trade, and the ratio of net concessional aid flows to total public debt. The second category covers policy variables variously represented by some measure of the balance between government revenues and expenditures relative to GNP, rates of change for credit, money and real exchange rates, the change in imports (relative to income) and the ratio of new foreign debt to exports. The third set of variables registers achievements in respect of more immediate policy goals in the form of domestic saving, investment and the change in exports (all relative to GNP), and the foreign debt burden (relative to exports). Finally, 'bottom-line' performances are represented by the growth of per capita income, the current account balance (relative to GNP), the overall external balance (relative to exports) and inflation.**

As one of the practical examples in the respect of overall macroeconomic policy and performance evaluations, Balassa (1982) focuses on estimating the balance-of-payments effects of external shocks and of policy responses to these shocks. He investigates the adjustment policies applied in response to the external shocks of the 1974-78 period by oil-importing sub-Saharan African countries. External shocks refer to deterioration in the terms of trade and export shortfalls resulting from slowdown of the world economy. Adjustment policies are supposed to include additional net external financing, export promotion, import substitution, and lowering the rates of economic growth. As far as the analysis of overall macroeconomic performance is concerned, he concentrates on the rate of economic

growth and the debt service ratio by examining changes in the incremental capital-output ratios and the domestic and foreign savings ratios in the countries concerned.

In summary, given the impact of uncertain and unforseeable events and the wider macroeconomic contexts of debt problems, sovereign risk analysis should not focus on a narrow range of variables supposed to reflect the underlying circumstances of debt-servicing difficulties at a point in time but should be more broadly concerned with the macroeconomic histories of debtor economies and the sustainability of their current economic policies and performances. This implies that sovereign risk analysis be interpreted and understood in much the same context of overall macroeconomic evaluation procedure in general.

NOTES

1. Eaton and Gersovitz (1981), and Sachs and Cohen (1982) similarly discuss economic circumstances encouraging repudiations. However, in practice, repudiation usually tends to follow major political disruptions and a decision to withdraw from the international arena.

2. The analytic approach used in most statistical debt-monitoring systems is based on the financial-ratio analysis pioneered by Avramovic and his associates. It attempts to measure a country's ability to withstand an export shortfall by constructing financial ratios from individual balance-of-payments components. The approach views reschedulings as a problem of external debt management, and thus focuses attention on the determinants of a country's debt-servicing capacity. Three categories of variables were pinpointed as being important for assessing a country's short-run debt-servicing capacity: fluctuating variables (exports, capital flows, imports induced by internal shocks), offsetting variables (reserves, compensatory finance, compressible imports), and rigid variables (interest payments, amortisation payments, and essential imports).

3. Saini and Bates (1978), in this respect, argue (p. 6) that " ... a distinction must be made between involuntary and voluntary reschedulings, as the latter are usually more indicative of efforts to increase resource transfers than they are of balance of payments difficulties."

4. In this sense, McFadden *et.al.* (1985) ask (p. 187) "Is it possible to allocate responsibility for debt problems among the factors [their study] listed ... by an econometric analysis of panel data on a number of developing countries?" Before returning to proximate 'causes' of repayment difficulties, they answer at the same time that "A full attribution of causality would require a microeconometric analysis of the information flows and decision processes of different agents among other things."

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CHAPTER 3. HISTORICAL PERSPECTIVE OF INTERNATIONAL FINANCIAL FLOWS

CHAPTER 3

3-1. INTRODUCTION

International movements of capital may be directed through either official or private sources. The first can be classified under three headings: (1) governments and governmental agencies (called bilateral lenders); (2) international organisations such as the IMF and the World Bank (called multilateral lenders); and (3) relief agencies such as the Red Cross and Oxfam which provide financial aid, goods, and services as grants. In contrast, private sources comprise generally: (1) commercial suppliers and manufacturers which provide export credits for the purchase of their goods; (2) commercial banks which provide export credits or cash loans; and (3) other private investors who invest in foreign enterprises in which they seek a lasting interest (direct investment) or who purchase stocks or bonds issued by foreign companies or governments (portfolio investment). Among these various sources, official bilateral and multilateral loans and private commercial bank loans account for most of the loans portion[1] of the market and thereby play a major role in determining the levels and distributions of international financial flows to developing countries.

The international financial mechanism has evolved over time in response to the changing requirements of borrowers and lenders. It has also responded to changes in the objectives, constraints, and behaviour of the financial institutions operating in the system. Thus, it is essentially a result of the the world economic and financial environment. And in this respect the greatest changes to the evolution of the system itself have come in the form of independent, outside, events, and notably the momentous shocks represented by two world wars and the Great Depression of 1929-32. The structure and function of the system, in turn, has had an important impact on economic activity in developing countries. In this, as in many other respects, the economic policies of industrial countries, which compromise the most influential parts[2] of the international financial system,[3] shape the international economic environment for developing countries.

CHAPTER 3

The sharp increase in flows of foreign finance to developing countries during the 1970s gave rise to some concern about the relationship between the international financial system and developing countries. In particular, 'debt crisis' in the world finance markets starting to emerge from the early 1980s raised a question as to whether the developing countries had been borrowing too much or the creditors had overextended themselves. For obtaining some clues to this question and identifying essential factors having affected debt-servicing difficulties of developing countries, it may need to review the historical perspectives of international financial flows. It is the purpose of this chapter. This chapter starts by examining the phase of international capital flows since the late nineteenth century under the circumstances of changing world economic environments. Then it reviews the role and limit of official finance flows and commercial bank lending in relation to situational changes in the international finance markets.

3-2. HISTORICAL OVERVIEW

The flow of finance across national borders is not an exclusively twentieth-century phenomenon. What has changed is the scale and the diversity of these flows. In the late Middle Ages when credit operations and modern banking were gradually beginning to develop, it was sovereign spending that was often financed with foreign money.[4] The lack of institutions and internationally recognised and enforceable contracts prevented much else.

The history of international finance suggests a lot of examples not only of its productive contribution to economic development but its role as a cause of financial crises from time to time and, more frequently, debt-servicing difficulties in individual countries. However, it is not necessary to go beyond the last century for highlighting the lessons that would help to analyse the experience in the 1970s

and 1930s in particular. This section thus reviews the past general experience on international financial flows since the last nineteenth century with the years divided into five parts, *i.e.*, pre-World War I, interwar period, post-World War II, 1970s with external shocks, and 1980s of debt crisis.

3-2-1. PRE-WORLD WAR I (1870-1914)

Not surprisingly in view of Britain's headstart in industrialising, London became the centre of world financial markets as the modern, interdependent, world economy evolved. It acted as an intermediary for foreign investment from various parts of the world, particularly continental Europe. One major aspect of this increasing economic interdependence took the form of an interaction between the industrialised countries in Europe as a supplier of manufactures, new technology, and foreign capital and developing countries as exporters of raw materials and food, for which demand was augmented considerably as a result of the industrial revolution. The principal ventures financed by foreign savings in this period were the provision of items of basic economic infrastructure such as transportation (especially expansion of railroads) and public utilities without which the trade dimension of these developments could not function efficiently. And thus investors expected profits and repayments to be paid for by the resulting export earnings.

The main source of international finance was the private sector. Thus, the emphasis in foreign investments was placed very heavily on the principle of securing the best possible returns. Although there were some politically motivated grants or investments aimed at furthering foreign policy objectives of donor countries, they were not so significant. These private sources of foreign capital took the form of both stock and bond issues.

They were encouraged by the confidence generated by the golden days of economic imperialism and free enterprise. The rules of the foreign investment were

clearly established. International financial activities were accomplished within an international monetary system based on the gold standard. The proper role of the government of borrowing agents thus was to provide the basic facilities and environment for letting private enterprise get on with the job of development. It was also essential to favour investment by a climate in which borrowers were expected to honour their financial obligations. Debtor countries accepted their international obligations in general and did their best to keep their creditworthiness.

Outstanding foreign-owned assets were estimated to have totalled approximately 44 billion U.S. dollars in 1913. Table 3-1 shows the distribution of this sum geographically for both credits and debts. It is noticeable that more than fifty per cent of the latter were held in Europe and North America. Latin America accounted for another twenty per cent. With respects to recipients of capital the 1985 issue of *World Development Report* (*WDR*) of the World Bank characterises three groups as follows (p. 12):

> The largest single group included the market-oriented investments, largely undertaken by Britain, in the resource-rich countries of North America, Latin America, and Oceania. In 1914, these accounted for 70 percent of Britain's total foreign investments and more than half of all gross foreign assets. A second group, accounting for quarter of all foreign investment, involved investments in Russia and other Eastern European countries and in Scandinavia ... A third group covered the primarily politically motivated investments in China, Egypt, India, Turkey, and some African colonies.

Table 3-1 MAIN CREDITOR AND DEBTOR COUNTRIES IN 1913

Creditors	Gross credits		Debtors	Gross debts	
	$ billion	per cent		$ billion	per cent
U.K.	18.0	40.9	Europe	12.0	27.3
France	9.0	20.4	Latin America	8.3	19.3
Germany	5.8	13.2	U.S.A.	6.8	15.5
Netherlands Switzerland and Belgium	5.5	12.5	Canada	3.7	8.4
U.S.A.	3.5	8.0	Asia	6.0	13.6
Others	2.2	5.0	Africa	4.7	10.7
			Oceania	2.3	5.2
Total	44.0	100	Total	44.0	100

Source: Abbott (1979, P. 14).

When it comes to the incidence of problems, there were two broad categories of borrowers who failed to make their payments. The first were those who ran into difficulties because of world economy cyclical movements that produced abrupt declines in foreign exchange earnings. Examples included Argentina and Brazil in the 1890s. In these cases, foreign loans were utilised to ease liquidity crises until exports recovered. Second, countries such as Egypt, Peru, Turkey, and Greece, that suffered from stagnant revenues and expanding fiscal deficits. These experienced debt-servicing difficulties because capital inflows could not finance deficits without limit.

3-2-2. INTER-WAR PERIOD (1915-1944)

The two world wars transformed the United States from the world's leading debtor to its principal creditor nation and the main source of capital flows. New York replaced London as the world's financial centre. U.S. institutions simultaneously bought back a substantial amount of their own assets previously

held by other nationals, particularly European, and also invested heavily overseas. In contrast, in the United Kingdom, the proportion of overseas investment dropped appreciably. While between 1910 and 1913 the U.K.'s overseas investment averaged 75 per cent of all capital issues, it decreased to about 45 per cent during the mid-1920s and had fallen to about eleven per cent by 1935.

A second major change was that before the First World War private capital markets were dominant. However, in the inter-war period, public borrowing and lending assumed a much larger role. Borrowing by governments accounted for nearly half of the foreign dollar issues in the U.S.. This change was closely related to the phenomenon of war debts and reparation payments. The U.S. was owed almost all the debts made between the Allies who, in turn, had heavy reparation claims against Germany. These public lendings took the form of long-term bond issues.

A third notable difference followed from a change in trading conditions. The U.K. free trade had served to guarantee debtors a market for their products. However, the U.S. was more protectionist and the liberal trading system of the pre-war years gradually disappeared. Most countries raised tariffs and applied quotas and exchange controls. In addition, the Great Depression of 1929-32 swamped the newly industrialising economies. Commodity prices, the main source of foreign exchange earnings for them, collapsed and stayed down for years. New moneys from foreign sources became hard to obtain as financial crises arose in the industrial countries. Germany, facing declining production and exports, first obtained a one-year moratorium in 1931 and then defaulted on all its external debts in 1932. Beginning with Bolivia in 1931, a rising number of developing countries failed to service their debt obligations. All Latin American loans were practically in default by the end of 1933, with the notable exception of Haiti and Argentina. The move spread to Europe. Simultaneously, other international borrowers from private banks and other financial sources defaulted on their obligations.

In general, the financial penalties for defaulting were rather small in the 1930s mainly because the number of sovereign and private defaulters was too large for sanctions to be enforced. These defaults by sovereign and private borrowers in foreign countries gave international lending a bad reputation and scepticism among investors. The events of the 1930s were catastrophic and are remembered even now. It is in this sense that Friedman (1983) points out (p. 12) that "Many a skeptic today, consciously or unconsciously, reflects the experience of the 1920s and 1930s."

3-2-3. POST-WORLD WAR II (1945-1972)

By the end of World War II the only major currency which could be freely exchanged for other currencies was the U.S. dollar. And the U.S. continued as the major creditor country. Most of the European countries were not in a position to provide the massive injections of capital needed to restore their economies to their pre-war levels of activity. The job of financing the relief and reconstruction of Europe could only be undertaken by the U.S..

The U.S. initiated the European Recovery Programme (or the Marshall Plan as it was more commonly called), the essential element of which was reconstruction on a regional basis. From the experience of the 1920s and 1930s, the aim was to avoid reparations and war debt problems. There seems to have been a clear understanding, on the part of both the donor and the recipients, that the financial obligations would be sustainable if they were designed to avoid placing continuous burdens on the recipient countries. Thus, the transfers primarily took the form of grants of goods and services. Such aid under the Marshall Plan played a vital role in speeding the economic recovery of Europe. The success of the Marshall Plan vindicated the use of financial flows to achieve specific ideological and strategic goals and encouraged extensions to the whole of the Free World in a wider and more general context. This took the form of official capital flows to begin with but

later a growing volume of private capital flows accompanied the securing of new supplies of raw materials in developing countries.

The years 1950-73 have been described as an economic golden age, with the longest and strongest boom in world history.[5] This boom was closely associated with two noticeable international agreements. The first took the form of the Bretton Woods Conference in 1944. It established twin institutions, in the form of the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (IBRD, or the World Bank). The second milestone was the General Agreement on Tariffs and Trade (GATT), which was formulated in a treaty signed in 1947. All these institutions were set up with a similar aim, to prevent the recurrence of the competitive and disruptive trade and payments practices which had devastated international commerce and finance in the 1930s. In particular, the IBRD was to assist in reconstruction and development by facilitating the flow and investment of capital for productive purposes after World War II. Additionally, a number of regional development banks were established. It includes the Inter-American Development Bank (1959), the African Development Bank (1964), and the Asian Development Bank (1966).[6] These institutions have variously contributed to improving free trade and the relative freedom of financial movements and to supporting the developing countries with loans and grants. Others also, notably Japan and some European countries, benefited from these favourable changes in the world economic environment. The capital markets' contribution in particular was to ensure that insufficient domestic savings were supplemented more easily than in the 1920s and 1930s by foreign capital flows, chiefly in the form of official flows, private direct investment, and trade finance.

However, some developing countries encountered debt-servicing difficulties in this period. They were principally the result of inadequate domestic economic policies. In elaborating on these reasons for debt problems in some developing countries, *WDR* (1985) points out (p. 16):

Argentina, Brazil, Chile, Peru, and Turkey shared certain problems: large budget deficits; rapid inflation and delayed adjustments of the exchange rate; deteriorating terms of trade; declining export earnings; the accumulation of short-term external debt. Ghana and Indonesia also had these problems though more acutely, because they launched large, long-term projects that they financed with short-term credits and executed inefficiently.

Those countries rescheduled their debt obligations through *ad hoc* multilateral creditor group meeting such as the Paris Club. Amongst its special roles, the IMF has attempted not only to provide extra finance in times of trouble but to advise debt-problem countries on economic policy reforms designed to bring their balance of payments into better equilibrium and establish the basis for economic growth.

3-2-4. 1970S WITH EXTERNAL SHOCKS (1973-1981)

Although the 1960s saw a rapid expansion of world output and trade, some international monetary problems started to emerge. The U.S., which had suffered from continued balance-of-payments deficits throughout the period, suspended the convertibility of the dollar and devalued it in 1971. Those pressures on exchange markets threatened the basis of the Bretton Woods system and forced a generalised floating of exchange rates in 1973. This change in international monetary circumstances followed deteriorations in real sector situations. The rate of growth of industrial economies had begun to slow and inflationary pressures began to build up by the beginning of the 1970s.

In addition, the two oil price hikes, of 1973-74 and 1979-80, had a dramatic effect on the world economic environment generally, the international financial system. By 1980, the official U.S. dollar oil price had increased by almost eleven times over the price of 1973 (see Table 3-2).

Table 3-2 OIL PRICES IN THE PERIOD OF 1973-80
(US dollars per barrel)

	1973	1974	1975	1976	1977	1978	1979	1980
Official Price for Saudi Light	2.70	9.76	10.72	11.51	12.40	12.70	17.26	28.67

Source: IMF, *International Financial Statistics*, various issues.

The initial impact of the energy price rises was on the world balance-of-payments structure, with sharp improvements for oil exporters, and notably the Organisation of Petroleum Exporting Countries (OPEC), and corresponding deteriorations in the balance of payments of the oil importers, as seen in Table 3-3.

Table 3-3 WORLD CURRENT ACCOUNT PAYMENTS BALANCES IN 1973-80
(billions of US dollars)

	1973	1974	1975	1976	1977	1978	1979	1980
Industrial countries	20	-11	20	1	-2	32	-5	-40
Developing countries								
Oil exporting	7	69	35	39	29	6	63	111
Non-oil	-11	-37	-46	-31	-30	-42	-62	-88
Eastern Europe and Others	-1	-4	-13	-16	-8	-9	-3	-4

Source: IMF, *World Economic Outlook*, various issues.

The current accounts of the industrial countries moved from a surplus of 20 billion U.S. dollars in 1973 to a deficit of eleven billion dollars in 1974. And in the course of the second oil price hike it changed from 32 billion dollars surplus to 40 billion dollars deficit. In the case of developing economies, the deficit of the non-oil countries deteriorated from eleven billion in 1973 to 37 billion dollars in 1974, and from 42 in 1978 to 88 billion dollars in 1980. The surplus of the oil-exporting

developing countries, on the other hand, eventually reached 111 billion dollars in 1980 from a level of only seven billion dollars in 1973.

Higher oil prices played a role in transferring income from industrial and developing countries to high-saving oil exporters. The resulting excess supply of world savings put downward pressures on world output and interest rates. In real terms, interest rates turned negative for several years. The effect was that the OPEC surpluses were recycled, largely to the developing countries which continued to be characterised by high, and increasing, current account deficits.[7] Much of the finance involved was used, however, by developing countries to increase investment. This allowed them to maintain or even raise their growth rates. However, with their debt much increased and a higher proportion of it carrying floating interest rates, the developing countries were left more exposed to the fiscal and monetary policies of the industrial world. The significance of this exposure became clear in the early 1980s.

The recycling process was accomplished by a major change in the structure of financial flows between industrial and developing countries, as commercial banks became much more prominent than they had been. Although official loans and grants from industrial countries increased considerably in mid-1970s, the biggest change was the growth of commercial bank lending to developing countries. There was also a change in the composition of these private flows. During the 1960s private funds were predominantly direct investments. Since the 1970s, however, multinational commercial bank loans have provided the main source of flows and have surpassed both direct investment and public funds.

The years between the late 1970s and the early 1980s saw another series of major external shocks for developing countries. Apart from the second oil price hike in 1979-80, real interest rates increased dramatically by nearly five percentage points in 1980-81. The second major increase of oil prices failed to stop the increase in real interest rates largely because the OPEC surpluses were short-lived,

and monetary restraints to tackle inflation in the major industrial countries were much tighter. Moreover, from the beginning of the 1980s industrial countries were caught in a deepening recession. Developing countries were thus facing falling demand in their main export markets in addition to deteriorating terms of trade while having to pay higher interest rates on their external debt at the same time. Thus, it was that although the number of formal reschedulings recorded an average of four a year over the period 1973-79, these successive shocks around the turn of the decade finally triggered the debt crisis starting from Mexico's 1982 debt-servicing problems.

3-2-5. THE DEBT CRISIS OF THE 1980S

The finance for the large current account deficits shown in Table 3-3 could be obtained without particular difficulty until 1982. The growth of borrowing produced a corresponding rise in external debt. Combined with big increases in the real interest rates, it contributed to the deterioration in the main debt indicators as indicated in Table 3-4.

Table 3-4 DEBT INDICATORS FOR DEVELOPING COUNTRIES IN SELECTED YEARS
(ratios in per cent; amounts in billions of US dollars)

	1970	1974	1976	1978	1980	1981	1982	1983	1984
Ratio of debt to GNP	14.1	15.4	18.1	21.0	20.9	22.4	26.3	31.3	33.8
Ratio of debt to exports	108.9	80.0	100.2	113.1	89.8	96.8	115.0	130.8	135.4
Debt service ratio	14.7	11.8	13.6	18.4	16.0	17.6	20.5	19.0	19.7
Ratio of interest service to GNP	0.5	0.8	0.8	1.1	1.6	1.9	2.3	2.3	2.8
Total debt outstanding and disbursed	68	141	204	313	430	488	546	620	686
Ratio of private debt to total	50.9	56.5	59.0	61.5	62.9	64.1	64.6	65.8	65.0

Source: IMF, *World Economic Outlook*, various issues.

For all developing countries, the ratio of debt service to exports rose from fifteen per cent in 1970 to 21 per cent in 1982, then declined slightly to 20 per cent in 1984 and the ratio of debt to GNP increased from fourteen per cent in 1970 to 34 per cent in 1984. The ratio of debt to exports similarly increased from 109 per cent (1970) to 135 per cent (1984) and the ratio of interest payments to GNP rose from 0.5 per cent in 1970 to 2.8 per cent in 1984.

The deterioration in debt indicators was paralleled by a spate of debt reschedulings from 1983. For instance, 31 rescheduling agreements involving 21 countries were concluded in 1983. Since then, reschedulings have come to constitute a regular feature of international financial markets. In particular, Mexico's declaration of inability to service its external debts may have served as a reminder to creditors of the collapse of the world financial market in 1930s. The period of abundant inflows of foreign capital to the developing world came to an abrupt end in 1982, giving way to what came to be described as the debt crisis. International capital flowed mainly among the industrial countries in the 1980s. Developing countries were neglected by international lenders and investors, mainly because of their high external debts and deteriorating economic and political conditions. Capital inflows, if available, went primarily to meet the debt-servicing needs of debtor countries, and little additional capital was available for investment and sustained growth. With the persistence of the crisis through the 1980s, many debtor countries began to experience a reversal in resource transfers.

The international lenders' approach to the debt crisis since 1982 can be considered in two phases. During the first stage, extending from 1982 through 1984, prior attention was necessarily given to the adjustment of debtor countries' balance of payments, given a sharply decreased availability of external finance. Despite the increased resources and policy advice provided by official lenders, such as the World Bank, the IMF and others, to encourage continued commercial bank involvement, debtor countries had little choice but to accept a drastic reduction of

domestic consumption. In the short-term, this was necessarily achieved largely through substantial cutbacks of public and private investment and of imports.

However, with commercial creditors reluctant to increase their exposure in countries with debt problems and with debtor-economy domestic savings being transferred abroad to service the debt, borrowers could not finance the investment needed to generate growth and thus their capability to repay outstanding debt and interest payments. The resources for investment could only come from higher domestic savings or from repatriated capital. Before 1982, as indicated by Koerner (1986), the highly indebted countries received about two per cent of GNP a year in resources from abroad. But since then they have transferred roughly three per cent of GNP a year in the opposite direction. Domestic savings would have had to rise by five per cent of GNP to offset this change in net transfers.

Taking into account such a problem, the 'Baker Initiative' of 1985 stressed the need to maintain net flows of funds from official and private lenders. It synthesised the growing perception that maintenance of external debt service through the contraction of domestic investment and consumption was unsustainable, and that creditworthiness could only be permanently restored through the growth of debtor countries' output and exports. This aspect of crisis management has thus relied on three approaches: (1) vigorous structural adjustment efforts by the borrower countries; (2) increased financial and technical support by the international financial institutions; (3) and continued, to some limited extent, net financial flows from the private commercial banks.

The second stage of world debt strategy considerations started from criticism of the 'Baker Initiative' on the grounds that it brought about too small a flow of funds to reduce the scale of current debt-servicing obligations while important adjustment programmes failed mainly due to the overwhelming weight of debt burdens. The wave of criticism led a new concept, the so-called 'Brady Initiative'. It was argued that the most important thing would be to secure the import

capacity of highly indebted countries, the main importers of creditors' goods, and this could only be done through easing the burden of debt obligations.

During 1988 and 1989, creditor governments and banks alike concluded that debt reduction would have to be an element in resolving the persistent debt crisis. Creditor governments agreed at the 1988 Toronto summit to grant debt relief to the poorest and most heavily indebted countries. This mostly concerned official debt on which most of the low-income countries have always relied. Bilateral creditors have rescheduled under Paris Club arrangements, offering highly concessional conditions. Bilateral official lenders who had extended nonconcessional loans were encouraged to choose between cancelling one third of the consolidated amount, or adopting the longer repayment used for concessional debt, or cutting the interest rate. For private creditors, a so-called menu approach has been developed since 1986 which provides for a variety of voluntary methods of debt reduction. These include debt buybacks[8], exit bonds, and debt-equity swaps.

The current situation is that although there has been a considerable progress, the debt crisis continues to threaten the international financial system and the development of borrowing countries. As factors that could sustain and augment progress, the *WDR* (1991) suggests expanded country coverages of commercial debt and debt service reduction, more concessional rescheduling for the poorest debtor countries, and a reduction of the stock of debt owed to bilateral agencies. However, what remains more important is the selection and operation of debtor economic policies. In this respect, it is argued that net foreign capital transfers to developing countries in future should depend on whether countries can produce the policies to maintain macroeconomic stability and to improve their creditworthiness against the threat of internal and external shocks. This is a point which lies at the heart of the sovereign credit rating methods emphasised in this study.

CHAPTER 3

3-3. OFFICIAL AND COMMERCIAL FINANCE FLOWS

3-3-1. OFFICIAL DEVELOPMENT CAPITAL FLOWS

There are various ways of providing official finance for development and assistance. They range from grants and highly concessional loans to loans on nearly commercial terms. Such flows, particularly concessional flows or official development assistance (ODA), have long been especially important for low-income countries. In the case of project financing, commercial lenders are not likely to finance basic essential activities, such as education and medical facilities, which have long time lags before they contribute to production capabilities generally. Private banks usually prefer project lending to finance directly productive purposes. In contrast, official lenders may have other purposes for lending. The motives of donors for providing official assistance range from humanitarian dimension to political, security, cultural, and commercial interests. Combinations of these objectives can affect the nature of official flows and decide thus the effectiveness of such flows in promoting development.

Since the Second World War, many developing countries have had the aim of achieving rapid economic development through industrialisation. They needed large volumes of foreign capital to supplement insufficient domestic savings as pointed out earlier in this chapter. In particular, the success of the post-war reconstruction Marshall Plan in the 1940s and 1950s led donors and recipients to believe that a similar transfer of capital to developing countries would achieve similar results. Thus, in the 1960s large amounts of official assistance were invested in large-scale industrial projects, improved labour skills, technology, and management.

Through the 1970s and early 1980s the stated aid policies of industrialised-country governments and international institutions shifted gradually

towards assisting the poorer countries. The poverty orientation of aid emphasised basic needs, rural development, and urban infrastructure development. Aid donors started to perceive a limitation to inducing economic growth with aid-giving so that they underlined the importance of reaching the poor directly.

More recently there has been a renewed emphasis on the necessity of "programme aid", some of which is now described as structural adjustment aid. This is essentially directed at balance-of-payments support, and is intended to enable countries to adjust the structure of their economies while still continuing to grow, rather than having to restrict aggregate demand to close any balance-of-payments gap. This requirement also appears to coincide with the wishes of many borrowing countries. The IMF and the World Bank have taken a lead in developing this kind of official assistance.[9]

There has for many years been an almost uncritical consensus that aid is a good thing for the development procedures, and the more aid that is provided, the better. However, over time a succession of doubters have expressed their views on the effectiveness of official assistance. They argue that the costs of aid to developing countries are likely to be greater than the benefit they receive from the concessional terms. Regarding these objections to aid or official capital inflows, the *WDR* (1985) notes (pp. 101-2) two extreme viewpoints.

> **One school derives from dependency theory, arguing that underdevelopment is not merely the absence of progress; it reflects active exploitation of the "periphery" by the developed market economies of the "centre." Aid is therefore a tool to perpetuate the dominance of donors. If aid provides any benefits, these merely prevent unrest and keep developing countries in a submissive state. The other school claims that aid inevitably expands the role of government, distorts market signals, and finances some investments that the private sector would undertake if it were given the chance. Indeed, these critics would also argue that a liberalised private sector could provide all the resources needed for development, so aid is not justified.**

However, aid goes largely to the least developed countries which do not have access to the international private capital markets, and which find it difficult to

attract private foreign investment, primarily because of their low level of economic development. And concessionality can be defended and justified on the grounds that developing countries are less advanced in every respect than developed countries so that they are more likely to make investment errors. In this sense, the *WDR* (1985) argues (p. 102) that "the critics of aid offer little analytical evidence for their view, relying instead on anecdotal accounts of cases in which aid was used for nondevelopmental reasons or aid projects were badly designed ... such criticism is about the way aid is implemented rather than its basic rationale."

3-3-2. COMMERCIAL BANK LENDING

It might be considered that private lenders would be more stringent than official lenders. Since private banks are privately owned, losses on loans are major setbacks. A bad lending record means the bank loses its own credit standing in private money market which has its own serious consequences since a modern bank must be a borrower in order to be a lender. Their credit evaluation mechanisms aim at assessing the creditworthiness of the borrowing entity. Additionally, commercial banks need to consider their portfolios.

Borrowing from banks can appear at times attractive to developing countries. For project financing it is generally accepted to be possible to mobilise syndicated credits relatively quickly. Official agencies usually require that a detailed feasibility analysis be carried out according to their specific criteria, while commercial banks generally pay little attention to the purposes served by proposed credits. Instead private lenders concentrate their interest on guarantees, preferably from the borrowing agent's government. In addition, bank finance is not linked with the purchases of materials from the lender's country, and in that sense it can provide a more favourable source of loans.

However, such relatively easy availability of commercial bank loans can lead to inefficient lending and inappropriate borrowing. Borrowing governments may see no difficulties in pledging guarantees and may fail to pay sufficient attention to relating repayment commitments to the use of the funds and to planning their future foreign exchange income and expenditure. It should be noted that there are also some unfavourable factors to borrowing countries in bank lending. First, since commercial bank finance is a rather expensive source of foreign capital as compared to official sources, the obvious effect of the change in the structure of external financial flows is to increase the overall cost of external financing. Second, commercial bank loans have generally substantially shorter maturities than official development capital inflows so that they usually shorten the overall maturity of outstanding foreign debts. Creditors therefore have that much more flexibility to react to perceived changes in a situation. It may also be that it is much more difficult to match the maturities of loans to flows of returns over time from the purposes financed by the loans. And third, this is a source that often carries floating interest rates rather than the fixed interest rates. Obviously, the exposure to interest rate increases on existing debt implies that borrower can from time to time face higher debt service costs than they might have anticipated. With the added laxities in commercial bank evaluations of sovereign risks, these three disadvantages of commercial bank lending took on a special danger in the situation that began to emerge during the early 1980s.

3-3-3. DEBT CRISIS AND COMMERCIAL LENDING

After the Second World War the U.S. for a time represented the only substantial source of private foreign capital[10]. It was during this period that development aid grew considerably. However, things changed during the early 1970s. Commercial bank lending became the fastest-growing and most flexible source of foreign finance for developing countries. The reasons had mostly to do with the need to cover their balance-of-payments deficits. The increases in the oil

price in the 1970s further emphasised this aspect of developing country financing. Non-oil developing countries were faced with a sharp increase in their import bills, which generally they were unwilling to reduce. On the supply side of the situation, sizable amounts of funds were transferred by oil importers in industrial countries to OPEC members and ultimately to the Eurocurrency markets. But due to the recessions in the West associated with the oil price hikes, the commercial banks' traditional customers were unwilling to borrow substantially. Developing country borrowers and lending banks from the West therefore naturally came together. They needed each other. The result was that over the period 1973 to 1981, bank claims on developing countries increased at an average annual rate of 28 per cent.

From the late 1970s commercial banks began to become concerned about their exposure to both lending and funding risks in their international business. By the end of 1982, the exposure of the nine largest U.S. banks to non-oil developing countries amounted to 221 per cent of their capital, compared with 163 per cent in 1977.[11] Additionally, certain banks were heavily exposed to certain countries some of which were countries which were considered to be in high default risk. European banks were also exposed to developing-country risk, but not usually to the same extent as the U.S. banks, whose traditional developing-country lending area of Latin America contained most of the high-debt, high-risk countries. However, some European banks, especially the German banks, had substantial exposure to Poland and other East European countries.

With increasing anxiety, the banks' relationship with the developing countries ran into difficulties. Many banks started to cut back their lending in this direction. Several factors contributed to this abrupt and unforeseen changes. First, as debt-servicing difficulties in a number of borrowing countries led to a need to reschedule significant volumes of debt, such a sudden deterioration in the perceived creditworthiness of developing countries accelerated an unwillingness of banks to increase their exposure further. Second, the worry in the industrialised countries was that an inability or unwillingness of borrowers to service debts would lead to

a lack of liquidity and a collapse of confidence in one or more major banks. If one major bank failed, then a 'domino effect' would induce the collapse of other banks, and finally a disintegration of international financial mechanisms and world trade. One effect was revisions to bank regulations to restrain certain areas of bank lending. Third, oil-money and large bank deposits could no longer provide enough liquidity to support the international financial market, largely because OPEC members did not have the current account surpluses of the 1970s. Fourth, banks were at that time able to access more profitable opportunities for lending within some industrial countries. These changed attitudes to international lending amongst commercial banks were supported by gradually reviving economic activities in industrial countries.

By August 1982, Mexico could no longer meet its principal repayments. It has become clear that other major debtor countries, notably Brazil and Argentina, were having great difficulty even in meeting interest payments on their debt by the end of 1982. In January 1983, Brazil, Romania, and Cuba have all announced to the banks and to the world that they were halting repayments of principal on medium- and long-term loans which were about to fall due. In 1983, 48 U.S. banks failed, which was the highest annual figure since the 1930s depression.[12] However, even this was exceeded by 79 failures in 1984. (This should not suggest, however, that these problems were exclusively related to difficulties with foreign debts. Many of the failures were brought about also by difficulties with business relating to U.S. domestic financial markets. Thus, Dale (1984) notes (p. 19) that "In the three years 1981-84 ... [U.S. bank] failures increased sharply to an average of over 33 a year, a failure already exceeded in the first half of 1984 ... because ... increased volatility of earnings, intensified competition, higher loan losses and great financial instability [meant that] the US banking system was becoming more risky.")

Banks have had to seek ways of rescheduling existing loans, which would not require writing off loans in their accounts, thereby preventing weaknesses in their balance sheets undermining depositor confidence. Essentially no formal mechanism exists for rescheduling bank debt. Each country has been treated on a case-by-case basis, and the elements of each arrangement have been worked out on an *ad hoc* basis by the parties involved. And pressures have been put on many, otherwise reluctant, commercial banks to commit further funds, to reduce the stock of debt, or to provide for more concessional reschedulings for some debtor countries during the period of settling the debt crisis.

NOTES

1. This proportion recorded nearly over 85 per cent on average over the period 1960-1985 according to Branford and Kucinske (1988).

2. Three entities can be considered to be involved in international flows of loans. They are lender, borrower, and intermediary. Sometimes, as seen in the case of bilateral official lending between governments, the last may not be needed because of direct links between lender or borrower.

3. The *World Development Report* (1985) of the World Bank defines (p. 85) term of international financial system as covering " ... the institutional arrangements for ensuring that the world's surplus funds flow to countries or entities in deficit, the rules governing the international exchange rate regime, and the mechanisms for creating and distributing liquidity."

4. For instance, Dutch capital helped to finance English factories and to launch the industrial revolution (see Loxley (1986) for details).

5. In particular in 1960s, the economic growth rate of industrial countries was five per cent a year on average. World trade grew even faster at an average of 8.4 per cent a year. Inflation rates in industrial economies as a group varied between two and four per cent a year, keeping real interest rates in the range of two to three per cent.

6. Two other international organisations were launched around this same time also. The International Finance Corporation (IFC) was created in 1956 to assist the private sector in developing countries through loans and equity investments. And the International Development Association (IDA) was formed in 1960 to provide a multilateral source of concessional finance for low-income countries.

7. Those OPEC surpluses did not go to the industrial countries because they swung back into current account surpluses which averaged almost thirteen billion U.S. dollars a year in 1975-78.

8. It means that a debtor buys back part of its foreign debt perhaps with international reserves or foreign exchange earnings.

9. The roles of the IMF and the World Bank in dealing with debt problems of developing countries with special reference to "programme aid" are discussed in various papers such as Kitchen (1986), Lomax (1986), Fraser (1987), etc.

10. This concept includes all types of foreign financial flows from private sources such as export credits, direct foreign investment, bank lending, portfolio investment, leasing, etc.

11. See Nunnenkamp (1986, pp. 92-109) for referring to the discussion of imprudent lending by commercial banks.

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CHAPTER 4. THE ROLE OF FOREIGN CAPITAL INFLOWS IN DEVELOPING COUNTRIES

CHAPTER 4

4-1. INTRODUCTION

Among modern theories of economic development, as Chenery and Strout (1966) point out (p. 680), there has been a " ... general agreement on the principal changes that characterize ... [economic development] transformation: an increase in human skills, a rise in the level of investment and saving, the adoption of more productive technology, a substantial change in the composition of output and employment, the development of new institutions, etc." Developing countries face various challenges in providing for this transformation process.

In particular, any country aiming to do this without external resources must provide for all of the requirements of accelerated growth from its own domestic resources or from imports paid by exports. More ambitious dynamics mean greater imports and therefore the need to rely on foreign resources. However, there seems to be no general agreement on the role of such foreign resource inflows in such circumstances. Perhaps this is because the impact of resource inflows on domestic savings, growth, or other macroeconomic indicators could differ across developing countries and over time.

This chapter attempts to review major discussions about the role of foreign resources[1] in developing countries by starting from what is referred to as 'two-gap analysis' and then going on to broader and longer-term perspectives by emphasising the importance of individual countries' overall macroeconomic policy and adjustment.

4-2. FOREIGN CAPITAL INFLOWS IN NATIONAL ACCOUNTS

In terms of conventional national accounting the balance between a country's resources and resource utilisations can be expressed at the highest level of aggregation as follows:

$$Y = C + I + X - M. \qquad (1)$$

This relates domestic income (Y) and income from exports (X) to expenditures on consumption (C), investment (I), and imports (M). (Government expenditure is not separated out from C and I so that, for the sake of simplicity, the public sector's contribution to the savings gap, in the form of the difference between government income and expenditure, is not specified separately.) The available national income must also equal its disposal in terms of allocations between consumption, total domestic savings (S). That is

$$Y = C + S. \qquad (2)$$

Equations (l) and (2) then result in

$$I - S = M - X. \qquad (3)$$

This implies that the internal imbalance in the resource gap, *i.e.*, a 'savings gap' between investment and savings, corresponds to the external imbalance of a 'foreign exchange gap', or 'trade gap', between imports and exports.

When a country can not cover the needed investment with its domestic resources, then foreign resources (F) have to fill the gap. Therefore, for a capital deficit economy, equation (3) can be expressed as

$$I - S = M - X = F. \qquad (4)$$

It suggests that capital inflows from abroad could be said to augment a country's total resources either by filling a savings gap between investment and domestic savings or a foreign exchange gap between expenditure on imports and earnings from exports.

Special opportunities for misunderstanding the implication of this result follow from the the relationship shown by equation (4) having a different meaning depending on whether it is viewed *ex ante* or *ex post*. In the case of the latter, the circular flow of national income means that the excess of investment over savings must necessarily be equal to the excess of imports over exports. However, *ex ante*, equation (4) becomes an equilibrium condition. One gap thus may be greater or less than the other in a disequilibrium situation. It might be thought realistic to investigate this possibility by using an estimated consumption function to predict savings which could then be compared with estimates of investment required to achieve some given growth target. A similar exercise could be undertaken in respect of an estimated import function and, perhaps, exogenously determined exports. For instance, Joshi (1970) describes (p. 121) this procedure in the following terms:

> Assume that the target is to increase GNP by a prescribed compound growth rate over a prescribed time-horizon T. Assuming a given incremental capital-output ratio, investment requirements in the terminal period (I_T) are determined. Initial savings are known. On the basis of this and a linear Keynesian saving function we can calculate total potential savings (S_T) in the terminal year. Then the difference between investment and saving ($I_T - S_T$) is the 'saving gap' which must be covered by foreign assistance. However, there are also certain import requirements which the system has to fulfil. Required imports in the terminal year (M_T) are determined on the basis of initially observed imports and a fixed marginal propensity to import. Maximum potential exports (X_T) are given exogenously. Then ($M_T - X_T$) is the 'foreign exchange gap' or 'trade gap'. Given that successful achievement of the target requires that both investment and import requirements be satisfied, required foreign aid inflow is determined by the larger of the two gaps.

4-3. DEBATES ON THE ROLE OF FOREIGN RESOURCES

4-3-1. SUPPLEMENTING DOMESTIC SAVINGS

The macrocconomic effects of savings on economic growth can be analysed in the simplest possible terms in the Harrod-Domar growth model. This model states that the rate of growth of output (g) is equal to the savings rate (s) divided by the incremental capital-output ratio (v). That is

$$g = \frac{s}{v}. \tag{5}$$

Since it is assumed in this simple framework that domestic savings can always meet the *ex ante* requirements for investment, there is no mechanism in which the resource gap between investment and domestic savings puts a constraint on further development.

However, as Bruton (1969) indicates (p. 440), many writings on development economics have suggested that

> ... development tends to create situations which, at various points in time, are characterized by a plentiful supply of all but one or a few of the factors 'required' for continued development. For these few, a gap between the quantity supplied and that required slows growth or halts it completely. When growth is thus limited by a bottleneck, there is underutilization of other factors.

Chenery and his co-workers (1962, 66, 70) investigate the theoretical and empirical implications of this kind of bottleneck in terms of the relative magnitudes of a savings gap and a trade gap, which has come to be generally known as 'two-gap analysis'.[2] They suggest that the two gaps constitute two separate and independent constraints on the attainable rate of economic growth.

In their two-gap theory, Chenery and Strout (1966) underline the role of foreign resources as a special example of relieving bottleneck constraints with statements (pp. 680-81) that

> **By relieving these constraints foreign assistance can make possible fuller use of domestic resources and hence accelerate growth. Some of the potential bottlenecks—of skills, savings, or foreign exchange—can be temporarily relaxed by adding external resources for which current payment is not required. More efficient use can then be use of other resources, so that the growth of total output may be substantially higher than would be permitted by the rate of increase of the most restrictive domestic factor.**

They assume that a target rate of growth is postulated and a capital-output ratio is accepted as a datum. Hence a specific saving rate is derived as necessary to achieve the targeted growth rate. Similarly, a fixed relationship between imports and growth of output is postulated from which one may derive the level and rate of growth of imports required. A savings gap appears when the domestic saving rate is below the level necessary to permit the investment required to achieve the target, while imports are adequate. Foreign resources cover the saving gap, and permit the achievement of the target. A trade gap appears, however, if with adequate savings, the flow of imports is below the required level. Here foreign capital inflows break the import bottleneck and permit the target to be reached. In this latter case, the key assumption is that the country is unable to transform its potential savings into exports.[3]

McKinnon (1964) also emphasises the dual role of foreign resources in affecting economic growth *via* this bottleneck context by saying (p. 388):

> **We have the classical view that foreign aid or investment only has the effect of supplementing domestic saving in the receiving country. On the other hand, we have the modern view ... that many goods have strategic importance in efficient industrial growth but cannot be produced domestically in the early stages of industrial development, or after a war. Foreign aid or private investment can have a large favourable impact on the growth rate when such a bottleneck constraint is binding, even though these transfers are a small fraction of available domestic savings.**

As a supplementary argument, emphasising the vital role played by foreign resources beyond considerations of what particular constraint is thereby relieved, Bowles (1987) indicates that foreign resource inflows can act as a supplement to domestic savings and hence raise the growth rate. Then, a question arises as to whether such growth rate can have a sustainability without any more foreign resources. With regard to this point, he explains (p. 789) a procedure of self-sustainability of the growth rate *via* raising the savings rate as following terms:

> This increase in the growth rate would raise incomes and since it is believed that the marginal propensity to save is greater than the average propensity to save in LDCs, the savings rate would increase and the higher growth rate would become self-sustaining without the need for further injections of foreign aid. Thus, ... inflows of foreign aid would have the effect of raising the savings rate in subsequent periods.

According to this view, foreign resources supplement domestic savings thereby allowing an increase in the growth rate from equation (5) to equation (6)

$$g = \frac{(s + i)}{v}, \tag{6}$$

where i is foreign resource inflows expressed as a percentage of GNP. This increase in the growth rate would raise incomes and the savings rate and thus the higher growth rate would be self-sustaining without further reliance on foreign resources.

However, since any imbalance between imports and exports must necessarily be the same as that between savings and investment *ex post* as indicated earlier, the possibility of an *ex ante* imbalance between the two gaps could imply 'wasteful' adjustments such as reductions in savings or expanded imports of consumer goods according to the two-gap theory. However, Bruton (1969) objects to such a possibility of 'wasteful' adjustments by arguing that problems would not exist if recipient countries had followed appropriate policies in the past and if a more realistic view is taken of the flexibilities currently available to policy-makers in developing economies. Pricing system in some public services is given by him as

an example of areas forcing such 'wasteful' adjustments due to maintaining inappropriate policies as follows (p. 443):

> **It is easy to find examples where domestic polices are such that a high rate of consumption of import intensive services occurs. This applies especially to the pricing of many public services, e.g., passenger transportation and electric power. The pricing of these (import intensive) services is such that their consumption is encouraged, there with more realistic pricing either greater savings or a shift in consumption would occur, either of which would contribute to resolving the trade gap.**

More particularly, the right allocation and effective use of investment should be of more concern for policy-makers in developing countries than any understanding of the role of two gaps in the development process. Consequently he concludes (p. 446) that " ... the distinction between the two gaps is due to particular policies that themselves are growth impeding, and not to some inherent characteristic of the development process ... "

Joshi (1970) also raises a question to the two-gap analysis. He argues that savings and foreign exchange constraints derived from mechanistic projections of growth target, the capital-output ratio, exports, and imports may hide various assumptions about domestic objectives and government policies. In particular, foreign exchange constraints are said to be induced from inappropriate and inefficient policies, not to exist as indispensable bottlenecks against economic development. Joshi writes (pp. 124-25):

> **It is easy to see that in many LDCs the industrialisation programmes have been haphazard, ill thought out and insulated from international costs and prices. The lack of any method of project selection has in many cases biased development away from agriculture and exports and in favour of highly import-intensive manufacturing activities. Cases have been found in which the direct and indirect foreign exchange costs of producing something are greater than the cost of importing it. It seems inappropriate to call a foreign exchange shortage which is the result of such policies a foreign exchange constraint.**

Like Bruton (1969) he underlines domestic policies rather than two-gaps themselves. It may be worth of noting his arguments (p. 128) that

> ... the distinction between a saving and a foreign exchange constraint is of very limited usefulness. Theoretically, it is based on very extreme assumptions which reduce its value as a classification of reality .... Indeed it may be positively harmful. For it lends academic respectability to the view that LDCs are hampered in their development solely by *external* factors. In fact *internal* measures by the LDCs are of great importances; failure to realise this can be very damaging, especially at the moment when foreign aid prospects look so gloomy.

4-3-2. ENCOURAGING CONSUMPTION

Numerous studies have expressed scepticism about the role of foreign resources in promoting economic development. However, as Bowles (1987) comments (p. 789), they hardly affected " ... conventional thinking until the publication of two papers by Griffin (1970) and Griffin and Enos (1970) in which they challenged the benefits of aid."

Griffin and Enos (1970) first summarise (pp. 319-20) the main ideas of conventional models reporting an positive relationship between foreign resources and growth as follows (pp. 319):

> ... These models visualize capital imports as having two effects: *(a)* increasing the level of investment directly by the amount of aid and *(b)* increasing the rate of capital accumulation indirectly by raising the level of income and (assuming the marginal propensity to save is greater than the average) the rate of internal savings. That is, it is imagined that all aid is invested, and this leads not only to a higher rate of capital accumulation but also to a larger proportion of income being saved.

In particular, with regard to the "basic model" of Chenery and Strout (1966) where the constraint on growth is assumed to be savings, Griffin and Enos criticise the assumptions of that model emphasising sustainabilities between foreign and domestic savings, by saying (p. 320) that in it

> ... domestic savings are at their maximum level, as determined by the maximum potential in the base period (which is assumed to have been achieved) and the marginal propensity to save. Thus the role of foreign assistance is to ease the savings constraint by providing investible resources to supplement domestic efforts. Chenery and Strout assume the recipient country is "unwilling or unable to increase

aid merely to increase consumption", and they believe recipient governments have "no incentive ... to increase aid by reducing savings." These are extremely odd assumptions. Foreign and domestic savings are substitutable resources. In effect, models of the Chenery-Strout type make domestic savings depend upon GNP or, alternatively, upon national income per capita, rather than upon total available resources. Yet as long as the cost of aid (*e.g.*, the rate of interest on foreign loans) is less than the incremental output-capital ratio, it will "pay" a country to borrow as much as possible and substitute foreign for domestic savings. In other words, given a target rate of growth in the developing country, foreign aid will permit higher consumption, and domestic savings will simply be a residual, that is, the difference between desired investment and the amount of foreign aid available. Thus the foundations of models of the Chenery-Strout type are weak, since one would expect, on theoretical grounds, to find an inverse association between foreign aid and domestic savings.

Additionally, so far as motives of the supply of foreign resources are concerned, Griffin and Enos claim that how much a country borrows is not determined by its need, or its potential, or its past economic performance, good or bad, or its virtue, but by the benefit a creditor country yields in terms of political support. Foreign resources, it is thereby argued, are not distributed on the basis of economic need but in accordance with political expediency. Thus, the level of external resource inflows is viewed as an exogenous variable determined by donor country motives. Given that foreign resources are viewed exogenously in this way, attention is then focused on the responses of a borrowing country to such resource inflows. This mechanism is assumed to operate in both the public and private sectors. Faced with inflows of foreign resource, a borrowing country government may reduce its tax effort or change the composition of expenditure towards consumption. Similarly, the availability of low-interest loans may reduce the incentive to save in the private sector. The result of this is that domestic savings rate falls as foreign resources are increased.

In particular, Griffin (1970) sets out to test this proposition using cross-section data for 32 developing countries in 1962-1964. He refers to estimates of the equation

$$\frac{S}{Y} = \alpha + \beta \frac{F}{Y}, \tag{7}$$

where S/Y is domestic savings as a proportion of GNP and F/Y is foreign resources as a proportion of GNP. The estimated value of the coefficient β is -0.73. This result of a negative relationship between domestic savings and foreign resource inflows, he argues, provides the empirical support for the theoretical argument that resource inflows cause domestic savings rates to fall. Thus, rather than being a supplement to domestic resources, foreign resources are said to act as a substitute for them.

About a negative relationship of foreign resources to domestic savings, thus, Griffin and Enos (1970) conclude (p. 326) that foreign resource inflows have " ... neither accelerated growth nor helped to foster democratic political regimes. If anything, aid may have retarded development by leading to lower domestic savings, by distorting the composition of investment and thereby raising the capital-output ratio, by frustrating the emergence of an indigenous entrepreneurial class, and by inhibiting institutional reforms."

These studies have stimulated much subsequent research on the relationship between foreign resources and domestic savings or economic growth. They usually test the relationship by estimating equations similar to equation (7). The negative correlation which Griffin (1970) finds is confirmed by later researchers.[4] For example, Papanek (1973) reports that domestic savings and foreign resources are negatively correlated from his cross-section study covering data from the 1950s and 1960s. And Mosley (1980) points out (p. 82) from his cross-section data covering the 1970s that "The negative correlation between aid and savings of which Griffin *et al.* made so much is still strong and significant ... "

4-3-3. CRITICISM ON CAUSALITY

However, those aspects of the Griffin and Enos (1970) arguments that this negative correlation should imply a causal relationship running from foreign

resources to domestic savings have been challenged. Papanek (1972), for example, raises a serious question on the claims about an implicated negative causality by arguing (p. 941) that

> **aid ... goes primarily to the needy: poor or crisis-ridden countries. This is not the same as arguing that aid is allocated to all needy countries and in proportion to need. Clearly, most aid is allocated in large part on the basis of political considerations. But among countries who have a claim for political reasons it tends to go disproportionately to those who need foreign resources more, and any one country is likely to receive more than its average allocation during its periods of greatest need.**

In this sense, it is claimed, there are many cases where high foreign resource inflows are correlated, over countries and time, with low savings and, in some cases, low growth rates. Poor countries often have low savings rates and low growth rates. If they frequently record greater resource inflows because of greater need, then savings and growth will be negatively associated with resource inflows for many countries without any causal relationship between them. Thus, causality runs from the general economic situation, of which the domestic savings rate is one indicator, to the extent of reliance on foreign resources. Mosley (1980) also appears to share the same opinion as Papanek (1972) on the grounds that he suggests (p. 90) that "The negative link between aid and savings noted by many commentators in the 1960s still holds good, but it is likely that this is little more than a reflection of the fact that the poorest countries attract the most aid in proportion to their income, and that the poorest countries save least, not a genuine causal relationship."

There is also criticism of the use of the specification found in equation (7) to prove a negative relationship between foreign capital inflows and domestic savings. First, Papanek (1972) criticises (p. 938) the authors concerned for the reason that " ... they are generally not specific about the savings function which underlies their assumed relationship." Instead, he suggests that " ... there are plausible savings functions which could result in one dollar of foreign inflows producing either a positive or a negative effect on savings and anything from no increase in investment to more than one dollar of additional investment." In particular, he

doubts about an usefulness and reliability of the studies reporting a negative relationship on the grounds that the measures of savings reflect an "accounting convention" rather than a "behavioural relationship". It would be worth of noting his arguments (pp. 938-39):

> **The negative statistical relationship between savings and foreign inflows ... can be in part the result of an accounting convention, not of a behavioural relationship. Confusion arises because domestic savings are calculated, following conventional economic practice, by subtracting foreign inflows ... from gross investment. This is quite appropriate to the extent that foreign resources are either (i) used for investment or (ii) are a claim on past or future savings ... However, to the extent that foreign resources are used for consumption *and* have a grant element one obtains misleading results by following conventional procedure. An extreme example would be a gift of foreign food directly to starving group. Even if the magnitude of neither investment nor domestic savings (in the normal sense) is affected by the gift, the conventional method will show a decline in savirgs: the starving group has consumed in excess of its income ... It remains appropriate in these cases to conclude that foreign resources were used to increase consumption, not investment. It is, however, misleading to reduce domestic savings by the amount of foreign resources received as a grant for consumption purposes. Nevertheless, analyses have ignored the differences in uses and sources and have subtracted all foreign resources from investment in calculating domestic savings ... Precisely the poorer, more slowly growing countries are likely to receive a higher proportion of grant aid and to use it to increase consumption. They are also likely to be countries with low savings rates. The use of the accounting convention may therefore by itself produce a correlation between low (apparent) savings and high aid inflows.**

In addition to these considerations, Papanek again disagrees with the conclusion reporting a negative causality in favour of emphasises on the probable effect of other exogenous influences on both variables. With respect to this point he concludes as follows (p. 948):

> **... the critics' case for a negative causal relationship between foreign inflows and savings is not proved by their quantitative analyses. In many instances causality is more complex than they assume. For a number of countries it is plausible to conclude that exogenous factors [such as war, he cites, weather, or political disturbances] caused both high inflows and low savings rates and generally low growth rates as well ... There is a real risk, therefore, that the implicit use of a *simplisite* savings function will serve to create the appearance of a causal relationship, when none really exists ... In some circumstances, foreign inflow undoubtedly stimulated savings, so that each dollar of inflows led to more than a dollar of investment, while in other cases they discouraged savings and a dollar of inflows may have to led to much less than a dollar of investment. However, as long as both savings and inflows are substantially affected by third factors, the negative correlation between the two found in many studies sheds little or no light on their causal relationship.**

However, Newlyn (1973) opposes the Papanek's (1972) assertion that grants for consumption should not be subtracted from gross domestic capital formation to calculate gross domestic savings.[5] Newlyn claims (p. 867) that such an argument can not be justified " ... if the correct definition of current account deficit is used in which current transfers, as distinct from capital transfers, are included in the current account ... [on the grounds that] consumption grants will be included in current transfers and will thus not be deducted from investment in calculating national savings." In such a treatment, current transfers (including consumption grants) will be added to the appropriate sector's factor income as receipts and, being offset by an equivalent amount of consumption, will leave the sum of sector savings unchanged. Thus, it is argued, misunderstanding comes not from accounting convention or behavioural relationship error but from specification error. In this respect, he underlines (p. 868) that the confusion about the relationship between foreign resource inflows and savings

> ... *has* arisen from the relationship between the correct use of accounting convention in question and the behavioural effects of capital inflow on resource use. This stems from the definition of national savings which entails its reduction by any increase in consumption which is financed by external *capital* [and thereby it] ... would be due to inappropriate specification of capital inflow rather than to any characteristic inherent in the accounting convention in relation to behaviour.

Furthermore, concerning the expected sign of the parameter β (*i.e.*, $\partial S/\partial F$) in equation (7), Newlyn goes on to explain (p. 869) that in the regression of savings (S),[6] measured by investment (I) minus foreign inflows (*i.e.*, $S = I - F$), on foreign inflows (F), confusion can arise when

> ... negative values of the coefficient between 0 and -1, which would normally mean a reduction in the dependent variable, actually mean no change in the absolute amount of national resources being used for investment but simply reflect the extent to which foreign resources have been used for consumption. Only if the negative value exceeds unity is there any substitution effect (absolute reduction in the amount of national resources being used for investment).

This crucial aspect has also been commented on in Wynn's (1980) empirical analysis. He claims (p. 15) that

> Unless all [the] additional resources are devoted to increased investment, the identity $S = I - F$ means that $\partial S/\partial F$ lies somewhere in the range $-1 \leq \partial S/\partial F < 0$. ... [Thus,] it should perhaps be noted that there is some confusion in the literature concerning the expected sign of the coefficient $\partial S/\partial F$ subject to alternative assumptions about the proportions of net capital inflow that are devoted to investment and consumption and the impact of this inflow on 'domestic saving'.

The overall conclusion is, therefore, that the theoretical and empirical studies on the relationship between foreign resource inflows and domestic savings do not produce a uniformly applicable characterisation of the use of foreign resources in developing countries. In this sense, it may be interesting to note Bowles' (1987) suggestions (p. 790) that

> ... the global generalization concerning causal mechanisms made by both Griffin and Papanek should be treated with extreme caution. In fact, the results ... lend no support to the view that a causal relationship exists, in either direction, between foreign aid and domestic savings.

Recipient countries of foreign resources differ inevitably in the circumstances in which they seek and use them. These heterogeneous situations among developing countries dictate the equally heterogeneous differences in the role played by foreign resources in practice.

4-4. FOREIGN CAPITAL AND DEVELOPING-COUNTRY POLICY

In returning to the policy issues raised by Bruton (1969) and Joshi (1970) in their notes of policy implications of the two-gap theory, it is noted that the 1985 edition of the World Bank's *World Development Report* (hereafter, *WDR*) also highlights the importance of individual developing countries' economic policy. As pointed out in the *WDR* (1985), foreign capital inflows have two potential benefits for a developing country. It can not only promote economic growth but also help an economy to adjust to internal and external shocks. However, they also have

potential disadvantages. It can either be wasted on inefficient investment or allow a government to delay essential economic reforms. And the accumulation of debt can make an economy more vulnerable to financial pressures from the world economy. And the report acknowledges the reality of inconsistencies in the relationship between foreign resources and investment or growth. As an illustration of the importance of efficient resource use, it reports (pp. 46-48) that

> The positive relationship between borrowing and investment is statistically significant in the 1965-72 and 1973-78 periods, but not in 1979-83. The link between borrowing and growth is more complex. ... [And] the relationship between changes in the debt to GDP ratio and economic growth was positive but not significant in the 1965-72 and 1973-78 periods. ... Finally, in 1979-83, the relationship between changes in debt to GDP and growth of GDP was negative. In an environment of rising real interest rates and contracting world economic output, increased borrowing no longer translated into higher growth. ... [The] experience is not uniform for all countries.

Given these results it is suggested (p. 48) that "The range of country experiences with borrowing, investment, and growth highlights the imperative of using all capital efficiently." And so far as foreign resources are concerned, it is also argued (p. 43) that "... the economic policies of developing countries are the fundamental determinant of the level of capital inflows, the efficiency with which they are used, and a country's capacity to service its debts." This has to take precedence over any arguments about two-gap constraints on the development process and over the relationship between foreign capital inflows and domestic savings.

However, this is not to suggest that domestic economic policy inappropriateness and failures have been the only cause of ineffective use of foreign resources and debt problems. As in the early 1980s, external shocks such as world recession and rising real interest rates became so severe that only the most prudent of developing countries managed to protect themselves only with further economic policy adjustment. Furthermore, no single set of policies can be considered applicable to every developing country since the situation which each country faces in world trade and capital markets, its natural and human resources, and its economic and political structures vary considerably.

However, as the *WDR* (1985) states, it might be clear that "flexibility in policy making and economic structures" can be generally recognised as having a vital role in cushioning the impact of internal and external shocks in any country over time. Chenery and Strout (1966) also earlier attempt a formalisation of the importance of flexibility in developing-country policies by saying (p. 725) that

> While the receipt of external assistance may greatly reduce the time required for a country to achieve a satisfactory rate of growth, dependence on substantial amounts of external resources creates some special policy problems. One lesson from the preceding analysis is that the focus of policy should vary according to the principal limitations to growth. Just as optimal countercyclical policy implies different responses in different phases of the business cycle, optimal growth policy requires different "self-help" measures in different phases of the transition.

In this sense, it appears that the special place of foreign capital inflows should be in helping an economy to have an efficient and flexible structure in general and to adjust to internal and external shocks effectively, in particular.

When a developing country faces a deteriorating balance-of-payments situation, there are broadly three possible ways for it to react. First, it can slow down the rate of economic growth, and in turn the demand for imports. This is often essential for countries with low foreign exchange reserves and poor prospects for further foreign borrowing. Second, it can keep up its growth rate, simply paying for its imports by borrowing abroad or running down its reserves. Or third, it can adopt policies that restructure the economy toward greater production of exports and import substitutes. This last alternative takes time. Its ultimate purpose is to restore the country's productive potential and allow it to improve the current account through higher output and increased exports. Concerning the difference between the second and the third option, the *WDR* (1985) explains as follows (pp. 57-58):

> A country that faces a shock (be it internal or external) that is considered to be temporary and reversible is justified in borrowing abroad for balance of payments purposes. In these circumstances, it does not need to implement policies to restructure its economy. In practice, however, it is often difficult to distinguish beforehand between temporary and permanent shocks. Because of the obvious

> political and social costs of adjustment, policymakers may be inclined to err on the side of optimism. If they do, the price is a more painful adjustment later. ... The nature of the eventual adjustment will depend on the uses to which borrowed money is put. If it is used to raise investment, it provides the potential for extra output with which to meet future debt service. If borrowing is used to maintain or increase consumption, however, the economy's productive potential has not increased while debt service obligations have.

The reverse is intended where foreign resource inflows are used to help to implement policy reforms and to buy particular imports to restructure the economy, not to postpone adjustment. In the process of such a structural adjustment, foreign inflows can, in effect, be used to soften the effects of change and therefore buy time for reforms to take effect. In particular, some of the adjustment programmes needed to produce sustainable long-run growth could initially cause a country difficulties such as a deterioration in its current account balance. In this respect, the *WDR* (1985) goes into further detail in noting (p. 65) that

> For example, trade liberalization is essential to encourage efficiency, increase supplies of spare parts, and improve the competitiveness of exports, but imports will usually rise before exports do. Through borrowing, a government can avoid having to deflate the economy to offset these effects. It can therefore hope to secure broad support for its reforms, which might otherwise be lost if the whole economy had to go through a recession.

4-5. SUMMARY

On-going situations, such as a given level of economic development, usually imply that there are constraints on change. And so far as economies interrelated with the world economy are concerned, the two-gap theory proposed by Chenery and his various collaborators argues that an investment-saving gap and an import-export gap appear as distinctive constraints on economic development. When economic growth is thus restricted by such bottlenecks, other factors are

assumed to be underutilised. In those circumstances foreign resources, it is claimed, can serve as a means of breaking the bottlenecks especially with supplementing particular domestic resources in such a way as to allow the fuller utilisation of all resources.

The general point of two-gap theory, however, has been challenged especially regarding to its rigid assumptions and too swayed focus on external constraints rather than internal economic policies. For instance, Bruton (1969) argues that more structural flexibilities in policies would eliminate any difference between the two gaps with a reduction of the need for foreign resource inflows. And Joshi (1970) goes further on by underlining that domestic macroeconomic objectives and policies have more important implications in economic development procedure rather than the distinction between saving and trade gap.

As far as the positive role of foreign capital inflows in complementing domestic savings is concerned, this has been challenged by later empirical results such as those produced by Rahman (1968), Griffin (1970), Griffin and Enos (1970), Weisskopf (1972), etc. They conclude from their empirical tests that only a fraction of foreign resource inflows has been used to augment domestic savings while a large share has been used to increase consumption and, hence, has, in some way, substituted domestic savings. Griffin and Enos go on to report that they reach almost the opposite extreme from the earlier work from Chenery and others by obtaining results showing no increase in investment and no increase in growth from foreign resource inflows. And they even argue further that a negative causality exists between foreign resources and domestic savings.

But this causality argument has itself been criticised by later studies. Based on the assumption that countries with relatively lower savings rate tend to receive more foreign resources, Papanek (1972) notes that negative correlation does not in itself establish a causality that says increased foreign resources reduce domestic savings. Specification errors in modelling the relationship between foreign resource

inflows and domestic savings are shown by Newlyn (1973) to formalise other reasons for different interpretations of negative correlations. He suggests that negative values of the coefficient of foreign capital inflows between 0 and – 1 in a regression of domestic savings on them should not be interpreted as reduction in the absolute amount of national resources being used for investment. It just reflects the proportion of foreign resources used for consumption.

As the *WDR* (1985) points out, foreign resource inflows give a benefit or a disadvantage to developing countries depending on the policy contexts in which they are set. In particular, the most important role of external resources is, first, to help to cushion shocks either from internal or external factors and, second, to provide finance to adjust economic structures and resource allocations to suit any new environment. Therefore, foreign capital inflows should be used to support policy flexibilities. This is something that it would be necessary to refer to in reviewing the implications of debtor-economy policies for the sovereign risk analysis.

NOTES

1. This term has been used in various ways depending on authors: foreign capital transfer (or inflow), capital imports, foreign assistance, aid, external resource (or finance), foreign savings, etc. Many of the studies focus on aid while the statistical basis for their articles is the deficit on current account, usually taken as measuring foreign resource inflows. The deficit is financed in a variety of ways: by public grants or concessional loans (in the pure meaning of aid), short-term commercial borrowing, private investment, changes in foreign exchange reserves, and so on. Depending on the form of finance its impact on an economy should differ. Thus, the previous studies concentrating on the relationship between aid and domestic savings while identifying the current account deficit as a measurement of the former may cause a confusion as to using this term. In this sense, this chapter uses the term of foreign resources (or capital inflows) as a broader definition which includes private investment to avoid such a confusion.

2. Chenery and Strout (1966) actually consider that three types of resources could represent separate limits to economic growth at any moment in time. They are the supply of skills and organisational ability, the supply of domestic savings, and the supply of imported commodities and services. The first two resource limits (*i.e.*, on skills and savings) are regarded as being relevant to "savings limit".

3. Chenery and Strout (1966) assume (p. 681) that " While investment can be devoted to increasing the supplies of skills or of imported commodities (through import substitution or raising exports), changing in these factor supplies can only be brought about gradually. They are also substitutes in the production process to only a limited degree in the short run."

4. A useful review and summary of those findings is given in Papanek (1972, Table 1, p.937).

5. With respect to the term of *domestic savings*, as Newlyn (1973) explains, it has been used ambiguously among studies. Some authors use it to mean the savings of the country in question as distinct from foreign savings, thus deducting foreign capital inflow from investment. Others use it to mean domestic product minus consumption. The latter corresponds to *gross domestic savings* with accordance with the U.N. Standard National Accounting System. On the other hand, the former denotes *gross national savings* adding factor income and current transfers net from abroad to *gross domestic savings.*

6. He prefers to call this variable as national savings to domestic savings with accordance to the U.N. Standard National Accounting System in order to avoid an ambiguous use.

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CHAPTER 5. DEBT MANAGEMENT

CHAPTER 5

5-1. INTRODUCTION

Foreign debt represents the accumulation of foreign loans net of repayments. The management of foreign debt refers to the technical and institutional aspects of organising the raising and repayment of foreign loans. A crucial aim of debt management is, as the 1985 edition of the World Bank's *World Development Report* (*WDR*) describes (p. 71), "to pick the best possible combination of risk and return consistent with the supply conditions."

Debt management raises two major questions in the context of sovereign risk analysis. The first concerns an extension to the broader policy considerations of the previous chapter, which discusses the successful use of foreign resources, in order to focus on how best to organise debt-creating ways of financing a current account deficit (as opposed to direct investments, portfolio investments, and aid). The debt country may, as Loser (1977) indicates (p. 169), "confront different terms for and availabilities of various types of loans and will have options concerning the composition of the loan "package" to be contracted." This point thus has to do with the decisions on, for example, the appropriate balance between debt and equity capital flows, the relative roles of official and commercial sources of funds, the proportion of debt at floating interest rates and fixed rates, the maturity structures of debt, and the appropriate currency composition of borrowings.[1]

The second issue addresses the questions of how to design and monitor foreign debt strategies. The latter particularly gives rise to 'rules of thumb' approaches to creditworthiness evaluations that are based on deciding whether a debt is sustainable (or optimal) or not. That is often referred to as an evaluation of 'debt capacity'. This aspect of debt management therefore presents another insight into a vital prospect of this study.

Largely with reference to the second of above two questions this chapter attempts to deal with some debt management issues briefly in the contexts of the

present study. First, it will discuss about general debt accumulation procedures based on the debt cycle hypothesis. Circumstances under which many developing countries have not followed what the debt cycle suggests make the discussion then move on to rather theoretical arguments on sustainability of debt management policies and optimal level of debt. This will mainly refer to McDonald's (1982) survey of 'debt capacity' literature. And finally, some 'rules of thumb' evaluations in relation to monitoring and assessing sustainable debt management are introduced.

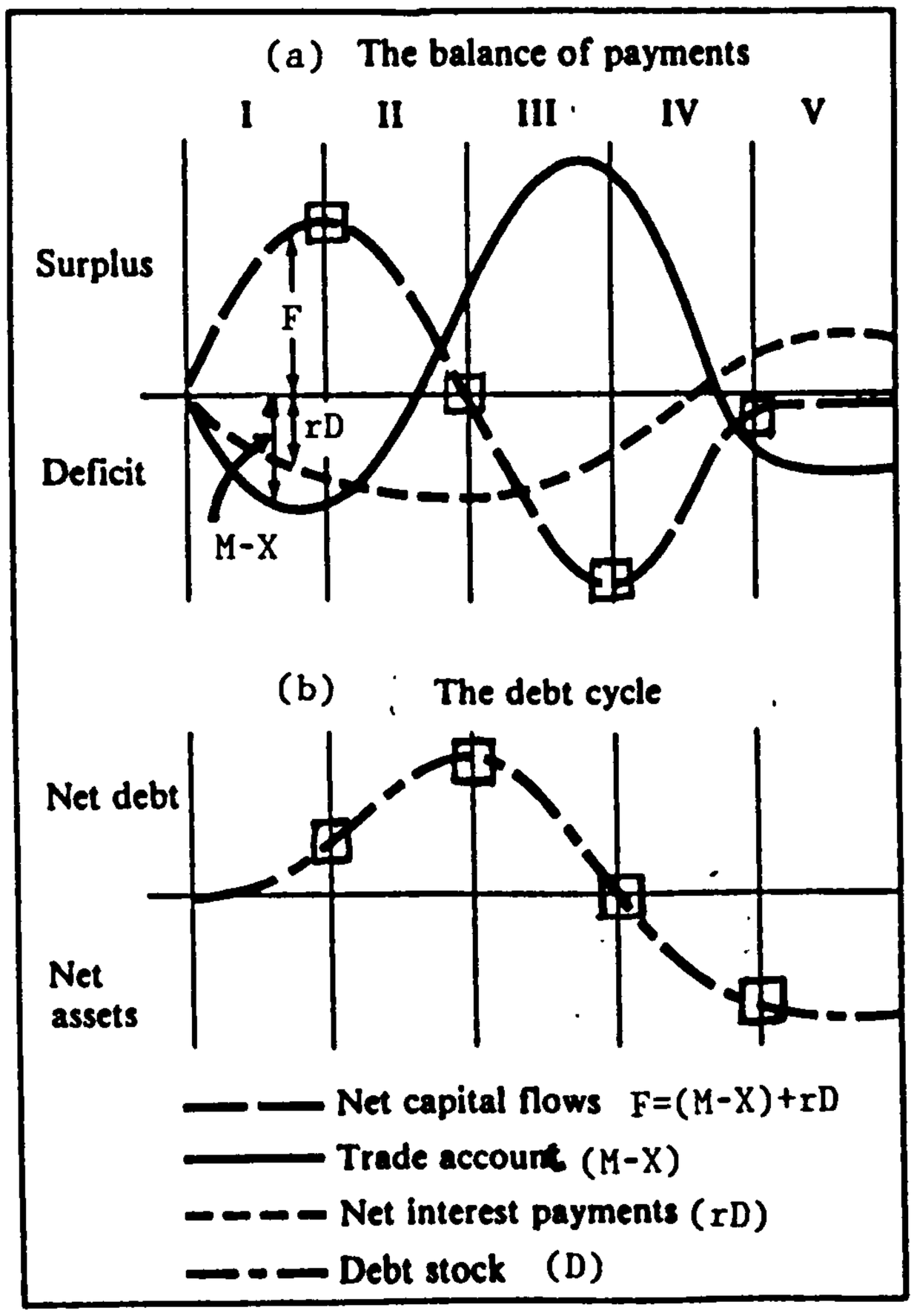
5-2. THE DEBT CYCLE HYPOTHESIS

5-2-1. BASIC CONCEPTS OF THE DEBT CYCLE

The primary question as to debt management of a borrowing country concerns whether the dynamics of its debt accumulations imply a later unsustainable debt-servicing burden. This means that debt should not be allowed to expand to an uncontrollable level, *i.e.*, it either grows to some manageable ceiling or it is eventually repaid. The conditions necessary for a debt to be repaid are essentially that an initial resource gap, in the form of an excess of imports over exports in the current account balance in the primary stage of economic development, has to be reduced and eventually closed. The stages through which this transformation is achieved constitute the debt cycle hypothesis.

The *WDR* (1985) and Meier (1989) describe the five stages of the debt cycle from a "young debtor" to a "mature creditor" in terms of four macroeconomic variables. These refer to an economy's trade account, net interest payments, net capital flows, and debt stock. The stylised balance of payments and debt stages are depicted in the two graphs shown in Figure 5-1.

Figure 5-1. BALANCE OF PAYMENTS AND DEBT STOCK DURING THE DEBT CYCLE



Source: The World Bank's *World Development Report* (1985, p. 47)

Notes : □ indicates a key turning point that apply to net capital flows (ΔD) in diagram (a) and to net debt stock (D) in diagram (b).

The circumstances describing the changes from one stage to another can be listed as follows:

Transition 1 (stage I to II): net capital flows are maximum (M-X+rD), thereafter they decline so debt rises at a slowing pace ($\Delta^2 D < 0$).

Transition 2 (stage II to III): net capital flows are zero so the level of debt reaches a peak ($\Delta D = 0$) and thereafter declines.

> Transition 3 (stage III to IV): net capital flows a.e minimum thereafter they increase and debt stock is zero (D = 0) so thereafter net asset position comes out.
> Transition 4 (stage IV to V) : net capital flows diminish to nearly zero so net foreign asset keeps a constant or slow-growing position.

And characteristics corresponding to each stage of the debt cycle are given (p. 47) as follows:

Stage I: Young debtor

- Trade deficit.
- Net outflow of interest payments.
- Net capital inflow.
- Rising debt.

Stage II: Mature debtor

- Decreasing trade deficit, beginning of a surplus.
- Net outflow of interest payments.
- Decreasing net capital inflow.
- Debt rising at diminishing rate.

Stage III: Debt reducer

- Rising trade surplus.
- Diminishing net outflow of interest payments.
- Net capital outflow.
- Falling net foreign debt.

Stage IV: Young creditor

- Decreasing trade surplus, then deficit.
- Net outflow of interest payments, then inflow.
- Outflow of capital at decreasing rate.
- Net accumulation of foreign assets.

Stage V: Mature creditor

- Trade deficit.
- Net inflow of interest payments.
- Diminishing net capital flows.
- Slow-growing or constant net foreign asset position.

The basic accounting identities and performance features underlying the debt cycle can be used to provide a description of 'debt capacity'. In this case it refers to whether a debt situation is sustainable or not in terms of either debt repayment or a manageable level of continuing debt outstanding. Such situations may then suggest rules of thumb ways of evaluating, or simply expressing, creditworthiness.

Only the first three stages of the five are actually of relevance to the present study because these refer to debtor-economy situations. When a country is in *Stage I* of the debt cycle it has a negative current account balance of payments (F) made up of a trade gap (or resource transfer from abroad because imports (M) exceed exports (X)) and interest (r) payments on any initial debt (D) if it is assumed that there are no other factor payments and no unrequited transfer payments such as aid receipts. That is

$$F = M - X + rD.$$

The financing of this has to come from loans if direct investment and changes in foreign exchange reserves are excluded so as to focus on the debt situation. The change in debt, in other words, is

$$\Delta D = F = M - X + rD.$$

The further (second order) dynamics, showing whether debt is accumulating at an increasing rate or not, are then sufficient to complete the relationships required to describe the turning points of the debt cycle.

$$\Delta(\Delta D) = \Delta^2 D = \Delta M - \Delta X + r\Delta D.$$

To begin with, in case of *Stage I*, both net capital inflows and the rate of new debt accumulation are positive, *i.e.*, $\Delta D = F > 0$ and $\Delta^2 D > 0$. This situation is eventually unsustainable because debt-servicing burdens grow unchecked. The requirement that debts eventually reach some ceiling is simply $\Delta^2 D < 0$. This requires a decreasing trade gap provided the already outstanding debt is not so large that the charges on this debt mean that the total debt has to go on growing

regardless of the resource gap, *i.e.*, the condition is $\Delta^2 D < 0$ so $\Delta X - \Delta M > r\Delta D$. *Stage I* ends when $\Delta^2 D = 0$. Apart from this caveat regarding $r\Delta D$, the critical performance requirement is that $\Delta X > \Delta M$. If this is so, then at some point in *Stage II* the trade gap will be closed ($M = X$) so that surpluses begin to appear. When the growing surplus is sufficient to pay for interest charges on the existing debt (*i.e.*, $X - M = rD$), the transition between *Stage II* and *III* will have been reached. In other words, the condition to transform from *Stage II* to *Stage III* is $\Delta D = 0$ and the level of debt reaches a ceiling. It might then be that the X, M dynamics change so that this level of debt is maintained. If, additionally, the servicing of this debt is just what the economy can afford, then the position could be said to mark the extreme position of 'debt capacity' in a just sustainable debt situation.

However, if the X, M dynamics remain unchanged, the debt will decline eventually to zero. The debtor economy will become a creditor at this start to *Stage IV*. A last *Stage V* could be added if the creditor economy is not to accumulate assets without check. This, then, requires a further shift in X, M performances to produce a constant net foreign asset position. In particular, the *WDR* (1985) appears to consider the characteristic of not ever growing foreign assets in *Stage V* as a natural procedure by saying (p. 47):

> **In the aggregate, of course, the world cannot be in either a net debt or net asset position. Therefore, as more countries move toward the mature creditor stage, the relative size of their asset position should tend to diminish.**

In this sense, it should be noted that the performance changes that bring about the transition from *Stage I* to *Stage II* will in themselves ensure that the economy rolls on through *Stage III* to *Stage IV* where it stays unless there is a further change to lead to *Stage V*. Table 5-1 summarises the conditions for each debt cycle stage in terms of the arithmetic of what is happening to debt.

Table 5-1. MATHEMATICAL CONDITIONS FOR THE EACH DEBT CYCLE STAGE

	Stage I.	Stage II.	Stage III.	Stage VI.	Stage V.
D	> 0	> 0	> 0	< 0	< 0
ΔD	> 0	> 0	< 0	< 0	$\equiv 0$
$\Delta^2 D$	> 0	< 0	< 0	> 0	$\equiv 0$

D : Debt stock.
ΔD : The first derivative of debt stock.
$\Delta^2 D$: The second derivative of debt stock.

5-2-2. FURTHER IMPLICATIONS OF THE DEBT CYCLE

Whether the debt cycle can be seen to apply in practice is another matter. Actually, many developing countries can be seen to have strayed off the paths suggested by the debt cycle hypothesis. The *WDR* (1985) provides various instances of historical evidence which are at odds with the hypothesis. It reports (p. 47):

> **For developing countries, the evidence is mixed. In the colonial period, many countries, particularly primary product exporters, ran current account surpluses, becoming, in effect, capital exporters. A small group of advanced developing countries moved from the young debtor to the mature debtor stage between 1950 and 1975, but most oil-importing countries remained in the first stage until very recently. A few, such as China, remained net creditors throughout all or most of this period.**

And another debt cycle limitation may be referred to in its predictions as to, in particular, how long a country may remain in any given stage of the debt cycle and how long it may take to clear a debt. The cycle model can only produce answers subject to given performance characteristics and initial conditions. At this point, the *WDR* (1985) presents the results of a simulation model illustrating a

hypothetical example of a country's passing from *Stage I* to *Stage II* of the debt cycle, where it remains for a prolonged period since the trade account remains in deficit throughout.[2] The key issue is the performance characteristics of the simulation. These refer to the familiar Harrod-Domar parameters (the incremental capital-output ratio and the savings ratio), augmented here by the interest rate, the growth rate of exports, import elasticity, and the rate at which foreign debts are amortised.

It is these six parameters that dictate behaviour with respect to growth, the current account deficit, debt, and debt servicing. In particular, it should be noted that it is the relative sizes of the growth rate of exports and the interest rate that dictate the switch from *Stage I* to *Stage II*. Thus, although the *WDR* ('985) does not point out as much itself, the critical feature of the simulation is a change in the growth of exports at the end of the tenth year and again at the end of the fifteenth year. Both are in excess of the real rate of interest whereas previously the reverse situation is assumed. As explained earlier, it is this performance shift that derives the succeeding stages of the cycle. Thus, given the additional conditions represented by the levels of the other (unchanging) performance characteristics, the *WDR* (1985) concludes (p. 53) that

> Countries running a resource gap need to be concerned with the behavior and relationship of a number of critical debt-related variables, including the growth rate of debt, the growth rate of exports and income, the size of the resource gap relative to income or debt, and the interest rate at which borrowing takes place. Specifically they will want to ensure that neither the interest rate nor the growth of debt persistently exceeds the growth of exports or income.

And to illustrate the conditions that prevent debt and debt ratios from growing at explosive rates, the *WDR* (1985) derives guidelines for borrowing mathematically as follows:

$$\Delta D = T + iD$$

$$t = T/D$$

$$\Delta D/D = \dot{D} = t + i$$

where D is debt outstanding, T the current account balance on goods and nonfactor services, t the resource gap as a proportion of debt, and i the interest rate on debt. Overdots indicate growth rates. Hence,

$$(\dot{D/Y}) = \dot{D} - \dot{Y} = t + (i - \dot{Y})$$

$$(\dot{D/X}) = \dot{D} - \dot{X} = t + (i - \dot{X})$$

where Y is GDP, and X denotes exports.

These references to performance characteristics demonstrate that what is more important in debt management than interest in any debt cycle is the question as to how a debtor country can manage its domestic economic policies. And beyond these simple, stylised, examples lies a need to monitor how well an economy can cope with sudden shifts in the world economic environments to maintain sufficient foreign exchange earnings and sustainable levels of debt. Thus, the debt cycle should be viewed in the relation to overall macroeconomic policies and performances.

5-3. THEORIES OF SUSTAINABLE AND OPTIMAL DEBT

A valuable survey of the literature relating to the issue of 'debt capacity' can be seen in McDonald (1982). The first part of this review deals with theoretical aspects of two broad approaches to deciding a country's debt capacity. The first relates to the question as to how much a country should borrow, *i.e.*, what is its optimal level of debt? The second approach focuses on the sustainability of debt policies. In turning first to the issue of sustainable debt situations, McDonald

begins by explaining why the Harrod-Domar formulations behind the debt cycle results do not have anything to say about the efficiency of investment in spite of its crucial role in the economic development procedures. Thus, he notes (pp. 606-7) in the case of these formulations:

> **... if the target rate of growth is less than the real interest rate, then the debt situation is not sustainable, independent of the marginal product of investment. The source of this conflict lies with the specification of consumption behavior in these models. Consumption (saving) behavior is specified as a function of output, not of income. Thus, income accruing to foreigners is treated, in effect, as if it were consumable. The higher the propensity to consume and the lower the ratio of domestic income to output, the more likely that problems will arise. If, on the other hand, consumption is specified as a function of income rather than of output, the nature of the results is quite different ... it can be shown that, provided that the marginal product of capital exceeds the marginal cost of borrowing, problems of debt sustainability do not arise**

Other investigations of the effects of relaxing Harrod-Domar rigidities and lack of institutional content are reviewed. One focus is on the situation where governments rely on foreign borrowing to assist in financing domestic expenditure plans. For a debt situation to be sustainable, it is necessary that the tax base should expand quickly enough to allow the government to service the external debt. However, there are some constraints on the government's taxing powers due to institutional and technical factors although all benefits of investment projects accrue to the private sector, since it is assumed that any government investment is infrastructural in nature. The government's taxing powers are closely associated with private savings and investment behaviour. At this point, McDonald indicates (p. 607) that

> **... low private savings behavior can be a source of debt problems in situations in which governments face such fiscal constraints. Furthermore, such debt problems can arise even if all the net inflow of external finance is used for investment and the marginal product of the capital stock is greater than the real interest rate.**

However, it should be noted that, in the even broader contexts of economic management and the means by which management inputs can be monitored, the fundamental origin of debt problem associates not solely with such an institutional

content but rather with economic policies for utilising external finance in general. In this respect, McDonald is led to argue (p. 608) that

> **It is evident that debt problems frequently have their source in overambitious government expenditure plans. However, these models are based on some rather rigid behavioral and institutional assumptions. It is important, therefore, to be careful in interpreting the models. Specifically, policymakers have more influence on fiscal parameters than these models would allow, and in general it is the policymakers—not the exogenously imposed institutional constraints—that must bear responsibility for debt problems.**

So far as debt optimising frameworks are concerned, McDonald centres his attention on papers aimed at deriving "optimality criteria in the context of intertemporal optimising models." The basic framework of the analysis is to maximise an "intertemporal utility function" given a specified supply function of foreign capital. He notes (p. 609) that

> **In the steady state, as along the optimal path, the marginal cost of foreign borrowing will be equated to the marginal product of capital. This condition, given the supply function of external finance, fixes the optimal quantity of debt at each point in time.**

Some studies have moved on from focusing on economic growth driven by investment to examine the role of foreign resources in achieving a more efficient intertemporal allocation of consumption. In particular, if a country is principally subject to variable export earnings and can engage in external financial transactions, foreign capital can be used to transfer consumption from years in which export performance is above trend to years when it is below trend. Additionally, the availability of external finance may allow a debtor economy facing internal and external shocks to lengthen the adjustment period and thereby to reduce the costs of adjustment. These concessions to broader practicalities bring McDonald to the conclusion (pp. 613-14) that

> **... once the role of external finance is expanded outside the investment role, the analysis becomes quite complex. While the additional considerations can be dealt with at a theoretical level, it is clearly very difficult, at a practical level, to judge the optimality of borrowing policies. It would involve detailed knowledge of both the parameters of the intertemporal utility function and the production technology**

> of the economy, and information as to whether shocks are permanent or temporary and, if temporary, how long they will last. Indeed, the picture is even more complex in that the models that have been discussed present simplistic representations of the supply side of the international financial markets. Thus, it is not sufficient that the borrower views the policies as sustainable. As in any financial market situation, be it domestic or international, the lender must also view the policies to be sustainable ... Given all these considerations, there are, obviously, great difficulties in applying the theoretical principles ... to practical judgements of debt capacity.

These difficulties in applying "growth-cum-debt approaches" to debt capacity lead McDonald logically to the second part of his survey where he considers the subject that is central to much of this present study, *i.e.*, "indicator approaches" to identifying the circumstances in which countries have encountered debt problems in practice. It will be later argued that it is especially useful even in this 'indicator' context to return to the broader implications of the role of foreign resources.

5-4. RULES OF THUMB EVALUATIONS OF SUSTAINABLE DEBT

Eaton and Taylor (1986) also discuss, amongst other topics, the unbounded debt/GDP form of insolvency found in a growth model with fixed savings and import ratios if the real interest rate exceeds the growth of output. They refer to aspects of the timing of the switch between *Stage I* and *II* of the debt cycle so as to produce a constant debt to export ratio. They note (p. 218) that in adapting the Harrod-Domar model to handle foreign borrowing opportunities

> ... recent authors have focused on export growth as the determinant of output growth by limiting capital goods imports through the trade gap. The simple condition for solvency now can be taken as export growth rate > interest rate. In fact, if creditors are willing to let debt grow faster than exports when the debt/export ratio is low (which seems to be a common rule of thumb) then at steady state the critical rate of interest will exceed export growth, by an amount depending on the lenders' desired debt/export ratio for the borrower.

Johnson (1985) illustrates ways in which "key ratios" are used in practice by a bank to produce country "credit scores" and, in particular, how the results produced can be utilised to devise (p. 9) a " ... kind of rule of thumb which [he considers] a lot of practising bankers would apply" to judge a country's solvency. It is worthwhile noting in the sovereign risk analysis contexts of this study, that he attempts to produce a more general framework for monitoring and assessing debtor countries' debt capacity. Thus, his "country credit scores" system aims at checking every aspect of a debtor's macroeconomic situation and its debt management policy.

The system includes a "combination of judgmental and statistical indicators". The former is designed to assess qualitative aspects of a country's performance, including its political situation, in a quantitative way by assigning numerical scores to them. The judgmental indicators are grouped into four categories. They are domestic economic policy, external economic policy, political characteristics, and political stability. In contrast, the "statistical" (*i.e.*, economic) indicators focus on ten macroeconomic variables such as GNP per capita and the debt to GNP ratio, which can be found in many other creditworthiness evaluation systems. Each of these two sets of indicators are designed to have 100 points as maximum total scores. However, no attempt is made to explain where the scores come from. He only reports (p. 5) that "We distribute the weighting rather arbitrarily." Where the empirical validities of these scorings come from is another matter. However, later on Johnson turns with some enthusiasm to his closing thoughts (p. 9) that there is an

> ... enormous range of different debt: export ratios which countries have. Ultimately you are talking about countries individually and not about all developing countries. Therefore, you have to have a fairly detailed sophisticated model for each country, building in its own statistical peculiarities, but within a general framework which enables you to compare one country with another ...

Another example of the application of rules of thumb to judge creditworthiness in terms of what is a "sustainable situation" can be seen in Congdon (1988). He

also focuses on the debt to export ratio in evaluating a borrowing country's sustainable debt situation. Thus, it is argued (p. 108):

> **Because of exchange controls, the currencies of developing countries are not fully convertible and, because of the past record of inflation and depreciation, they are not widely respected. Developing countries must therefore honour their external debts in terms of other nation's currencies. In practice, by far the most common currency is the dollar ... An implication would seem to be that [debtors'] ability to repay depends on their receipts of dollars and other hard currencies, which in turn depend on exports. A favourite yardstick of developing country creditworthiness is therefore the ratio of debt to exports. If the debt/export ratio is stable over time, the country concerned is deemed to be in a sustainable situation and its creditors can feel relaxed.**

And he continually points out a practical merit of using this ratio by saying that it " ... has the virtue of being easy to relate to general economic trends ... [and is] standard and easy to estimate."

However, it should also be noted that Congdon acknowledges the change in the U.S. monetary control procedures and the associated increase in real interest rates, the oil price hikes, and falling primary commodity price in the late 1970s as the principal reasons for the mounting debt problems that finally became unmanageable in 1982. They are not directly linked to the ratio of debt to exports, which is suggested as a rules of thumb criterion by him. These factors can be generally regarded as external shock variables. Moreover, as he also admits (p. 117), the "debt/export ratios for most developing nations were no worse in 1980 than a decade earlier." In this respect, it seems therefore that too much trust in debt to export ratios may lead to the serious oversights on the parts of both creditors and debtors in monitoring and assessing the challenges coming from external and internal shocks, which has more important implications in debt management. Such a point can be also found in a Congdon's similar view (p. 130) that "The mistake ... is to overlook the domestic consequences within the developing countries of their impressive record on the external front."

5-5. SUMMARY

This chapter switches the focus from the various and effective roles of foreign savings to the management of capital inflows in the form of loans in particular. The contractual obligations of debt servicing mean that the foreign exchange demands of cross-border service payments on foreign loans create balance-of-payments obligations. This implies that debt management policies have to be considered part of a country's macroeconomic framework.

Debt accumulation procedures are examined by way of the debt cycle based on foreign borrowing adaptations of the Harrod-Domar growth model. The focus is on explaining five hypothetical stages marking processes from a young debtor to a mature creditor. But it is also noted that there are limitations in the debt cycle hypothesis in practice. It neglects to emphasise conditions governing transformations between stages as well as the influence of much broader macroeconomic considerations beyond the simple relationship between exports and debt.

In order to discuss sustainable debt situations and optimal further, relaxations of some of the rigid behavioural and institutional assumptions of the Harrod-Domar model are necessary. A convenient summary can be found in McDonald's (1982) survey of 'debt capacity' literature. Various studies underline other possible sources of debt problems. And, in particular, various noninvestment motives for foreign loans such as smoothing consumption paths and slowing the pace of economic adjustments cause difficulties in judging borrowing policies at a practical level. This makes it clear that any easily applied rule for assessing debt capacity can be unrealistic in practice.

Then, some rules of thumb ways to monitor and assess debt sustainability and thereby creditworthiness are illustrated. For managing the overall level of foreign borrowings and debt, many rules of thumb criteria—for instance, the control to

limit the total debt service ratio to some level—have been suggested. However, such rules must be treated with caution. No simple rule is appropriate in all circumstances across countries and over time.[3] Although some countries show the same debt service ratio, their debt sustainabilities when difficulties arise are often markedly different. These differences depend upon a number of factors including, as Wynn (1989) illustrates (p. 198), "adequacy of foreign earnings, the size of foreign debt commitments, the amount of foreign exchange and gold reserves, and the further flexibilities available via reduced consumption and imports and more foreign borrowing."

NOTES

1. Mehran (1985) discusses this point extensively.

2. See the *WDR*(1985, p. 48) for details.

3. Facing such difficulties in finding some rules of thumb ways in debt management, what remains to be important then would concern the issues regarding how best to evaluate debtor economies' debt-servicing capacity. Sharma (1989) also indicate this point by saying (p. 3) that " ... one must not forget that although there can be no hard-and-fast rule for 'optimal' indebtness, economist do love to make assessments."

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CHAPTER 6. SOVEREIGN RISK ANALYSIS PROCEDURES IN PRACTICE

CHAPTER 6

6-1. INTRODUCTION

Sovereign risk analysts aim at monitoring the economic and political environment of borrowing countries so as to produce their sovereign credit ratings which will help to decide the terms and allocations of sovereign loans. They have three broad analytical alternatives open to them in the first stage of this task. Two of these are the subject of the analytical methods reviewed in this chapter, namely, country reports and checklist procedures.

The systems used for assessing sovereign risk in practice vary in approach and complexity from bank to bank. One aspect of this is that different techniques are used often in combination. These points are reviewed first with reference to the results of four major surveys of the risk assessment procedures used in practice. The surveys suggest that the various risk appraisal methods can be categorised largely into one of three types, *i.e.*, country reports (or case studies), checklists, and statistical models.

The last is the most quantitative and systematic of the three. On this account, it has attracted the most attention in the academic literature on the subject. However, according to the survey results it seems evident that banks have been reluctant to adopt statistical methods of analysis. This could imply that, on the one hand, the insights gained from statistical models may be less than impressive to practising assessors despite the theoretical attractions of these models and, on the other hand, the two other assessment methods may offer some useful advantages not found in statistical models. It is therefore necessary to inquire if there are some lessons for statistical models in this.

6-2. SURVEYS OF PREFERRED PRACTICES

6-2-1. MAJOR SURVEYS

A useful initial reference point to discussions of alternative methods of sovereign risk analysis (SRA) can be found in four surveys of SRA procedures preferred in practice. These include the surveys published by Goodman (1977), Mathis and Maslin (1981), Burton and Inoue (1983), and Heffernan (1986). They differ variously with regard to coverages and objectives of their inquires.

On the first count, Goodman reports on a survey of country risk appraisal methods conducted by the Export-Import Bank (Exim-bank) of the United States. The survey covers 37 U.S. banks, including the twelve largest, and seventeen other banks selected to give the sample greater geographic diversity. It is reported that these banks account for almost 30 percent of the banking system's total assets and well over half of its international loans. Mathis and Maslin provide the results of a Robert Morris Associates' (RMA) survey aimed at investigating (p. 39) " ... the link between the concept of exposure to country risk and bank management systems for controlling that exposure." The coverage of the survey is the hundred largest U.S. banks. Of those banks, 70 return questionnaires. In view of the exclusively U.S. contexts of these earlier investigations a major innovation of the Burton and Inoue inquiry is that it aims to clarify the similarities and dissimilarities in country risk evaluation systems employed by U.S. and non-U.S. banks. Their findings are (p. 41-42) " ... deduced from correspondence and interviews with economists and loan officers of 25 international private sector banks supplemented by published accounts of North American methods." Their sample covers banks variously based in the U.S. (11 banks), the United Kingdom (3), France (3), Switzerland (3), Canada (2), Japan (2), and Germany (1). Heffernan's (1986) survey also relates to the international banks of different countries, in this case, 122 institutions operating in London in August 1984. It

includes North American, European, Middle Eastern, Asian, and Australian banking institutions. She reports (p. 66) that "Of this group, 60 per cent ranked among the world's top hundred by size of deposits and/or capital base in the June 1984 edition of *The Banker*."

In general terms these inquiries refer to three broad headings: (1) organisational arrangements (such as who actually prepares SRA in each bank and how frequently the analysis is updated); (2) the structure and techniques of the SRA system used; and (3) the way in which SRA results are used to determine loan policies, such as country exposure limits. Attention here is focused on the second of these headings but it would be instructive to note also findings as to the procedures used to evaluate the results of predictions from SRA. It is no doubt surprising given the expense and the importance attached to SRA that only one bank in the Exim-bank survey acknowledged testing the results from its country evaluation system against past experience. In this respect, the Exim-bank survey (1976) notes (p. 17) that

> Testing of this sort is relatively simple; prior conclusions concerning specific countries reached using the evaluation system are compared to the country's subsequent record in paying its debts. Despite the insight that this exercise could provide, most banks surveyed either explicitly or more implicitly decided not to do it. This pervasive reluctance to test the accuracy of past country evaluations is one of the survey's important findings.

In contrast, Heffernan reports (p. 72) that " ... 11 per cent of the respondents admitted that they did not compare their country risk evaluation system in its *ex post* performance."

The evidence of increasing sophistication in SRA procedures is also regarded as one of the few patterns common to the results from these surveys. Although none of the studies comes up with any clear indications of the relationships between size and type of bank and various practices reviewed under the three headings listed above, it does seem that there has been a more to develop more systematic procedures. As Burton and Inoue note, the trend, generally, has been

towards greater elaboration by a progression from non-systematic to systematic, subjective to objective, and qualitative to quantitative methods. At this point, Heffernan reports (p. 72) that

> **Compared to earlier surveys, it appears that the international banks have become more systematic in their approach to country risk assessment, with 93 per cent of the sample reporting the use of in-house economists for this purpose and just under one-quarter of the participants relying on sophisticated quantitative techniques to evaluate risk.**

6-2-2. PRACTICAL USE OF RISK ASSESSMENT PROCEDURES

The Exim-bank survey identifies five types of country evaluation in use in practice. They are labelled as being fully qualitative (11 per cent[1]), structured qualitative (62 per cent), checklist (11 per cent), quantitative (2 per cent), and finally no system at all (14 per cent). These may be described briefly in the following terms. First, the "no system" banks have no systematic procedures for evaluating country creditworthiness. Country risk evaluation is performed only on an *ad hoc* basis when reviewing individual credit applications. Thus, compilation and evaluation of data is done on an irregular basis so that there appears no standard format for conducting and presenting the findings of country surveys. Second, the "fully qualitative system" is based on a qualitative report evaluating a country's economic, political, and social conditions and prospects. These reports, however, follow no standardised format and, as a result, vary in depth and scope from country to country. Third, the "structured qualitative system" is based on a standardised country evaluation report together with economic statistics that may vary somewhat among countries and over time. It is different from the "fully qualitative system" in facilitating cross-country comparisons by providing a summarised country evaluation in the form of a single rating. Fourth, the "checklist system" aims at scoring each country's performance with respect to various indicators or variables. The individual score on each indicator is aggregated into a summary score for a country's overall evaluation. Fifth, the

"quantitative system" adopts standard econometric and statistical tests in choosing variables and selecting the weights applied to these variables. The following surveys essentially followed this categorisation in referring to much the same types of risk evaluation systems as in the Exim-bank survey.

Many banks are reported to use the fully qualitative methods in the RMA survey. It actually reveals that at least a third of the banks rely only on fully qualitative results or on the subjective judgements of the loan officer. However, most respondents from the larger, more internationally orientated banks are found to employ a structural qualitative approach, consisting of a standardised format of analysis covering both domestic and external factors as well as political analysis. And about ten per cent of the respondents use the checklists. Many banks indicate, however, that they use a combination of procedures.

In reporting the findings of their survey of SRA methods, Burton and Inoue (1983) note that most banks investigate country risk systematically by combinations of qualitative and quantitative methods, but some non-U.S. banks do not have a formal evaluation system, relying instead on "hunch, guesswork and rule of thumb". Furthermore, even banks which have somewhat sophisticated econometric models compensate for their inherent defects (*e.g.*, a disregard for political instability variables which are difficult to quantify) by a qualitative modification to empirical results. The relatively more recent surveys show, however, that banks have adopted more sophisticated methods as time has gone by. Thus, Heffernan (1986) reports (pp. 67-68) that

> **... all of the respondent banks indicated that they use one or more of the 'systematic' approaches to country risk, that is, they use something other than an *ad hoc* method in assessing the creditworthiness of a country. This suggests a greater degree of sophistication than that found in ... earlier surveys.**

Especially, it is found that 22 per cent of the respondent banks make some use of statistical models.[2]

Both the Burton and Inoue (1983) and Heffernan (1986) surveys consider at some length the variables consulted in risk analysis. There is some doubt as to the analytical contexts involved, but presumably their discussions are not confined to checklists even if nothing is said to this effect. Thus, while it may be surprising that any and all relevant variables should not be consulted in preparing country reports in general, there might be some point perhaps in seeing if the selection of variables considered to be relevant is similar among the banks.

Heffernan is somewhat more explicit about the context of her assessment of the importance of economic indicators. In her survey, she asks the banks to list the five economic indicators perceived by them to be the most important in an assessment of country risk and to rank these indicators. According to characteristics of the variables identified by the respondents, the author categorises all of the variables into four groups. These groups are (1) foreign trade indicators, (2) variables related to the external debt position, (3) domestic economy indicators, and (4) others. The results are reported (p. 69) as showing that "The highest concentration of variables (38 per cent) could be classified in the foreign trade category, followed by the external debt category (29 per cent) and domestic economy indicators (25 per cent)." So far as individual variables are concerned, some measure of a "current account and balance of payments" is listed as the most commonly cited: by 87 per cent of the survey banks. The next is the debt-service ratio with a 52 per cent citation rate. However, Heffernan admits (p. 69) that " ... there was a considerable variety among the specific variables mentioned, which suggest that there may be a highly subjective component in country risk assessment."

The earlier Burton and Inoue report notes that indicators such as GDP or GNP per capita (or their growth rates), the inflation rate, the domestic savings ratio, and foreign exchange related variables are relied on most frequently. Particularly, regarding the debt-related variables, the authors seems to be surprised to find that they are cited frequently despite some problems with these variables with respect to a publication delays and measurement difficulties. They observe (p. 43) that

The majority of banks take a country's external debt situation into account, but the variables they consider to be important range from debt outstanding/exports, debt outstanding/GNP and debt outstanding/foreign exchange reserves. The absence of a clear-cut measure is a consequence of the ambiguous foundation of debt-related indicators, a practical handicap arising from a two to three-year time-lag before external debt statistics are made available, and the narrow statistical base which usually excludes non-guaranteed private borrowings and short-term debt. Although many banks are critical of the usefulness of the debt-service ratio, ironically, this is one of the commonest variables in use.

And as far as socio-political variables are concerned, while it is substantially difficult to quantify them, Burton and Inoue are of the opinion that their importance to sovereign risk assessment can not be overlooked. Thus, they say (p. 43):

> Political risk analysis is, perhaps, one of the least satisfactory and under-developed aspects of country risk evaluation. All banks, more or less, consider the socio-political circumstances facing countries with the main emphasis placed on the quality of the policy makers, evidence of internal stability, relationships with neighbouring countries and, in some cases, the diplomatic relationship of the debtor country with the lending bank's government.

Similarly Heffernan further finds (p. 72) that

> The banks were in greater agreement when it came to the identification of the socio-political indicators important in country risk analysis ... [and the] weight the banks attach to these factors is surprising given the predominance of economic factors when one attempts to explain current sovereign loan difficulties.

Heffernan also relates evidence of an increasing tendency to increase the relative importance of socio-political factors in country risk evaluation compared with that of economic factors by saying (p. 71) that " ... it appears that, since the Burton and Inoue survey, the banks have shifted to a more equal weighting of the two factors."

6-3. COUNTRY REPORTS

6-3-1. FULLY AND STRUCTURED QUALITATIVE SYSTEMS

As noted already, the Exim-bank survey (1976) divides systems of country risk appraisal in use into five types. Among them the "fully qualitative" and "structured qualitative" systems can be considered to be within the category of country reports. First, in the case of the fully qualitative system, emphasis is placed on a qualitative report evaluating a country's economic, political, and social situations and prospects. Thus, it has no standardised structure and format, rather varying among countries over time while its evaluation procedure is subjective. The rationale for the fully qualitative approach is that it has the flexibility to be able to focus on a country's unique aspects and its most pressing current problems. And this system might be justified by the view that every country's economic, political, social, and cultural conditions and prospects are different from each other so that it is nearly impossible to make comparisons across countries uniformly. At the same time, however, such an abandoning of any attempt at cross-country comparisons is regarded as its most serious disadvantage. As a result cross-country comparisons become difficult. Moreover, the evaluations tend to be retrospective rather than prospective on the grounds that they focus on describing past and current situations and they suggest hardly any structural mechanism to foresee the further situation. Thus, few banks rely exclusively on this system according to the results of major surveys. In this respect, the Exim-bank survey points out that it could be an intermediate stage in changing analytical evaluation procedures by stating as follows (p. 10):

> Whether or not a bank uses a fully qualitative system does not appear to be related to the institution's overall size and foreign lending, the breadth of its international communications network, or the procedural format used in country evaluation. It does appear, however, that the four banks that use a fully qualitative system are just beginning to use country evaluation systems even though three of these banks have considerable experience in foreign lending. The fully qualitative system may simply be an intermediate stage as the bank seeks to develop a more structured system suitable to its needs.

Goodman (1977) reports that eleven per cent of the Exim-bank survey's respondent banks use the fully qualitative approach in preparing country reports based on largely subjective evaluations. In the case of the RMA survey, Mathis and Maslin (1981) find that at least a third of the banks rely on fully qualitative systems. But Heffernan (1986) does not show clear percentage of those banks that use a fully qualitative system for country risk evaluation.

Second, while a qualitative system has no structure and format in principle, the structured qualitative system produces a country report that follows, more or less, a standardised format and which generally includes some economic statistics. Thus, the structured qualitative approach can better facilitate cross-country comparisons. Moreover, the inclusion of economic data helps to provide a basis for deriving a single summary statistic and allows future trends to be projected, thereby reducing the retrospective inclinations of these kinds of report. Although the structured qualitative approach often summarises the country evaluation in a single rating, it can be differentiated from checklist systems principally in that the presentation of qualitative information does not extend to a selection and scoring of indicators.

Of the participants in the Exim-bank survey, 62 per cent are to follow a structured qualitative system. Although Mathis and Maslin (1981) do not give a figure, they find that "most" large banks rely on a structural qualitative approach. However, there has been a tendency for the proportion of banks using the structured qualitative system to decrease as more sophisticated methods are adopted. According to Heffernan's (1986) survey, it is reported that 22 per cent of the respondent banks make use of "standardized country spread sheets", which can be inferred to be a reference to the the structured qualitative system.[3]

6-3-2. THE WIDE RANGES OF INFORMATION IN COUNTRY REPORTS

A risk assessment system is an information system, and in general terms such information system intends to deal with a relatively straightforward process. The organisation in question has a problem, or a question that it wishes to pose. An informational system is then designed so as to bring together and assess the information which answers the question or deals with the problem. This information is then disseminated within the organisation so that those faced with the problem may more efficiently find the solution.

The question which a banker wishes to address is whether the country will be able and willing to repay a debt. Country appraisal requires a report by the banks on the implications of a borrowing country's general political and economic situation for its ability and willingness to obey contractual debt obligations. Such a notion of sovereign risk may lead to a methodology that is both wide raging and complicated. A bank may have to include all potential significant risks in doing its country assessments, and not simply confine itself to those which have appeared in the past or in other countries or for other banks. In integrating all available relevant information, a country report can provide a useful frame of reference. This point is also noted by Friedman (1983). He explains (pp. 214-15) that

> **Of all country risk evaluation systems, the integrated and comprehensive approach is highly regarded as the most reliable. It aims to be comprehensive enough to cover all significant identifiable risk factors, and integrated enough to reach conclusions.[4]**

Thus, the major role of the country report may be expected to take into account as many relevant risk factors as possible so as to provide a comprehensive view of what a bank has to know about a country.

As noted earlier, evaluating a country's economic management is a crucial part of SRA. An analysis of a wide range of qualitative and quantitative indicators is required to reach valid conclusions about a country's economic management and

outlook. In particular, the need to judge economic management becomes important in trying to trace the background to an external payments crisis in terms of the effects of persistent inflation, overvalued exchange rates, inadequate reserves, and a history of unsuccessful monetary and fiscal policies. Unquantifiable political and social variables affecting economic management policies may also be relevant. In that case, qualitative country reports can be of benefit to risk assessors.[5]

Balance-of-payment management requires special investigation for the reason already reviewed. It is partly also because, as Friedman (1983) notes (P. 221), "balance of payments management is one area in which it is relatively easy to demonstrate the quality of national governments' macroeconomic management, particularly as it impinges on servicing external debt." He goes on to suggest that an "integrated and comprehensive assessment method" should have three distinct "layers" of analysis: (1) "anticipation of balance of payments difficulties"; (2) "governmental responses to such difficulties"; and (3) "the outlook for other risks" .[6] Such assessments are seen to be made up of both quantitative elements and qualitative information from relevant sources both in the field and at headquarters, the analysis of data, the application of the experience and accumulated knowledge of bank officers, and the formulation of country conclusions following integrated and comprehensive analysis (*i.e.*, in terms of a qualitative country report) which is said to produce "the most reliable" kinds of results.

With regard to practical utilisations of the country report, Heffernan (1986) presents a "typical" type of spread sheet on the basis of what is " ... currently being employed by a London-based international bank involved in sovereign lending.[7]" She divides the kind of individual components included in the typical country spread sheet into three subsections. These cover domestic policies, external conditions, and external debt. The first subsection includes six variables, *i.e.*, real GDP growth rate, GDP per capita, share of investment in national income,

consumer price index, fiscal deficit as a percentage of GNP, and unemployment rates. The second one incorporates a measure of economic openness, volume indices for exports and imports, terms of trade, current and capital account balances, and the exchange rate. The third consists of a growth rate for external public debt, percentage change in terms of trade, percentage change in LIBOR (London Interbank Offered Rate), the portion of debt subject to variable interest rates, an indicator of world liquidity, and debt-related ratios such as the debt service ratio.

Illustrations of the use made of observations on these variables include the statement (p. 141) in relation to the first subsection that "Countries with traditionally high fiscal deficits as a percentage of GNP and or unacceptably high inflation rates provide important signals to the potential lender." However, it is interesting at the same time to note that there are limitations in deciding what it is exactly that constitutes "high fiscal deficits as a percentage of GNP" and "unacceptably high inflation rates". Similarly, problems of interpretation occur in analysing the second part of spreadsheet, where we are told an analyst " ... would concentrate on the vulnerability of the economy to random shocks." Again it might be asked what is meant by 'vulnerability' and 'random shock'. These are issues which are closely linked to what was noted in the earlier definitions section concerning broader macroeconomic contexts of *sovereign* risk and the importance of *uncertain* events in understanding sovereign *risk*. In the final part of the stylised report format, Heffernan reviews long-term and short-term aspects of creditworthiness, focusing on the implications of the kind of information provided by the spread sheet. Again so far as this study is concerned, it is argued that there should be little doubt in this that what is important is an assessment of the sustainability of a borrowing country's current policies and performance.

CHAPTER 6

6-4. CHECKLIST PROCEDURES

6-4-1. FACILITATION OF CROSS-COUNTRY COMPARISONS

The checklist system is a technique that aims at summarising a country's overall performance into a single letter or number rating. Once the 'list' itself is decided, the indicators can be scored, usually simply with reference to country rankings. In the case of qualitative variables, this necessarily involves subjective judgement. The score for each indicator can then be aggregated into a summary score for each country. It is of course possible to vary the influence that each component variable has on the final score by assigning different weights to each indicator. This is described by Goodman (1977) as the weighted checklist approach. By contrast, an unweighted checklist avoids any consideration of how such refinements are to be decided in practice.

A checklist score has of course potentially a major advantage in cross-country comparisons over what can be achieved using the country reports. Additionally, Wynn (1989), argues (P. 194) that " ... checklist results represent something more than a set of abbreviated and rationalised country reports since comparatives are pivotal to the analysis itself in placing different aspects of a country's situation, policies and performance on a common footing." In particular, the resulting scores could be tested statistically against actual repayment experience. Although this would provide a means of investigating weakness in such analysis, the literature has nothing to say about any such tests being undertaken by practising country assessors.

6-4-2. PROCEDURES IN THE CHECKLIST SYSTEMS

The checklist procedure can be subdivided into four parts. They incorporate the selection of indicators to evaluate a country's situation, their quantification, the

scoring of those quantifications through inter-country comparisons, and the aggregation of scores into an overall country rating. First, with regard to the choice of indicators, the literature has nothing to say about any formal theoretical underpinnings.[8] Only some broad principles in selecting indicators have been suggested. To begin with there is the question of comparability among sample countries. Thus, identical and reliable data sources are indispensable. In this sense, Thornblade (1978) asserts (p. 74) indicators in a checklist system should be " ... derived from standard international sources ... [so that] banks who do not have a network of international offices ... must rely on a few international data sources (IMF, World Bank, OECD, and so on)." Consistent and standard measurement and definitions of variables from country to country and timeliness of data are also considered to be important criteria in determining what variables are to be included in checklists. Government deficits are a particularly notorious examples in these respects. Debt-related variables are similarly regarded as being "potentially unreliable" by Thompson (1981). He notes (p. 189) in particular that

> A word of caution about all debt figures is in order. Some countries give full data on their own external debt but debt indicators tend to be among the least easily available, the least reliable, and the most outdated of all published data ... in constructing a country evaluation system, it is preferable to use data on macro-economic performance which give a correct signal as to the health of the economy, rather than potentially unreliable data on debt.

Different assessors have different ideas on whether, and if so, how, checklist variables should be classified. One popular diversion seems to be between short-term financial conditions and rather longer-term potential economic performance. Thornblade, for instance, classifies indicators into three categories in writing (p. 75):

> The checklist indirectly measures the history of a country's productivity with the variables falling into three groups: measures of level of development, rate of development, and net international liquidity (the tendency to live below the bound of external resources). Generally, a high level of development implies past success in increasing productivity. This means that the economy is probably diversified and the management and education level fairly sophisticated. A high rate of recent economic growth suggests

> current success in allocating external borrowing for productive purposes. A relatively high level of net international liquidity indicates that the country is already competitive in the world economy; it may also suggest that loans flow into the country in such volume and on such terms (longer maturity, lower interest rates that the country readily meets its import needs.

In the case of Thompson, he uses two categories of indicators (*i.e.*, "liquidity", and "structural" indicators) to produce two checklist scores, while he refers to as indices. The rationale for this is argued as follows (p. 185):

> The indices are designed to answer two fundamental questions. 1. Are the country's liquid assets sufficient to cover its immediate needs? and 2. Is the economy sound, well-managed, and capable of generating external revenue in the future? Accordingly, two indices are constructed for each country: A *liquidity* index which measures the adequacy of the country's international assets to meet its current international obligations, principally to pay for imports and to service international debt, and a *structural* index which tests for the underlying soundness of the economy ... The liquidity index is relatively simple to construct since it involves matching a country's current foreign exchange income or assets to its obligations ... [However,] The structural index is intended to point up more fundamental problems in the economy and the likelihood of future payments problems, and hence the conceptual underpinnings of the structural index needs elaboration.

As far as socio-political variables are concerned, Thornblade and Thompson omit them altogether in their checklists. As a reason for this, the former reports (p. 74) that " ... the checklist is intended only as a complement to the country essay, in which the area officer assesses political factors ... that could significantly alter the performance reflected in the country ranking." The latter suggests non-quantifiability as a major reason for excluding them with the statement (p. 189) that "Political or social variables are missing not because such factors are unimportant but because they are not quantifiable and can be obtained only through detailed country analysis." However, Merrill (1982) deliberately underlines the inclusion of socio-political indicators in the "questionnaire" system used by his bank in noting (p. 89) that "Quantification of social and political factors is an important part of the questionnaire, with 40 questions comprising 35 percent of the total risk score."

As far as indicators included in checklist systems are concerned, as suggested above, their number, range, grouping, definition and measurement vary depending on assessor procedures. A broader appreciation can be gained, however, from the Exim-bank survey's (1976) compilation of checklist indicators. This can be further augmented by a tabular review of quantitative indicators set out in a Group for Thirty (1982) report particularly in the emphasis given to social and political variables. A compilations is presented in Table 6-1.

Table 6-1 MAJOR INDICATORS INCLUDED IN CHECKLISTS

I. Variables Relating to the Internal Economy

a. GNP/GDP
b. GNP/GDP Per Capita
c. Real GNP Growth
d. Growth Rate of Per Capita Income
e. Inflation Rate
f. Investment to Income Ratio
g. Money Supply Growth
h. Domestic Credit Growth
i. Government's Net Budget Position
j. Income Growth to Fixed Capital Formation Ratio

II. Variables Relating to the External Economy

a. Exports and Export Growth
b. Imports and Import Growth
c. Share of Leading Non-Oil Export in Total Exports Revenues
d. Share of Trade in GDP
e. Trade and Current Account Balances
f. International Reserves and Overall Balance
g. International Reserves to Imports Ratio
h. Debt Service Ratio
i. Total External Debt
j. Principal Payment to Total External

III. Social and Political Variables

a. Political Stability
b. International Banking Division's Region Rating
c. Past Trend in Unemployment
d. Philosophy and Policies of ruling group
e. Ability of Government Officers
f. Flexibility of the Political System
g. Religious Problems
h. Opposition Groups
i. Wealth Disparity

Note: Indicators are mainly referred to Exim-bank (1976), Blask (1978), Nagy (1978, 79), and Group of Thirty (1982).

Second, a principal issue to be considered in quantifying selected indicators would be how to deal with country differences in terms of size, economic structure, level of development, and so on. This raises the subject of the scaling of variables in order to be able to compare like with like. Thornblade (1978) notes this by saying (p. 74) that

> ... the emphasis in [their] work on country ranking has been on analytical, rather than absolute, variables ... the variables that are selected are corrected for size. Thus, the checklist is composed of variables like reserves relative to imports, IMF credit usage relative to fund quota, and so on.

However, Wynn (1987) argues (p. 5) that "The results inevitably reflect compromise and ambiguity in the choice of scaling factors, the mixing of stocks and flows in various ratios and the choice of time spans in measuring relative rates of change." However, the checklist can offer rather more flexibilities to monitor a country's specific circumstances through the various quantifying ways of them. For example, Thompson (1981) introduces multiple measures of inflation and the growth of money in terms of different time spans. So it is that Wynn notes (p. 5) " ... the major advantage of checklists remains the latitude in the number of indicators that can be accommodated overall so that there is not the same obligation to load all qualifications into one or two expressions of a concept."

Last, the results for the scoring of variables need to be aggregated to produce an overall score. The alternatives can be differentiated largely according to whether a weighting system is introduced or not. As an example of an unweighted system, Thornblade (1978) writes (p. 79):

> To derive an overall ranking, a country is rated according to its rank on each variable, from 1 to n, "n" being the total number of countries. The rankings on each variable are then added together for a total score which determines the overall position for each country. Each variable in the above list is given equal weight in arriving at the total.

In contrast, Thompson (1981) adopts a weighted checklist approach. He explains (p. 185) this procedure as follows:

> In order to obtain a distribution of country scores corresponding to performance, the data on country performance for each variable are arranged in numerical order for all countries in the sample group ... Scores are assigned based upon the country's score relative to other countries. To take a simple example, it may be decided to assign a weight of 5 for the increase in consumer prices in the most recent year. Inflation rates of countries in the sample are arranged from the highest to the lowest and scores are assigned on the basis of where any inflation rate falls in comparison to the inflation rates of all countries. For instance, an inflation rate of 5 to 7 % may yield a score of 60, while a rate of 2 to 4.9%

> yield's 80 ... The score of the variable is then multiplied by the weigh assigned that variable. The final index number for a country is then the sum of all its weighted scores.

Similarly Merrill (1982) reports that his bank also follows the weighted checklist approach with reference to its country risk "questionnaire" system.[9] He notes (p. 89) that "Most questions must be answered on a scale from one to seven and have predetermined fixed weights which establish their importance to the total risk score."

However, since the scoring and aggregations of checklists involve subjective judgement, the results need to be treated with care. Thus, it may be inappropriate to rely on only this system alone. A number of authors have therefore argued that checklists should serve primarily as a screening device in staged processes of country evaluation. For example, Thornblade asserts (pp. 79-80) that

> ... a checklist is only a first step in assessing country risk. Why undertake an intercountry comparison of selected data at all? We have found that a country comparison which is relatively free of subjective input stimulates a more incisive debate about country risk and international lending priorities ... [Thus,] In order to get an increase in lending for a country which ranks low, the area officer would have to develop a special study, using the checklist variables as part of the framework for discussion.

And Thompson is also of the opinion that checklists are useful as a screening device, giving a concise picture of the current status of a country and its progress over time. Similarly, Merrill reports that his bank utilises a checklist as just one of a number of country risk evaluation techniques.

NOTES

1. The figures in parenthesis refer to the percentages of banks reporting as using each system.

2. With regard to this result, Heffernan (1986) argues that it is a relatively high percentage when compared with the Goodman (1977) paper, where only one of the 37 banks could be placed in this category. In the results presented by Mathis and Maslin (1981), no bank was reported to be following the fifth, 'other quantitative', approach listed by the Exim-bank survey.

3. Heffernan's (1986) classification of the alternative systematic methods for evaluating country risk (p. 68; Table 2.7) mixes up descriptions of what is done with who does it (*i.e.*, a bank or some outside agency). Thus it is somewhat difficult to compare the reports of Heffernan directly with those of Exim-bank survey (1976). However, there might be no great problem in equating the "standardized country spread sheets" of Heffernan to the "structured qualitative system" of Goodman.

4. Friedman (1983) categorises the country evaluation systems commonly used by commercial banks under three heads. These are the "Delphi approach", the "quantitative and econometric method", and the "integrated and comprehensive method".

5. Applications of a wide-ranging and structured assessment format in the style of country reports can be seen in Hodd (1991).

6. Friedman (1983) goes even further by saying (p. 216) that "It cannot be overemphasized that many country risks exist in addition to the transfer problem and that country risk analysis must go far beyond balance-of-payments analysis."

7. See Heffernan (1986) Figure 4.1 (A typical country spread sheet), pp. 128-29.

8. Wynn (1987) points out similarities and differences between checklists and statistical models with reference to indicator selections by saying (pp. 3-4) that " ... neither relies on formal theoretical underpinnings, of the kind found, for example, in what growth theory has to say about sustainable or optimal accumulations of foreign debt ... The effects are much the same too in terms of a limited consensus between studies as to what should not be included ... There are differences, however, in both style and scope. Each has its facilities and drawbacks. Statistical models are restricted by the available degrees of freedom and other data related problems and yet have the benefit of formal tests of data consistencies; checklists are without the latter but, subject to this qualification, clearly offer more freedom in the number of indicators that can contribute to an evaluation."

9. In practice, his bank is reported as using all kinds of country risk assessment methods, ranging from "country studies or reports" to "checklists" to "questionnaires or scoring systems" to "econometrics". ("Questionnaires" are said to consist of 74 questions for every country, covering domestic and international economics as well as political and social factors.)

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CHAPTER 7. PRINCIPAL ISSUES AND LIMITATIONS OF EXISTING STATISTICAL MODELS

CHAPTER 7

7-1. INTRODUCTION

Statistical methods of analysis potentially represent the most objective and sophisticated means of quantifying sovereign credit ratings. In particular, they offer the best response to most of the drawbacks encountered in country reports and checklists. These include, notably, inadequacies in weighing the relative credit ratings of different countries in the case of country reports and the need for personal judgement in designing and operating checklist systems.

There are three aspects to the application of statistical methods. These concern the ways in which variables thought to be worth looking at are related by an equation to observed debt problems, the evidence and the procedures which are used to estimate the parameters of any such model, and the criteria used to judge how well the resulting credit ratings are a guide to what happens in the future.

Answers are required to four questions so far as the first (specification) issue is concerned. These variously relate to the mathematical form of the model, the quantification of the dependent variable, the rationalisations of explanatory variable selections, and the lags used to relate these to observed debt problems. Next, there are two major issues in estimating parameters: how to select an appropriate sample, and how to deal with problems such as muticollinearity and serial correlation. Last, there is the question in judging forecast performance of how best to weigh credit ratings against observed debt problem realisations.

This chapter reviews these features with reference to ten major studies published between 1971 and 1985. They include work reported by: Frank and Cline (1971), Feder and Just (1977), Mayo and Barrett (1978), Sargen (1977), Saini and Bates (1978), Feder, Just and Ross (1981), Cline (1984), Kharas (1984), Taffler and Abassi (1984), and McFadden *et.al* (1985). A table summarising the essential features of the models and results found in these studies is presented in the last section.

CHAPTER 7

7-2. DEPENDENT VARIABLE QUANTIFICATIONS

7-2-1. INTRODUCTION

Statistical approaches to sovereign risk analysis focus attention on empirical means of selecting economic indicators that are considered to reflect a debtor country's potential debt-servicing difficulties. In such studies, rescheduling events have been most widely used as a principal evidence of debt problems in the past. The binary nature of this variable (*i.e.*, whether a country is involved in rescheduling or not) makes researchers depend on other less familiar techniques (*e.g.*, discriminant and logit analyses) rather than conventional regression methodology. In addition, it should be noted that use of binary-valued reschedulings as a means of quantifying dependent variable raises a number of questions, especially those associated with the representation of varying degrees of debt-servicing difficulties.

This last issue concerns first the fundamental question as to whether reschedulings alone should be relied on as the only evidence of debt-servicing difficulties. In particular, it could be argued that debt reschedulings often might be the end result of a culmination of what may be long-standing debt-servicing problems. Second, the scope of the dependent variable can be seen to be somewhat ambiguous, particularly when it comes to the treatment of 'multiple reschedulings' and 'voluntary reschedulings'. These issues are dealt with in the following sections.

7-2-2. RESCHEDULING AS AN EVIDENCE OF DEBT PROBLEM

In practice, starting with the pioneering work of Frank and Cline (1971), most statistical sovereign risk assessment models have focused on the circumstances surrounding past debt-servicing difficulties of developing countries. The quantification of such difficulties therefore assumes a crucial role in estimating a

statistical model. But complications arise in that there are no unambiguous observable economic indicators defining debt-servicing difficulties. Frank and Cline confine their interest to debt rescheduling. Since then the issue of how to quantify the dependent variable has been simply discussed with reference to binary '0' or '1' allocations.

From the point of lenders' perceptions, the main concern is the risk of a debtor's inability or unwillingness to honour future payments of interest charges and amortisation. Events such as 'default' or 'repudiation' will rarely be of concern in defining the dependent variable in contrast to other events such as rescheduling. Thus, as Eton and Gersovitz (1981) point out, a loan is not legally in default until the lender declares that the borrower has failed to honour the terms of the loan. In practice, default cases have been rare (*e.g.*, Cuba in 1961) with respect to sovereign loans in the post-World War II period. And it should be noted that the occurrence of default or rescheduling does not generally imply repudiation of the loan agreement. Repudiation usually tends to follow major political disruptions and a decision to withdraw from international capital markets and the commitments of previous regimes rather than the dictates of strictly economic motivations. One major factor discouraging direct repudiation is that debtors may well face retaliation from world financial markets. Creditors prefer rescheduling procedures in order to avoid a complete halt in the flow of debt-servicing payments. Much the same is true of those circumstances in which debtor countries experiencing debt-servicing difficulties may not actually reach the stage of a formal rescheduling. Instead, they could go into arrears for a time which is then often followed by a re-establishment of the payment terms of any previous agreement. The main aim of a rescheduling is therefore to provide a means by which creditors and debtors can reach a cooperative solution to their differences.

The convenience of the facility offered by reschedulings means that many authors proceed without further consideration of a basic framework. However, whether this is an assumption that can be accepted without reference to empirical

evidence is probably worth questioning. But it has to be admitted that such authors keep the best of company since even Kharas' (1984) theoretical framework for evaluating a debtor country's debt-servicing capacity is tested simply with reference to observed reschedulings.

There are instances in the literature where other events, notably involuntary arrears, *i.e.*, explicit balance-of-payments difficulties, are also considered to be evidence of debt-servicing problems. For example, Feder and Just (1977) use the cases of arrears in public or publicly guaranteed payments as additional information in quantifying the dependent variables. In practice, they consider that a debt-servicing problem is deemed to have occurred in any year in which significant arrears occur. The point could be extended to other alternative means to avoiding a formal rescheduling agreement, which are available both to debtor countries and creditors. These include a greater reliance on short-term borrowing. While such arrangements may be counted a 'success', they could just as much be regarded as a 'near-rescheduling' that could easily have turned into a formal rescheduling. Thus, the treatment of the dependent variable depends to some extent on the purposes to be served by the model. In this respect, one point to be worth mentioning is that the identification of the early stages of debt problems could greatly facilitate the development of the 'early warning' properties of statistical model.

Generally speaking, an exclusive reliance on rescheduling events as representing debt-servicing difficulties could be accepted if the aim is to represent extreme situations. This seems acceptable when anything beyond, in the form of a default or a repudiation, is rare in practice. The occurrence of a rescheduling could be argued therefore to signal a lender's view that the borrowing country's policy orientation is regarded as being unsustainable. Where more sensitive indications of less serious, intermediate, situations are required reference could be made to a country's balance of payments as a measure of pressures for policy adjustment. One problem that remains is that some rescheduling agreements are unrelated to

balance-of-payments issues. For instance, financial aid programme for developing countries sometimes takes the form of reschedulings (*e.g.*, India and Pakistan in 1960's). Such reschedulings are therefore simply resource transfers.

In summary, reschedulings have been frequently referred to as the principal representative of debt-servicing difficulties. This appears to originate from the fact that given outright default or repudiation cases are quite rare, reschedulings are the most plausible, striking, and conclusive events in the spectrum of debt disruptions. However, debt-servicing difficulties might be helpfully seen in a broader balance-of-payments, and thereby general macroeconomic framework. It is interesting to note the views of McFadden *et. al.* (1985, p. 187) in this context that " ... the proximate "cause" of repayment difficulties, inadequate foreign exchange inflows to finance current account deficits, is the same for everyone. It might be expected that difficulties arising from a variety of sources would all be mediated through the macroeconomic variables affecting the balance of payments account."

7-2-3. OTHER OPTIONS AS THE DEPENDENT VARIABLE

In referring to Frank and Cline's (1971) study first it is noted there seems to be no special discussion in their study concerning the properties of rescheduling as a reflection of debt-servicing difficulties nor any consideration of other options for the dependent variable. Feder and Just (1977) assume that lenders concentrate their concerns on (what they call) the "default" possibility, defined (p. 30) " ... as any case in which public or publicly guaranteed payments to lending institutions are delayed or rescheduled with or without the consent of creditors." Delayed debt payments are also considered to be included in the definition of a 'default' together with reschedulings. These arrears are further used as a means of pinpointing dates for the onset of debt problems.[1]

Sargen (1977) observes (p. 20) that "cases of expropriation or outright default on bank loans have been quite rare in the postwar period ... The more common case has been the formal restructuring or refinancing of external-debt obligations in the wake of foreign-exchange crises." The major reason for debt-servicing difficulties is considered to be associated with foreign borrowers' problems in converting domestic currency into foreign exchange, *i.e.*, what he refers to as a "transfer risk". Such problems are seen to be associated with overall balance-of-payments difficulties which in extreme situations lead on to debt reschedulings eventually.

Mayo and Barrett (1978) try to specify what they intend should be an "early warning model". This aims at extending a forward looking power for predictions by means of adopting a five-year time horizon. Thus, the dependent variable is defined (p. 85) to take '1' or '0' value " ... depending on whether: a rescheduling will occur sometime within five years, meaning either in the current year or anytime up to five years hence; or no rescheduling will occur within five years." Only formal rescheduling cases are used for dependent variable, because, they explain (p. 84), " ... the early warning model [is specified] using one measure of debt-servicing difficulty, that of formal multilateral reschedulings" in order to serve best " ... continuity of discussion and for comparison with the earlier studies."

Saini and Bates (1978) are the first authors to embark on a detailed discussion of the definition of the dependent variable. They argue that researchers should be careful in dealing with reschedulings in quantifying the dependent variable since all reschedulings are not the same but differ depending on causes and aims of debt rescheduling while, on the other hand, there can be other options besides a formal rescheduling because rescheduling is only one kind of response to what might be a wide range of debt-servicing difficulties. Thus, on the first count, they exclude "voluntary reschedulings" which do not reflect balance-of-payments problems but are rather a means of increasing resource transfers to debtors in order to aid

developing countries regardless of debt-servicing problems. Most of these voluntary rescheduling arrangements relate to official loans rather than loans from commercial banks. In contrast, balance-of-payments support loans, implying the use of foreign loans to avoid consequences where a rescheduling would have otherwise been necessary or where arrears of external payments would have been incurred, are reckoned as additional evidence of debt problems. Based on the results of empirical analysis, they report (p. 6) that "the failure of the foregoing studies to include these adjustments in their dependent variables casts doubts on the relevance of their results and limits their usefulness."

In some rescheduling cases, the full details are not publicly known. In particular, Feder, Just and Ross (1981) note that since there are instances where debts are restructured or debt payments are deferred for some length of time without publicity, an inclusion of such unpublished debt-servicing difficulty cases in the non-rescheduling sample distorts the estimates of the statistical model for sovereign risk assessment. In their own study, they include ten unpublished cases of serious debt arrears (*i.e.*, 25 per cent of their total rescheduling cases) identified by access to private World Bank files. And in line with Saini and Bates (1978), they exclude any reschedulings from the sample that are reached as a result of creditor desires to provide development aid in circumstances of no great foreign exchange stringency.

Taffler and Abassi (1984) also regard a debt rescheduling as the nearest state to default. Their "debt difficulties" sample is put together on the basis of whether a given country for a particular year was reported as having been obliged to seek a rescheduling of its debt. Thus, no attempts are made to separate out voluntary rescheduling or to use proxies for debt problems because of what they see to be the potential "bias" that could arise. Although they do not explain just what is meant this "bias", it may be perhaps more accurate to say that they mean potential error of missclassifying country-year observations. In the case of Kharas (1984), he notes that the failure of a debtor country to fulfil its obligations to service its

outstanding debt can take the form either of a legal renegotiation by both parties or of arrears incurred by a unilateral decision. However, he seems to employ only formal rescheduling cases (given in the Appendix 2, p. 438) in his empirical investigations.

Expanding the conceptualisation of debt reschedulings to include foreign capital supply-side factors of the kind that are found in a study by Eaton and Gersowitz (1981), Cline (1984) interprets a debt rescheduling as a consequence of the disequilibrium that occurs in international credit markets when the amount the countries seek to borrow exceeds the amount that foreign banks are prepared to supply at the "upper ceiling interest rate", beyond which the lender will be unwilling to lend more even in return for a higher interest rate. As such he identifies the occurrence of reschedulings as a bargaining process result in which foreign capital market can not clear. For the dependent variable, recorded debt reschedulings are utilised. Some modifications of directly observed rescheduling cases are made, however, such as the inclusion of Argentina, Brazil and Mexico's serious debt payment suspensions in 1982 in spite of the delay of formal rescheduling agreements until 1983, and the exclusion, on the other hand, of the reschedulings in Indonesia in 1970 and Ghana in 1974 on the grounds that they were primarily designed to confer development assistance rather than being the consequence of developments in private capital markets. And for the same reason, frequent reschedulings in India and Pakistan are also excluded from his analysis.[2]

As pointed out earlier, McFadden *et. al.* (1985) argue that the proximate cause of repayment difficulties is inadequate foreign exchange inflows to finance current account deficits even though the apparent origins of repayment problems may be quite heterogeneous among developing debtor countries. They consider reschedulings and restructuring of debt, IMF higher-tranche supports, and arrears on interest charges or principal repayments as all constituting evidence of debt-servicing problems in which the foreign exchange inflows required by trade conditions and domestic policy responses can not be met through ordinary

rollovers or new loans. In particular, reschedulings and IMF higher-tranche supports are seen as evidence of a repayments "crisis". With this rather broad concept of the dependent variable,[3] they attempt to expand their model's scope by examining various factors affecting debtor's repayment difficulties.

In summary, since some countries have used various options other than a formal rescheduling when they faced debt-servicing difficulties while it may be that there are such things as unpublished reschedulings, entire reliance on reported reschedulings seems to be inappropriate in capturing the real circumstances of debt-servicing problems. All of the studies surveyed above have concentrated on tests of whether their explanatory variables could successfully classify countries into rescheduling and non-rescheduling cases. And they have also adjusted the dependent variable population by adding some other debt management options[4] while omitting reschedulings that serve other purposes. Substitutes for formal reschedulings have also been reckoned as in terms of abrupt falls in foreign reserves, debt refinancing and restructuring, emergency controls on foreign exchange and imports, balance-of-payments support loans, IMF stabilisation loans, arrears, extended moratoriums and so forth. However, most of these options can be quantified only in a binary-valued form and this dichotomous classification method may have limitations in terms of the efficacy or accuracy of the statistical models.

7-2-4. EMPIRICAL EVIDENCE MANIPULATIONS

7-2-4-1. ASSIGNING A DEBT-PROBLEM YEAR

In general, most studies regard the years of rescheduling agreements as the years of experiencing debt-problems. But some authors seek to adjust a reported rescheduling year in order to capture better the timing of debt-servicing difficulties. This modification of an actual published rescheduling year may reflect the fact

that reschedulings themselves are imprecise indicators of the real circumstance of debt problems and that a (0,1) distribution over time for any one country can be arguably influenced by a researcher's view.

The explanation of debt reschedulings found in Frank and Cline (1971) does not give any explicit clue for identifying those country-year rescheduling cases. For example, there is no description as to why they drop the rescheduling country-year observations of Peru in 1968-69, Liberia in 1963, and Yugoslavia in 1965-66. In particular, eight of their thirteen reschedulings contain sequences of two or more years. However, the beginning year in such a sequence appears to be adopted alone as a rescheduling year judging from their description (pp. 338-39) of error cases.

By contrast, Feder and Just (1977) attempt to identify debt-servicing difficulty date more precisely by adjusting the reported year of rescheduling agreement. Thus, in the case where an agreement was reached ahead of time, the rescheduling date is assigned to the year in which payments were first deferred. For instance, although in 1965 Yugoslavia negotiated a rescheduling of payments due of 1966, 1966 is regarded as the year of debt-servicing difficulties. But, on the other hand, in the case where a rescheduling agreement was arranged after debt-servicing difficulties were already apparent, a rescheduling is assumed to have taken place in the year in which significant arrears occurred. The effects of their modifications are not disclosed in their paper.

There is presumably less need to be troubled in deciding real debt-problem dates in Mayo and Barrett's (1978) procedures since their dependent variable quantification has the wide aim of a five-year spread. A shortcoming of their study could be that the dependent variable may have a scheme of autocorrelation imposed on it.

In line with Feder and Just (1977), Feder, Just and Ross (1981) assign dates of reschedulings to following years irrespective of the actual reported date if a rescheduling request is viewed by them as being made in anticipation of economic circumstance in the following year. Kharas (1984) also argues that rather than simply using the published rescheduling year, a relevant date relates to when substantial debt-servicing difficulties occurred. In this respect, he states (p. 428):

> In certain instances, reschedulings for the following year could be forecast in advance and were preempted by immediate formal negotiations. Where this is known to have taken place, the date of the rescheduling is assigned to the year in which the original forecast projected difficulties.

In particular, McFadden *et. al.* (1985), instead of adjusting the nominal rescheduling dates, use other options (such as arrears on interest or principal due, and higher-tranche IMF support) as a means of supplementing the information available in reported reschedulings to pinpoint debt-problem years more precisely.

7-2-4-2. TREATMENT OF POST-RESCHEDULING OBSERVATIONS

The effects of a rescheduling on a debtor country's debt-servicing ability in the following years can be considered from two standpoints. On the one hand, a rescheduling may lead to better economic circumstances, otherwise a rescheduling would be needed in the next year or more severe debt disruption would take place. The following years' non-rescheduling observations may be thereby related to the previous rescheduling event. On the other hand, serial reschedulings (*i.e.*, rescheduling several times in a row) may imply interdependent reschedulings. In other words, the first rescheduling is related to much the same circumstances as are subsequent successive reschedulings.

Strictly speaking, in the case of the former (non-rescheduling observations following a rescheduling) it may not really matter whether such situation is due to the rescheduling or not, since successive 'trouble-free' years may be considered as an evidence of a new and independent debt status of the economy. However, some

authors exclude those observations from the non-rescheduling sample as shall be seen shortly. The latter case (successive reschedulings), on the contrary, could have significant effects on serial correlation between dependent variable observations since the problems precipitating the first rescheduling have probably persisted so the debt situation is much the same as that indicated by the first rescheduling. It is, in any case, relatively easy to forecast such successive reschedulings so the practical value of such forecasts is greatly reduced. But it would be difficult to differentiate such successive reschedulings from otherwise cases. Both points are closely related to the question of how to deal with post-rescheduling country-year observations.

Frank and Cline (1971) do not give any specific explanations regarding the treatment of successive reschedulings or of non-rescheduling observations following a rescheduling year. Reinvestigating Frank and Cline's study with logit analysis, Feder and Just (1977) drop any observations for non-rescheduling years where a country has previously rescheduled for a period of "several years (at least two)". This is because they consider (p. 30) that it is " ... difficult to pinpoint dates precisely [when] rescheduling is more of a process than an event and in some cases, the full details are not publicly known." For example, the non-rescheduling observations of Peru in 1971 and 1972 are apparently excluded from their non-rescheduling sample data since this country rescheduled in 1970. In contrast, they treat instances of reschedulings occurring "several times in a row" as different rescheduling cases " ... unless data are not available to distinguish between two successive reschedulings." For instance, the 1968 and the 1969-70 reschedulings of India and Peru are each reckoned as two independent reschedulings.

Sargen (1977) raises a number of questions about treatment of the post-rescheduling observations. First, he expresses concern over the situation where a country has rescheduled its debts over successive years. He omits successive rescheduling observations from his data on the grounds that they are the extensions of the original rescheduling. The reason for that is said to be an attempt

to construct a model which is able to " ... distinguish rescheduling from non-rescheduling countries, rather than identifying the time of the rescheduling." And then he also comments on the treatment of observations on rescheduling countries in subsequent non-rescheduling years. Again he drops observations following a rescheduling from the sample data for the same reasons. However, it can not be identified precisely which country-year observations are thereby lost because there is no precise description of this process in his paper. On the contrary, as explained already, Mayo and Barrett (1978) define the occurrence of a rescheduling as including a rescheduling up to five years hence. The problem of the consequent high intercorrelation between sets of five successive observations on the dependent variable however is not discussed.

Observations for the two years following a debt rescheduling are excluded regardless of whether they corresponds to successive reschedulings or are otherwise seen to be 'problem-free' in the Saini and Bates (1978) study. They consider this procedure appropriate because reschedulings usually affect some subsequent time series observations by altering domestic debt management policies so that, in particular, "instances of multiple reschedulings are more properly characterised as the continuation of the initial rescheduling exercise rather than as new events." The question then follows as to how appropriate this uniform two-year deletion is. For example, India rescheduled its debt over a four-year period from 1968 to 1971. In that case, is the rescheduling in 1971 a completely separate event from the one in 1968? In other words, is it rational to assume that the effects of the rescheduling in 1968 last only for two years and nor three or more years?

Feder, Just and Ross (1981) do not explain explicitly the treatment of post-rescheduling observations. However, if sixteen successive reschedulings given in their "partial list of reschedulings" (p. 668) are reviewed, there is no doubt that they consider multiple reschedulings to be independent events. Taffler and Abassi (1984) omit country-year observations for up to three years before or after a rescheduling, which they term "weak years", from the non-rescheduling data since

they reckon rescheduling features to persist in these years. The aim of such an exclusion is to avoid incorrect assignments of (0,1) distribution to sample observations. Then, why do they drop the observation for three years before rescheduling? Of course, those omissions might not present a serious practical problem since exclusion of some non-rescheduling observations would not greatly affect the size of the information set used to estimate a statistical model because of the highly imbalanced distributions of rescheduling *versus* non-rescheduling country-years. However, in many cases, previous years' non-rescheduling observations before a rescheduling year are pertinent to the essential forecast objectives of the analysis. Therefore, an assessment of debt-servicing difficulties for those years before a rescheduling should be accomplished by examining other options such as significant payments arrears as early warning signs of debt problems rather than following rigid rules for observation exclusions. As far as serial reschedulings are concerned, Taffler and Abassi treat each rescheduling as an independent case on the grounds that the banks consider it to be thus. Therefore, no attempts are made to omit successive reschedulings. However, it is not a banker's perception but the identification of a proper causal relationship between dependent variable and debt-servicing difficulties that is important.

Cline (1984) excludes the observation in any one year following a rescheduling from his analysis regardless of whether it would otherwise be reckoned as an observed non-rescheduling or another rescheduling. His reason for doing this is that in a year following a rescheduling there could be a tendency to predict a further rescheduling because the underlying conditions are unlikely to have changed so another rescheduling is likely to occur as a follow-up. What the empirical justification for considering this would be is not discussed.

There seems to be no straightforward explanation about the treatment of post-rescheduling observations in the papers of Kharas (1984) and McFadden *et. al.* (1985). However, regarding the exclusion of country-year observations, McFadden *et. al.* also state that "in the panel of countries some years are omitted

because of missing observations." In addition, if it is taken into account that Table 7-6 in their study (p. 189), giving the distribution of repayment problems for 93 countries between 1970 and 1982, shows the pattern of transition between debt-servicing difficulties in year $t-1$ and in year t, and that they test the "state dependence" with reference to the effect of previous status by using the lagged dependent variable, post-rescheduling observations appear not to be excluded.

7-2-5. SUMMARY

Reschedulings have been seen as a convenient evidence of debt-servicing difficulties without any specific examination. All of the authors thus have in fact utilised rescheduling events for the binary-valued dependent variable in their empirical studies. However, these studies have shown different features in dealing with post-rescheduling years, selecting more relevant rescheduling years, and employing other proxies for debt-servicing problems. As a result, instances of evidence of debt-servicing difficulties vary in terms of country-year observations between authors even though their sample periods are similar. Resolving the implications of such diversity must in itself present a considerable challenge to the further development of statistical models.

7-3. INDICATOR SELECTIONS

7-3-1. INDICATOR SELECTION RATIONALISATION: GENERALITIES

Frank and Cline (1971) lay the foundations of statistical approaches to sovereign risk analysis putting the main emphasis on finding an index that summarises *ad hoc* selections of indicators which may be associated with the likelihood that a developing country will experience debt-servicing difficulties. They refer to eight independent variables. These are the debt service ratio, the growth rate of exports, an index of export fluctuations, non-compressible imports as a fraction of total imports, per capita income, the ratio of debt amortisation to total outstanding debt, the ratio of imports to gross national product (GNP), and the ratio of imports to reserves.

As the criteria for choosing such indicators, "relative simplicity" and "higher degree of predictability" are suggested. However, the reasons why these eight variables are selected are essentially set out in terms that relate specifically to each variable in turn rather than to some general theoretical framework. The one exception to this approach can be found in the comment (p. 330) that the " ...eight factors ... [they] felt might have an influence on the capacity to service debt ..." They go no further even though the fact that they themselves recognise the underlying interrelationships between variables is evident enough in their observation (p. 329) that "Behind the composite index which we derive is an economic story which takes place in terms of stochastic money flows and accounting balances and surpluses."

The 'debt capacity' concept used by Frank and Cline is taken from an earlier study by Avramovic *et. al.* (1964). There the principal emphasis is on short-run components of the balance of payments as reflecting debt-servicing difficulties while dealing separately with the analysis of the long-term evolution of debt.

Three groups of economic indicators are suggested as being important in the first, short-term, contexts of what is referred to as "the liquidity aspect of debt servicing capacity." These are fluctuating variables (exports, capital flows, emergency and inflation-induced imports), offsetting variables (reserves, compensatory finance, compressible imports), and rigid variables (minimum tolerable imports, debt service interest payments, debt service amortisations).

In order to appraise a country's debt-servicing vulnerabilities to external shocks, especially changes in world trade, Avramovic and his associates (1964) highlight the debt service ratio defined as the ratio of service on debt to export earnings. The rationale has to do with foreign exchange crises. This is because any shortfall in foreign exchange earnings or capital imports which is not covered by exchange reserves must be met by reducing imports. Since debt service is a fixed obligation, the higher the debt service ratio, the greater is the relative burden on import reduction for a given shortfall in foreign exchange. These considerations might help Frank and Cline (1971) to select their explanatory variables so as to rely mainly on financial aspect of a balance of payments (*i.e.*, trade- and debt-related indicators). The one exception is per capita income.

Frank and Cline raise one misgiving concerning the debt service ratio in acknowledging historical cases where quite high debt service ratios have not been associated with servicing difficulties and *vice versa*. Thus, they consider (p. 330) that

> ... the debt service ratio *in and of itself* [would] not be a very good indicator of a country's ability or lack of ability to pay its debts. The debt service ratio is merely an indicator of the proportion of foreign exchange earnings which are free to purchase imports. If exchange earnings are high relative to import demand, a high debt service ratio can be maintained. Furthermore, a country with good credit standing in international money markets may be able to finance a high debt service ratio for a time at least, through a high level of borrowing.

The point therefore illustrates a general problem in relying on *ad hoc* indicator selections. Each individual indicator can be shown to be inadequate in particular

aspects or in explaining special circumstances. Other indicators then have to be added on to cover such loopholes. The result is an unstructured specification to the extent that each variable stands in its own right without reference to formal linkages between cause and effect or explanations as to how these indicators might themselves be interrelated. Neither is there any indication of an *a priori* ranking of their likely importance.

With regards to the selection of other variables, thus, Frank and Cline note (p. 331-32) without any particular framework that

> We assume that a country with a high export growth rate is less likely, ceteris paribus, to reschedule since the prospects are brighter for increasing foreign exchange earnings in the near future ... [and] a country with stable export earnings [is] less vulnerable to foreign exchange crises and [can] tolerate a higher debt service ratio ... [and] the higher [non-compressible imports as a fraction of total imports], the more difficult it will be for a country to meet a debt servicing burden, and therefore, the more likely debt rescheduling ... [and] the lower per capita income, the less flexibility there would be for reducing consumption and thus, the more likely debt rescheduling ... [and] a low value for [the ratio of debt amortization to total outstanding debt] suggests that a country predominantly long term debt liabilities [so that it] does not have very much shortrun flexibility in reducing in debt service commitments by temporary reduction of borrowing ... [and] a country with low imports relative to GNP is more likely to be able to withstand temporary import cuts ... [and] the country with high reserves relative to imports is unlikely to be in need of debt rescheduling.

Feder and Just (1977) subsequently reinvestigate much the same variable selections as Frank and Cline (1971) by using logit analysis. Two new indicators are added, however. These are the ratio of capital inflows to debt service and the growth of per capita domestic product. There is one deletion: the ratio of non-compressible imports to total imports. The rationale for including the capital inflows to debt service ratio is that (p. 27)

> Capital flows—in the form of loans, grants, direct investments and transfer payments—are an important source of foreign exchange receipts which can be used for debt service. Hence, higher capital inflows should be associated with lower default probabilities.

Again the balance between different indicators is called into question. However, a country may not need large capital inflows because of low levels of debt service obligations or a favourable trade performance. The combination may show a low rescheduling probability in contrast to implications of the capital inflows variable by itself.

The second additional indicator, the growth of per capita domestic product, is selected on the grounds that (p. 29) the " ... process of growth is such that export capacity is increased both through expansion of the traditional exports sector and by developing new industries producing for exports or producing marketable goods which can be redirected into export channels." Far more fundamentally, however, the long-term implications of the debt cycle suggest that the only way in which foreign borrowing can be justified is in the generation of new income in the future. The exports element of these new income streams is simply one way in which they can be remitted abroad.

Non-compressible imports are omitted because (p. 26)

> ... the data for calculating it were not comparable among countries for all of the years used and because theoretical arguments have been developed which qualify this indicator ... Moreover, there may be raw materials and intermediate goods that are imported for production of domestic nonessential goods which can be reduced; but separation of these from other intermediate goods, is usually impossible. Furthermore, the possibilities for reducing imports may depend heavily on a government's internal political status rather than on the economic importance of import items. Thus, it seems that the notion of compressible imports may be of little empirical use ...

Sargen (1977) criticises the "debt service approach" inspired by the Avramovic *et. al.* (1964) study as concentrating too much on identifying a country's ability to withstand an export shortfall with reference mainly to financial ratios of "individual" balance-of-payments components (*i.e.*, debt- and trade-related indicators). It is considered (p. 23) that this debt service approach " ... focuses on the events immediately surrounding a rescheduling, rather than on the underlying causes ... [so that] 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." Therefore, foreign exchange cash flow variables (*e.g.*, the debt service ratio, the reserves to imports ratio, or the exports growth rate) rather than monetary indicators (*e.g.*, the inflation rate, the exchange rate, or the interest rates) appear to have been key variables. The limitations of the first are noted (pp. 23-24) as being that they are " ... either exogenous or structurally determined [and thus] the scope for balance of payments adjustment appears quite limited."

Instead, Sargen reviews the relationship between monetary variables and debt reschedulings. The basis of this monetary approach is that a country's monetary policy (including fiscal and exchange rate policy) affects the overall balance of payments. Hence, debt reschedulings which occur as a consequence of the balance-of-payments difficulties should be regarded as a result of internal economic policy failures rather than externally generated financial problems. From this perspective, the author argues (p. 24) that " ... [the monetary approach] is primarily concerned with the overall determination of the balance of payments, rather than with individual balance of payments components."

The result is that two alternative sets of explanatory variables are proposed. The first set, the debt-service approach variables, includes five indicators identified mainly with reference to previous studies, *i.e.*, the debt service ratio, the ratio of reserve to import, the export growth rate, the growth rate of real GNP, and the level of per capita GNP. On the other hand, the second set, the monetary approach variables, contains just three indicators, *i.e.*, the inflation rate, the growth rate of money supply, and a measure of relative purchasing-power parity. The last is explained as the difference between the domestic and the U.S. inflation rates, on the wholesale-price basis, less the rate of domestic currency depreciation vis-a-vis the U.S. dollar. Thus, even accepting Sargen's views on the importance of recognising the effects of domestic economic policies on the balance of payments, it might be questioned whether these three variables are entirely adequate. The

point is further emphasised when inflation and money supply growth rate are obviously correlated with each other.

Others have had quite different views on the role of monetary variables. Thus, it is interesting to note that some studies such as Feder, Just and Ross (1981) and Cline (1984) deliberately exclude such variables from their model specifications on account of difficulties in projecting their future values. This, however, fails to recognise a second major advantage of monetary variables that is only touched on briefly by Sargen. He points out (p. 25) that

> ... 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 ... With respect to the monetary approach, however, inflation rates and exchange rates are generally available with relative 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.

The point is further emphasised perhaps also by the exogeneity of monetary variables as opposed to the clear endogeneity of debt variables. That is, the former occurs much earlier in any chain of cause and effect.

As a concluding note Sargen argues (p. 33) 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." And on this last point, in particular, he emphasises (p. 20) a belief that

> ... [his] 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 important 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.

While the "liquidity" and "long-term debt" labels for reschedulings may be open to debate, these observations nevertheless suggest that some care may need to be taken to allow for country differences in the contexts of sovereign risk analysis.

Saini and Bates (1978) refer to statistical significance results in one or more of the previous studies. Accordingly, six 'popular' variables are singled out. These are the imports to reserves ratio, per capita GDP, consumer price index, the imports to GDP ratio, the money supply growth rate, and the export growth rate. They additionally attempt to avoid the use of variables concerning outstanding debt by referring to four proxy indicators because of the incompleteness and inconsistency of debt information across countries. The proxies include the current account balance adjusted for change in reserves to exports ratio, the ratio of the five-year cumulative current account balance adjusted for change in reserves to exports in the latest year, the ratio of the net foreign assets of the banking system to the money supply, and the growth rate of international reserves. Of course, composite components of the balance of payments, such as a current account balance and reserves, may have the advantages sought by Saini and Bates and yet they are equally likely to pose serious problems for forecasting.

The timing of variables is central to the indicator selection process of Feder, Just and Ross (1981). In particular, they state (p. 654) that

> ... [their study] maintains a focus on applicability and suitability for projections beyond the short run. The explanatory variables introduced are such that they can be projected using simple macroeconomic models (such as a two-gap framework) thus affording a medium- and long-run projection horizon.

They are of the opinion that six indicators meet this condition. These include the debt service ratio, the foreign exchange reserves to imports ratio, the ratio of net noncommercial foreign exchange inflows to debt service payments, the ratio of net commercial foreign exchange inflows to debt service payments, the exports to GNP ratio, and the real per capita GNP to U.S. per capita GNP ratio. The authors also argue (p. 657) that these indicators reflect "the degree of liquidity squeeze in the

balance of payments as well as the government's ability to withstand a liquidity crisis." One may judge that the emphasis is firmly on the former given that the relative per capita GNP appears to be the only clear exception.

It is, however, especially disappointing that there is no explanation of the macroeconomic model required for predicting medium- and long-run predictions. This is all the more so given that such components of the balance of payments as capital inflows and reserves usually involve fairly complex interactions of various policy variables and external shocks. There remains some doubt therefore as to whether these variables can be as easily projected as Feder, Just and Ross claim.

Kharas (1984) attempts to put the basis of empirical analysis of debt-servicing difficulties on his theoretical arguments. He seeks a synthesis of traditional "growth-cum-debt models", in which one of the central features is the need for the government to be able to raise revenues to service debt. This conceptualisation develops the notion of a critical capital stock that is based on the parameters of the model, outstanding debt, and capital inflows. The critical capital stock is defined (p. 45) as representing "the growth of wealth just sufficient to ensure that interest payments to foreigners never exhaust national output given expected gross inflow and existing outstanding debt.[5]" And the relationship between this critical capital stock and the actual capital stock is considered an important element of the empirical application. Thus, it is hypothesised that a debt-servicing problem can be occurred if the latter is below the former.

In his empirical work, however, GDP is substituted for domestic capital stocks on the grounds (p. 428) that " ... there is no readily available series for capital stocks, compatible across countries ... [and] that if the fixed coefficients production function really holds, the GDP is an exact substitute." Accordingly three explanatory variables are featured: the ratio of net foreign capital inflow to GDP, the ratio of debt service obligations to GDP, and either the ratio of investment to GDP, or the reciprocal of per capita income.[6] In this respect, although Kharas

makes an interesting attempt to cope with the lack of the theoretical underpinnings in earlier statistical SRA models, his empirical analysis is also subject to some of the limitations that affect other studies, for example, the focus on rather narrow context of financial indicators and the possibility of structural instability across countries and over times.

Cline (1984) criticises the statistical models estimated in the early 1970s for being unable to account for subsequent structural changes in both the demand and supply sides of markets for cross-border loans. Thus, he states that (p. 206) " ... new analysis using contemporary data is required, ideally incorporating the influence of the changing environment in the international capital markets." As reviewed earlier, he interprets debt reschedulings as the consequence of the disequilibrium between demand for and supply of loans in the international markets. Based on this underlying hypothesis, two sides to a rescheduling are considered (p. 208) as follows:

> There is a "demand" side, reflecting the decision of the country to seek rescheduling. Because rescheduling tarnishes a country's credit rating, potentially raising the future cost of borrowing, countries will not seek rescheduling lightly. Instead, they will be likely to enter into the sequence of arrears, temporary moratorium, rescheduling only if the opportunity cost of continuing normal debt servicing has risen to levels perceived by policy makers to be prohibitively high. At that point their "demand" for debt rescheduling will shift discontinuously from zero to positive. For its part the "supply" of rescheduling is really the obverse of the supply of additional foreign finance on a basis of business as usual. The "nonsupply of credit" is essentially the state at which the "supply of rescheduling" comes into play.

Accordingly, the selection of the explanatory variables for model specification is carried out in relation to these views on the demand for and supply of rescheduling. Essentially, the demand for and supply of rescheduling are said to be a "probabilistic phenomenon" of a specific indicator. The demand side variables are the debt service ratio, the ratio of reserves to imports, the rate of economic growth, the level of per capita income, and the ratio of the current account deficit to exports. Eight supply side variables are chosen: the debt service ratio (or the ratio of net debt[7] to exports as an alternative to the debt service ratio),

the ratio of inflationary erosion of debt to exports, the ratio of amortisation to debt, the level of per capita income, the ratio of domestic savings to GNP, the rate of exports growth, and a measure of global credit abundance. With the exception of the measure of global credit abundance, however, all these variables have appeared one or more of previous statistical studies of SRA. And in spite of the plausibility of the underlying theoretical viewpoint, there appears to be no relevant criteria or concomitant explanation guiding the selection of individual explanatory variables in his paper. The measure of global credit abundance represents one innovation in Cline's (1984) explanatory variables, however. This is defined as the "total net external borrowing by all non-oil developing countries." The intention is to account for external shocks on markets for foreign savings, such as the large surge in international lending in the 1970s due to a recycling of 'oil dollars' and the shrinkage of global credit supply in the early 1980s.

It is difficult to differentiate between the effects of the groups of indicators on the probability of rescheduling occurrence. The author therefore argues (p. 220) that estimates of his 'reduced' form equation of the probability function of the demand for and supply of debt reschedulings presents no difficulties for interpretation since " ... there are no variables in which both demand and supply influences exist but with opposite signs." For example, the debt service ratio and the level of per capita income appear as both supply- and demand-side variables but have the same sign on both counts. This may be because the ways in which creditors judge a country's creditworthiness have much in common with debtors' view.

McFadden *et. al.* (1985) argue that the proximate cause of repayment difficulties is inadequate foreign exchange inflows to finance a current account deficit even though the apparent origins of repayments problems may be quite heterogeneous among developing countries. Fifteen "potential factors" related to repayment problems are categorised under three headings. These are noted being factors in the world economy, factors in debtor countries, and factors affecting the

supply of credit. In the case of the world economy factors, deterioration of the terms of trade in debtor countries, recessions in industrialised countries, and volatility in world trade are included. With regard to debtor countries' factors, six "characteristics and behaviour" are pointed out, *i.e.*, noneconomic external shocks (*e.g.*, weather, social unrest), poor macroeconomic performance and policy management, inadequate investment programmes, unsustainable economic growth plans, speculation and capital flight, and "potential threat of default" strategy. McFadden *et. al.* argue that factors such as high international interest rate, deterioration of maturity structure due to relatively more reliance on short-term debt, "crowding out" of the credit demand of developing countries by low-risk borrowers (*e.g.*, industrialised countries), "capital market imperfections[8]", and "erratic behaviour of creditors[9]" can be considered as the factors affecting the supply of credit. However, it should be noted that most of these credit supply-side factors can be subject to a subset of financial market environments in the first category (*i.e.*, factors in the world economy). Because they are also largely beyond the control of borrowing countries.

Despite the discussion on a categorisation and relationship of potential factors associated with debt-servicing difficulties of borrowing countries, McFadden *et. al.* raise (p. 187) a fundamental question of "Is it possible to allocate responsibility for debt problems among the [fifteen] factors listed ... by an econometric analysis of panel data on a number of developing countries?" Instead of attempting to give a direct answer to this question, the authors say (p. 187) again that it should be asked " ... whether it is reasonable to expect a macroeconomic pattern that is stable over countries and time ... [given] that the circumstances of different developing countries vary considerably, and the apparent origins of repayment problems are quite heterogeneous." However, it is also concluded that most of the developing countries with debt-servicing difficulties are the same in suffering from insufficient foreign exchange flows to finance current account deficits. Regarding this proximate cause of repayment problems, therefore, they assume (p. 187) that " ... difficulties arising from a variety of sources would all be mediated through the

macroeconomic variables affecting the balance of payments accounts ... [so that there could be some] stable macroeconomic leading indicators of debt crises."

McFadden *et. al.* introduce a conceptualisation of demand and supply effects in the international credit market in selecting actual explanatory variables for their model specification like Cline (1984). As demand effects, they employ the variables related to debt service due, reserves, imports, income, and terms of trade. To capture lender's effects, the ratios of imports to GDP and debt to exports, GNP per capita, and the growth rate of GDP are entered in the models. However, like Cline's analysis, there is no precise explanation about the choice mechanism of the explanatory variables and there remains the risk of overlapping effects from demand and supply variables in any one "reduced form" type of equation.

7-3-2. SUMMARY

Table 9-2 shows that the ten major statistical SRA models reviewed here refer to no fewer than 28 distinct explanatory variables amongst the final selections investigated. The half of them are unique to just one particular study. Only two appear in as many as nine of the studies. Seven variables appear over five times. They are the debt service ratio, the reserves to imports ratio, per capita income, the current account balance items, the growth rate of exports, the ratio of imports to income, and the real growth rate of income.

As many of the authors themselves admit, these selections of suggested explanatory variables are governed by *ad hoc*, individual considerations without detailed theoretical underpinnings. This would seem to suggest opportunities for some other formulation of explanatory variables that could perhaps provide a broader perspective that would link sovereign risk analysis to overall macroeconomic performance evaluation procedures.

7-4. LAG STRUCTURES

When constructing models, it is important to recognise that some amount of time usually lapses between the movement of the independent variables and responses registered in terms of some dependent variable. This has to do with both adjustment processes and the way in which plans for the future are based on expectations of future conditions. In the context of statistical sovereign risk assessment models, problems concerning the specification of a model's lag structure relate to issues such as whether the purpose is to find 'early warning' indicators or to represent the immediate situation surrounding reschedulings, the modelling of situations believed to influence decisions to reschedule in practice, and any difficulties that there may be in forecasting explanatory variables when it comes to using an estimated model for producing predictions. A further consideration could be the avoidance of simultaneity problems that might be thought to be a problem in aiming at monitoring circumstances immediately surrounding a decision to reschedule. Thus, balance-of-payments variables could be affected by flows of loans which in themselves reflect, rather than influence, debt problems.

Most statistical models rely on a one-year lag. Frank and Cline (1971) rationalise this in respect of all eight of their independent variables by assuming (p. 331) that " ... the debt service payment interruption in year *t* occurs after decisions made near the end of year *t-1* and that these decisions are based on the appearance of indicators during year *t-1*." This is however surely something that does not correspond to reality if only because publication delays must mean indicators influencing decisions in year *t* could not possibly be 'available' in year *t-1*. Indeed, the actual for year *t-1* cannot even be compiled before the end of the year for flow variables. Such an assumption could therefore only be justified on other grounds such as the *t-1* observations are taken as proxies for *forecasts* of these variables that were available to policy-makers in year *t-1*. Publication delays then of course must mean that considerable problems have to be overcome in using such a specification for forecasting.

The way in which some variables are measured must, moreover, imply considerably more complex lag structure. For instance, "normal exports" rather than actual exports in year *t-1* are used in the denominator of the debt service ratio. These are calculated by a "regression of the logarithm of exports on time for the five-year period ending in year *t-1*." Similarly the variable of growth rate of exports is computed as four-year averages over an eight-year period preceding the year of observation. And average absolute percentage deviations from an eight-year trend over the period to *t-1* are used to represent export fluctuations.

Feder and Just (1977) also apply a one-year lag for their nine explanatory variables. One minor change is implied however in the use of an average of the annual growth rates over the eight-year period to *t-1* in measuring the growth of exports. Additionally, the growth rate of per capita GDP, which is one of two additional variables, is computed as an average of the annual rate of growth between year *t-5* and *t-1*. No explanation is offered as to why this should be different from the eight-year period used for exports.

Sargen (1977) appears to refer to lags of up to two years since he reports (p. 30) that

> 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.

It should be noted that the growth variables, for prices, money, exports, and GNP, are all measured as "average annual rates" over the same three-year period. However, it is not explained why such a lag structure is adopted.

Since the dependent variable is defined to include reschedulings up to five years hence in Mayo and Barrett's (1978) study, the lagging of independent variables ranges over a minimum of *t* to the maximum of *t-5* years. The rationale for this timing is "to reflect the normal maximum term of commercial bank lending." But

as indicated earlier, a decision on lag structures has to be made not by reference to lenders' forecast horizons but rather to assumptions as to the timing of the movement of independent variables and their implications for dependent variables.

Saini and Bates (1978) lag all explanatory variables by one-year in relation to the dependent variable. In case of export growth rate, it is computed as averaged over three years. Nothing is said about the periods used in the case of "changes in the consumers price index" or the "money supply growth rate."

Because of the absence of any explicit discussions on the subject, it is not possible to be sure about how Feder, Just and Ross (1981) lag their independent variables. However, it seems to be implied that explanatory variables are measured contemporaneously when the authors say (p. 657) that " ... they underlie the [rescheduling] decision actually taken." Additional evidence is perhaps also available in their statement (p. 654) that their explanatory variables " ... can be projected using simple macroeconomic models ... thus affording a medium- and long-run projection horizon" which implies a facility which could readily forecast to period *t*.

Of the final set of four variables[10] in Taffler and Abassi (1984), only inflation rate reaches back to *t-3* year information in its transformed form, $(CPI/CPI_{t-3})^{1/3} - 1$, where *CPI* denotes the consumer price index in year *t*. In the case of the other three variables, all that is said is that (p. 546) "To capture the conditions conducive to rescheduling, data for the year prior to rescheduling were employed."

With regards to the measurement of 'expected capital inflow', on which Kharas (1984) assumes a country's long-run creditworthiness depends, he reviews three alternative expectation formulations. First, actual values of capital inflow are used as a proxy for expected values. Here it is reasoned (p. 429) that "If capital flows depend only on the probability of rescheduling, which is determined in period *t-1*,

then capital inflows in period *t* would not be affected by whether a rescheduling actually occurs or not." The second modelling recognises that there may be a simultaneity problem when a country reschedules at the beginning of a year, and when this affects the level of inflows in that year, because of the need to rely on time periods in units of one year. Thus, he states (p. 429) that

> **In this case, actual capital inflows cannot be taken as independent of the error term. We can, however, use a lagged value. It was felt that time-series data on individual countries were too short to attempt a more sophisticated autoregressive proxy than the simple one-year lag.**

The third assumption derives from the notion that attention centres not so much on whether a country reschedules or not but whether it moves from one state to another. If there is no change of state, the actual value of capital flows is taken as the expected value. In contrast, if a change of state takes place, then it suggests that this does have a simultaneous impact on capital flows and so the lagged value is used as a proxy. For other right-hand side variables, there appears to be no-lag structure.

Cline (1984) enters all his variables except three (*i.e.*, per capita income growth, the level of per capita income, and global lending) with one-year lags. For the one-year lagged variables it is assumed (p. 221) that " ... because of time lags in data, decisions taken in a given year are broadly determined by data pertaining to the end of the previous year (debt, reserves) or the flows for the full previous year (for example, debt-servicing ratio)." As pointed out earlier with regard to the one-year lag structure of Frank and Cline (1971), this statement of Cline can be justified only if he discusses about proxies for forecasts. In the case of per capita income growth and global lending, it is assumed that they have an immediate impact on the precipitation of debt-servicing difficulties. And so far as the third exception is concerned, the level of per capita income, it is considered that it makes little difference whether this is measured contemporaneously or with a one-year lag since it is usually relatively slow-moving. The lagging of all explanatory variables

in McFadden *et. al.* (1985) is taken as one year to reduce the problem of simultaneity as in the case of Cline's study.

7-5. STATISTICAL ESTIMATION PROCEDURES

7-5-1. INTRODUCTION

Since statistical SRA models consider that debt reschedulings or payment arrears represent the incidence of debt-servicing difficulties. They focus principally on the construction and estimation of models where the dependent variable is binary. This means that conventional regression techniques are inappropriate and specially designed qualitative choice methodologies have to be used. The two statistical methods relied on by the major studies are the discriminant and the logit (or probit) analysis.

Given the weak theoretical underpinnings to suggestions of indicators of past debt reschedulings, the task left to empirical evidence to distinguish between alternatives assumes a special importance. Most analytical innovations have therefore been concerned with statistical methodology. The principal issue has been the relative merits of different kinds of analytical framework although more attention has been given recently to tackling problems such as multicollinearity and serial correlation.

7-5-2. PRINCIPLES OF DISCRIMINANT ANALYSIS

Discriminant analysis seeks to classify an observation correctly into one of two completely independent groups on the assumption that qualitative variables may

be differentiated by certain quantified features. The technique derives a 'watershed' to discriminate statistically between country characteristics with reference to observed reschedulings and non-reschedulings. Although it seems clear that logit analysis is to be preferred both conceptually and in terms of convenience of operation and interpretation, use of discriminant analysis has continued from Frank and Cline's (1971) pioneering study through to the recent application found in Taffler and Abassi (1984).

Essentially, it provides a rule for classifying observations into two or more groups with the object of minimising the expected cost of any categorisation errors. The familiar distinction between type I and type II errors therefore assumes a special importance in this context. If a failure to predict a rescheduling is reckoned a type I error, it then follows that a type II error would occur in forecasting a rescheduling that in fact failed to materialise. In practical terms the costs are likely to be different. So far as lenders are concerned, the first takes the form of less than expected income while the latter is registered in terms of lost opportunities if, for example, lending is avoided or reduced as a consequence of a predicted rescheduling.

The basis of this 'error-cost-minimisation approach' to a discriminant rule can be best explained by examining first a classification linked to just one characteristic, X. Any separation of country-year observations into, say, two groups (*e.g.*, rescheduling and rescheduling-free years) will leave each group with its own mean, variance and probability density function for X. Assuming equal variances, normal distributions, equal *a priori* probabilities that any observation comes from one group or the other, and the properties of X are such that the two groups are well separated, the two density functions will be the same in all respects other than group means. It then follows that the choice of a critical value for X, X^*, midway between the sample group means and the adoption of a rule that says that observations for which $X < X^*$ belong to one group while the remainder ($X > X^*$) belong to the other, would both equalise the probabilities of making type

I and type II errors and minimise the overall error probability. It therefore also follows that if the costs of type I and II errors are the same, the overall error cost is minimised.

Things become more complicated as the above restrictions and assumptions are relaxed. With more than one performance characteristic, a weighted sum of X's, *i.e.*, a linear discriminant function $Z(X)$, can be used to 'score' a country's performance overall. If all the other assumptions hold, the weights can be chosen to maximise the difference between the Z means of the two groups in order to minimise the combined costs of type I and II errors. Where the two populations have unequal X covariance matrices a quadratic $f(X)$ is required. Details of its parameters, in order to minimise the expected cost (C) of making errors,

$$C = P_R \bullet C(I) \bullet P(I) + P_{NR} \bullet C(II) \bullet P(II),$$

are set out in Frank and Cline (1971, p. 334). P_{NR} and P_R are the *a priori* probabilities that an observation comes from the alternative non-rescheduling (NR) and rescheduling (R) country-year populations, $C(I)$ and $C(II)$ are the costs of type I and type II errors, and $P(I)$ and $P(II)$ are the probabilities of making type I and II errors. Essentially, these parameters are functions of the means of the components of X in the NR- and R-populations and the covariance matrices of X in the two populations. Parameter estimates can be obtained on substituting the two sets of sample means and covariances.

Where the *a priori* probabilities of the occurrence of NR- and R-events are different ($P_{NR} \neq P_R$) and the costs of making type I and II errors are unequal [$C(I) \neq C(II)$], the critical value Z^* used to predict country-year classifications is displaced from the mid-point between the observed mean Z's for the two populations. The relative shift is given by

$$\ln \left[\frac{P_{NR} \bullet C(II)}{P_R \bullet C(I)} \right] .$$

Some decision about the relative costs of type I and II errors is therefore required while sample data could, for example, be used to estimate P_{NR}/P_R in the form of a ratio of the observed frequencies of problem-free country-years and reschedulings.

Standard discriminant analysis procedures therefore assume that characteristics or indicators used to identify or classify the members of different groups are multivariate normally distributed. If the discriminant function is to be linear then it is also necessary that the dispersion matrices should be equal. And, of course, if the technique is to be operationally useful the groups have to be sufficiently distinct that the search for significant indicators, showing well separated means for the composite index Z, has an attainable objective. Just how far these conditions are likely to be encountered in the context of business, finance and economics has been reviewed by Eisenbeis (1977). It is concluded (p. 893-96) that

> If one had to rank the problems according to severity of their affects on the usefulness of the analysis, it would seem that the problems related to classification are the most severe, with the issues surrounding the selection of the appropriate *a priori* probabilities being the most important followed in turn by the selection of the appropriate classification rules (linear vs. quadratic) and assessment of classification accuracy. In particular, the failure to relate estimates of the *a priori* probabilities to the population *priors* by, for example, assuming equal *priors*, in fact limits the ability to make any meaningful inferences about the overall performance or accuracy of the classification scheme. Similarly, use of linear classification rules when the group dispersion matrices are equal [*sic*, unequal] nearly always results in a underassessment of the overall classification accuracy of the rules, moreover, there may be significant distortions in the individual group error rates. Other problems such as nonnormality, the selection of subset variables and reducing dimensions, [and] interpreting the significance of individual variables, are not so easy to remedy.

On the question of the assumption that observations in the two populations are multivariate normal distributions, Eisenbeis reviews the practice commonly used in other areas of statistics of data transforms to change observed distributions prior to estimating a discriminant function. These have been used, as is discussed in the following section, in the context of sovereign risk analysis together with ways of tackling the *a priori* probabilities of which population a country-year belongs to and tests of the equality of covariance matrices for the two populations.

7-5-3. APPLICATIONS OF DISCRIMINANT ANALYSIS

Frank and Cline (1971) in their first use of discriminant analysis to evaluate the sovereign risk of loans to developing countries refer to two estimation criteria. The first uses a 'Bayesian procedure' to find the most efficient discriminant function, $Z = f(X)$, and a critical value, Z^*, by assigning countries to rescheduling or non-rescheduling groups so that the expected cost functio*n*[11] is minimised. Their second estimating methodology, a 'minimax solution' which focuses on minimising the maximum value of $C(I) \bullet P(I)$ and $C(II) \bullet P(II)$, in the situations where P_R and P_{NR} are not known.

Their first-round estimates of the linear discriminant function refer to all eight of their suggesting indicators while assuming the *a priori* probabilities, P_R and P_{NR}, are equal and the misclassification costs, $C(I)$ and $C(II)$, are equal. For this estimation, the Z-scores are scaled so as to produce a critical value of Z^* of zero. Although the t-statistic results do not, strictly speaking, have the conventional distributions owing to violation of the assumption of multivariate normal distribution in the underlying explanatory variable populations, they carry out t-tests so as to exclude five explanatory variables from their simple linear discriminant equation.

Another problem with application of discriminant analysis found in Frank and Cline concerns the assumptions in the 'Bayesian approach' that P_R and $C(I)$ should be equal to corresponding P_{NR} and $C(II)$. It is especially curious as to how the assumption that the *a priori* probabilities P_R and P_{NR} are equal can be accepted when there is such a large imbalance between the frequency of the two sub-populations of rescheduling and non-rescheduling country-years. Even their sample of 145 country-years has only thirteen rescheduling cases (8.9 per cent).

Sargen (1977) also applies discriminant analysis in much the same contexts. As in the case of the 'Bayesian approach' used by Frank and Cline and Sargen

attempts to minimise the same expected cost function of making two types of errors. Unlike Frank and Cline who assume that the costs of misclassification, $C(I)$ and $C(II)$, are same so that Z^* is equal to zero, Sargen reports the results depending on the assumption that the expected cost of type I error is three times that of type II error. Although a decision as to the ratio between the costs of making two types of errors might require a quite subjective judgment, no comment is offered on the choice actually made. So far as the *a priori* P_R and P_{NR} probabilities are concerned, Sargen uses the frequency of reschedulings relative to non-reschedulings. This is of course appropriate provided the pooled data represent a random sample from the populations. Otherwise it should be recognised, however, as Eisenbeis observes, that the resulting classifications would only minimise the classification errors in the sample rather than the population when it is not at all obvious what the population *priors* should be or how they should be estimated especially given that they may vary from period to period. Sargen in this respect notes (p. 30) that

> Tests for equality of the multivariate group means and variance-covariance matrices indicated that group differences were statistically significant. 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 function also had the advantage of being easier to interpret, because of the smaller number of terms involved.

With regard to the problem of assuming normal distributions for both rescheduling and non-rescheduling groups, Sargen also recognises the consequences of violations in determining the relative or absolute importance of individual variables. In particular, he observes (pp. 28-30) that "Plots of variables for the rescheduling group ... suggest that the data are not normally distributed," with the effect that "Unlike the coefficients in the linear-regression model, the discriminant-function coefficients are not 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) ..."

Sargen tries to deal with this problem by employing a "forward step-wise regression procedure" in order to obtain a measure of the relative importance of each variable, prior to applying the "discriminant sub-routine". The adoption of such a procedure seems to be based on the consideration (p. 35) that

> **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.**

However, this technique can not ensure complete elimination of all inappropriate independent variables from the equation as Saini and Bates (1978) point out. And it is still possible thus to omit an important variable due to a high interrelation with other variables.

Taffler and Abassi (1984) also adopt linear discriminant analysis as a statistical classification technique and follow a 'Bayesian procedure' in deriving a critical cut-off score, Z^*, given by the distance from the mid-point between two sub-populations centroids. A cost ratio of 3:1 is used with reference to Sargen (1977) without any explicit explanations about this citation. What is noteworthy in particular with regard to the determination of a cut-off point is that the authors estimate the ratio of the *a priori* probabilities for an observation belonging to the rescheduling and non-rescheduling groups with reference to actual within-sample country-year frequences. Hence, Taffler and Abassi reckon this ratio as being 1:4 (*i.e.*, 20 per cent of country year cases in the sample corresponds to the rescheduling group) by adding "weak year" cases (defined as country year cases for up to three years before or after a rescheduling event) to the rescheduling country group. This appears to be a modification of their decision to leave out such "weak years" from the non-rescheduling country group on the grounds that " ... they may have still contained [rescheduling country] characteristics." With misclassification cost ratio of 3:1 and *a priori* determined group probability ratio of 1:4, a critical cut-off discriminant score, Z^*, is calculated as -0.288. In

practice, however, a cut-off of zero is applied for operational convenience by adjusting the discriminant function constant term.

In common with Sargen, Taffler and Abassi point out that statistical problems for discriminant analysis follow from the rather unrealistic underlying assumption of multivariate normality and equality of the dispersion matrices of each of the two country-year groups. However, the authors argue that there should be no great disadvantages in using discriminant analysis by referring to other researchers' findings on theoretical and empirical comparisons between discriminant and logit analysis.[12] Moreover, a discriminant score, Z, is regarded (p. 549) as having the same meaning as the logit probability, P, since " ... the probability form of the logit function can be matched by the appropriate transformation of the discriminant score Z via $Pr(NRC) = (1 - e^{-Z})^{-1}$ [*sic* $Pr(NRC) = (1 + e^{-Z})^{-1}$] allowing an equivalent interpretation, if required ..." However, this transformation between the results formats of the two procedures can not mean that their statistical properties and assumptions need to be in any equivalent.

Transformations of the second-stage (the initial set of variables was 60) variables set of 42 ratios or rates of growth are reported in terms of logarithmic, square root, and reciprocal forms. The main aim of these transformations seems to focus on making the distributions of individual variable closer to the required normal form by reducing the degree of skewness and kurtosis inevitable in ratio data. Then, Taffler and Abassi propose (p. 547) next procedure of data transformation as follows:

> **Coefficients of skewness and kurtosis were then calculated for the untransformed and transformed variables for the [rescheduling country] and [non-rescheduling country] groups separately to indicate the appropriate transformation (if any) for each variable. After transformation any outlying observations in each group were winsorized, *i.e.* replaced by limiting values 2.5 standard deviations from the mean of the other observations calculated on the basis of the remaining cases.**

7-5-4. PRINCIPLES OF LOGIT ANALYSIS

In view of the numerous difficulties and qualifications surrounding the use of discriminant analysis, anything else might seem to be an improvement. In fact, however, there is an alternative readily available in logit analysis which is easier both to use and to interpret. The logit model assumes that the probability (P) of an event is associated with a vector (X) of economic indicators *via* the function.

$$P(X) = \frac{1}{1 + e^{-BX}} \quad ,$$

where B is a vector of fixed coefficient to be estimated. Thus with the weighted sum BX ranging over the entire real line, $P(X)$ is confined to the range 0 to 1 with the probability increasing for higher positive values of BX and *vice versa*.

The function can be rearranged to express a transform of $P(X)$ as a linear function (BX) of the explanatory variables, which has of course the same functional form of the discriminant score, Z, thereby suggesting estimation of the coefficients B might similarly prove feasible, in this case with reference to ordinary least-squares procedures.

$$\frac{1}{P(X)} = 1 + e^{-BX}$$

and

$$\frac{P(X)}{1 - P(X)} = e^{BX}$$

so that on taking logarithms of both sides

$$\log_e \frac{P(X)}{1 - P(X)} = BX.$$

The ratio $P(X)/[1 - P(X)]$ is in effect the familiar odds in favour of an event happening if $P(X)$ is its probability. For example, the odds are 4 to 1 for a

probability of 0.8. The logarithm of the ratio can therefore be said to be a *log odds*, or *logit*, variable. Since the odds of an event range from zero to infinity, the transform has the unrestricted range of a normal random variable from minus to plus infinity. The properties of the classical linear model are thereby adhered to.

The logit approach thus has a distinct superiority to the discriminant one in terms of the analysis of empirical evidence since the logistic distribution is virtually indistinguishable from the normal distribution except at the extreme ends so that statistical tests such as the *t* or *chi*-square tests are relevant in determining the importance of individual indicators (see McFadden (1976)). In addition, as Feder and Just (1977) argue, the nature of the logit analysis does not force a country in time to become suddenly a member of another population as is implied in discriminant analysis. For these many reasons logit analysis must be preferred in empirical analysis of sovereign risk models in spite of such individual empirical results as lead Saini and Bates (1978) to write (p. 15) that there is " ... no material difference between the discriminant and logistic analyses in their ability to isolate cases of debt servicing difficulties."

The usual tests of statistical significance in the context of regression analysis are therefore more readily available than in the case of discriminant analysis. Furthermore, it is not necessary to assume that independent variables have multivariate normality for hypothesised populations. Thus, even binary independent variables may be used as in the case of the regional dummy variables used by Feder, Just and Ross (1981).

The conceptual framework of logit analysis also provides a far more appropriate representation of the kind of circumstances that underlie a decision to reschedule. This is because the model is both behavioural and probabilistic. Thus, on the one hand, it is intended that the explanatory variables should cover major considerations that will first suggest rescheduling as a policy option and later influence the timing of any resort to that option. On the other hand, the decision

to reschedule will not always be unavoidable, nor even inevitable, so that a given set of circumstances may, or may not, precipitate a move to reschedule depending on a variety of issues relating to political preferences and just how the advantages and disadvantages of alternative policies are perceived. This impact of choice is worth emphasising: every conceivable aspect of two situation may coincide and yet two different policy reactions may be forthcoming, albeit with different probabilities. In contrast, discriminant analysis posits the existence of two or more separate populations and aims at correctly classifying observations as belonging to one or the other. This may have somewhat more relevance in the context of cross-section data but time series data would have countries switching from one population to another. This last may stretch the imagination far when the fundamental nature of a country's economy and political hue usually changes only very slowly over time. And yet, on the contrary, it may make sense to model the impact of changing circumstance on shifts in the probabilities with which various policy options may be adopted.

7-5-5. APPLICATIONS OF LOGIT ANALYSIS

Instead of forcing country-year observations into one of two separate sub-populations as in discriminant analysis, logit analysis assumes that the associated effect of certain explanatory indicators on a binary-nature dependent variable yields a logit probability in terms of the likelihood for a certain event (usually rescheduling) to take place. Thus, logit analysis can be specifically applied to dichotomous choice probability of a sovereign risk evaluation model.

The first application reported can be found in Feder and Just(1977). They emphasise the superiority of the logit approach in two respects. First, they say that " ... it makes more sense to claim that the country suddenly became a member of another species ... [Second,] more appropriate statistical tests can be performed to determine the relevance of various economic indicators ..." Concerning the second

point particularly, asymptotic tests can be utilised for excluding insignificant explanatory variables as a response to asymptotic normal distribution features of coefficient estimates.

A maximum likelihood methodology provides the most suitable estimation when using the logit model with individual observations.[13] The likelihood function L to be maximised has the form,

$$L = Pr(Y_1, \ldots, Y_N) = Pr(Y_1) \bullet Pr(Y_2) \bullet \cdots \bullet Pr(Y_{N-1}) \bullet Pr(Y_N),$$

on the assumption that the individual observations are independent of each other observation. If it is supposed that rescheduling cases are n out of a total N observations, by using $\prod$ to represent the product of a number of factors the likelihood function L can be rewritten as

$$L = P_1 \bullet \cdots P_n \bullet (1 - P_{n+1}) \bullet \cdots (1 - P_N) = \prod_{i=1}^{n} P_i \prod_{i=n+1}^{N} (1 - P_i),$$

where

$$P_i = \frac{\exp(BX)}{1 + \exp(BX)}, \quad (1 - P_i) = \frac{1}{1 + \exp(BX)}.$$

To obtain estimators of B the logarithm of the likelihood function L is taken and then this can be differentiated with respect to a vector of fixed coefficients, B.

As Feder and Just (1977) discuss, the maximum likelihood estimation procedure has a number of desirable statistical properties. All parameter estimators are 'consistent', 'asymptotically unbiased', and 'efficient'. In addition, they are 'asymtotically normal' so that the analog of the regression t-test can be applied. That is, the ratio of the estimated coefficient to its estimated standard error follows a standard normal distribution. Additionally, in testing the relevance or significance of all, or a subset, of the coefficients in the logit model when maximum

likelihood procedures are used, a test using the *chi*-square distribution is valid (usually a *F*-test is applied in ordinary regression). Hence the likelihood ratio, λ, is defined as

$$\lambda = \frac{L_0}{L_{max}}$$

where L_0 means the initial value of the likelihood function, L, when all parameters are set equal to zero and L_{max} represents the evaluation of the function at its maximum. Then, the appropriate test follows directly from the fact that

$$-2log\lambda = -2(logL_0 - logL_{max})$$

is based on a *chi*-square distribution with k degrees of freedom, where k is the number of parameters in the equation (see McFadden (1974)).

Following Feder and Just (1977), Mayo and Barrett (1978), Feder, Just and Ross (1981), Cline (1984), and McFadden *et.al.* (1985) also utilise logit analysis to relate a set of economic indicators to the probability of debt reschedulings. All of them apply maximum likelihood techniques for estimating parameters of explanatory variables and use *t*-statistics for selecting relevant and significant variables.[14] In general, likelihood ratio statistics suggest that all the models produce good overall fits to data. Cline, for example, quotes the *chi*-squared statistic as a measure of overall statistical performance, and reports results typically in a range to indicate overall statistical significance at the one per cent significance level.

Unlike most studies of sovereign risk evaluation, Kharas (1984) adopts a probit analysis in investigating his model empirically. However, maximum likelihood estimation of probit model parameters is essentially similar to that of the logit model except that the probabilities, $P(X)$ associates with the 'cumulative normal' rather than the 'cumulative logistic probability function' which has slightly fatter tails at both ends. The probit approach thus can be seen as being in the same category of parameter estimating techniques as the logit approach. One thing to

note concerning the estimation methods in the McFadden *et.al.* (1985) study is that they use probit analysis to examine the robustness of the Feder, Just and Ross (1981) model, when applied to the relatively larger sample available in their study, although in estimating and testing their own model they revert to logit analysis. There appears however to be no clear statement about the reason for this change in statistical techniques.

7-5-6. ESTIMATION PROBLEMS

7-5-6-1. MULTICOLLINEARITY

In terms of conventional definitions multicollinearity problem arises when two or more independent variables (or combinations of variables) are highly (but not perfectly) correlated with each other. Although it remains possible to obtain unbiased estimates of the coefficients, their interpretation can be quite difficult depending on the strength of the correlation. The partial coefficient of any variable is interpreted to measure the change in the dependent variable due to a change in the variable in question, *ceteris paribus*. However, the presence of multicollinearity implies that there is in effect a reduction in the amount of independent information available in the sample with which to guarantee such an interpretation. Whenever a given change in one variable occurs, the corresponding observation on its highly correlated partner is likely to change. Thus, the distributions of the estimated parameters are quite sensitive to multicollinearity and the higher correlation between multicollinear variables the higher the estimated variances and the lower the estimated *t*-values.

Only limited discussions about multicollinearity problems can be found in statistical sovereign risk evaluation studies even though most of the models involved include debt and balance-of-payments explanatory variables that tend to be *a priori* correlated with each other. Feder and Just (1977) have an early

reference, however, in their observation (p. 34) that "In comparing the results [of four versions of their model], it may be noted that the significance of the export growth coefficients increases appreciably when GDP growth is deleted ... This apparently happens because export growth is relatively highly correlated with GDP growth in most developing countries (where the export sector is the leading sector)." Despite this consequence, the authors include GDP growth in one of the final runs of their model with the correlated partner (*i.e.*, export growth) on the grounds that the *t*-value of export growth still results in a significance level of 7.5 per cent in a one-sided sense when the amortisation to debt ratio is excluded. This equation is thought to have possibly good predictive results for countries where GDP growth is not closely related to export growth. However, it should be noted that this result might demonstrate another source of collinearity, in this case with reference to export growth and the amortisation to debt ratio.

Multicollinearity may be anticipated as a serious problem in such studies as Mayo and Barrett (1978) and Taffler and Abassi (1984) given that both attempt to extract a manageable set of independent variables from very large numbers of initial indicators which are made up from various extractions from a smaller underlying set of basic debt and macroeconomic variables. For this reason, Taffler and Abassi employ a "varimax rotated principal component analysis" on their second-round reduction set of 42 variables in order to (p. 548) " ... identify the degree of intercorrelation among the variables, ensure that serious collinearity was avoided in the development of the discriminant function and understand better the salient characteristics of country economic performance being measured ..." And anxiety over the problems of multicollinearity is a major influence on the selection of their fourth-stage set of eight variables by means of choosing one or two variables from each of the seven components as illustrated in the Table-2 (p. 551) of their study so as to retain only relatively uncorrelated measures.

However, some problems can be raised both in their using these procedures and in interpreting the results. First, it should be noted that there are inevitable

ambiguities since variables are categorised into ten components without taking into account whether they are strongly or weakly correlated not only within a component but across the components. Second, *levels* and *flows* of variables are used collectively so that multicollinearity problem exists necessarily. For instance, the authors demonstrate that most important variables in the second component referred to as "external indebtness" representing debt-related ratios include levels and flows. Hence, the debt to GDP ratio[15] is with the ratio of net financial flow[16] to imports which can be regarded as one of flow features of the former. In this respect, a question is still valid as to whether their "varimax rotated principal component analysis" adequately removes the underlying multicollinearity.

7-5-6-2. SERIAL CORRELATION AND HETEROSKEDASTICITY PROBLEMS

Serial correlation is the violation of the classical regression analysis assumption that different values of the error term are independent of each other. It is especially likely to occur where the order of the observations has some meaning and it therefore occurs most frequently in time series data sets. That is, the error term from one time period depends in some systematic way on error terms from other time periods. The major consequences of serial correlation are that the variances of estimated coefficients increase and predictions are inaccurate although the bias of coefficient estimates remains unaffected.

The reference to time series data universally found in statistical sovereign risk evaluation models could therefore lead to serially correlated observations. Any country which shows a high value in one variable (*e.g.*, GDP, inflation rate, or debt-service ratio) for one year usually tends to exhibit the same characteristic in one or more subsequent years. The effect on error rates is, as Sargen (1977) states (p.28), that " ... a country which is misclassified (or correctly classified) in one year will tend to be misclassified (or correctly classified) in other years." However, most statistical models do not deal with this problem beyond such general acknowledgements. This might reflect doubts as to whether or not various

diagnostic or detection methodologies such as the 'Durbin-Watson test' and the remedies for serial correlation applicable to ordinary least square regression can be applied to discriminant and logit analyses. However, if serial correlation could make forecasts meaningless, and so compromise the main purpose of statistical models, some attempts should be made to treat this problem seriously.

For binary-valued country observations such residuals will reflect 'unexplained' circumstances whereby a country (or a group of countries) falls into one risk category for a number of successive years, periodically switching to another category and back again. As in the case of multicollinearity, the information content of the data is thereby reduced. Sargen (1977) summarises the point in observing (p. 35) that "The presence of serial correlation means that the number of independent observations is considerably smaller than the total number of observations." The effect produces problems for the usual statistical tests of hypotheses and for forecasting since any country-year classification error is likely to be carried over into succeeding years. In this study, it is argued that serial correlation will usually reflect the systematic influence of omitted but relevant variables. The careful and comprehensive variables selection procedures described below should therefore greatly reduce the possibility of serially correlated disturbances.

Strangely enough there is not even so much as a mention in the literature of the possibility of heteroskedasticity, which is in some respects the 'counterpart' problem of cross-section data. However, it may be that this is just as likely to be as troublesome given the scope for variations in dispersions between observations associated with any number of a variety of different ways in which countries contrast, often sharply. It may also be that the widespread use of ratios helps to discount extreme contrasts in variances but their success in this context has never been formally investigated. And some new sample designs can be made to cope with this heteroskedasticity problem. Here, it is intended that the attention given to sample selections should reduce to a minimum possibility of having to rely on observations from greatly different economies.

CHAPTER 7

7-6. FORECAST PREPARATIONS AND CONDITIONALITIES

7-6-1. INTRODUCTION

The question as to whether residuals analysis in the observation period is also relevant to forecast preparations needs to be considered first. This is because in the context of the most appropriate functional form (*i.e.*, logit analysis), a cut-off probability P^* value has presumably to be decided by residuals analysis if predicted probabilities, $\hat{P}$'s, are to be classified into one of the two groups (*i.e.*, rescheduling or non-rescheduling). However, given that residuals analysis is primarily a means of measuring the robustness of statistical models in explaining individual past reschedulings rather than a preliminary process to applying such models to forecasting, it appears to be more appropriate to review this analysis conventionally under the heading of the analysis of estimation results.

7-6-2. FORECAST PREPARATIONS

The principal objective of statistical approaches to sovereign risk assessment is to produce forecasts of future foreign debt problems of borrower countries. In general, a forecast can be defined as a quantitative estimate about the likelihood of future events obtained from certain models based on past and current information. Thus, by extrapolating such models beyond the period over which they were estimated, the information in them can be used to make forecasts of future events. When an estimated model is available, broadly speaking, two types of forecasts can be prepared, *ex post* and *ex ante*. In the former the forecast period is such that observations on explanatory variables are known with certainty. Therefore, *ex post* forecasts can be checked against existing data to provide a means of evaluating a forecasting model that is free of any errors that might be encountered in forecasting explanatory variables. On the other hand, *ex ante*

forecasts are subject to this additional source of forecast error in using explanatory variables which are themselves forecasts.

7-6-2-1. EX ANTE FORECASTS

Frank and Cline (1971) discuss the preparation of forecasts mainly with reference to a two-variable version of their model. The variables are the debt service ratio and the ratio of debt amortisation to total debt outstanding. Of their total of three statistically acceptable variables, the imports to reserves ratio is dropped from many of the forecasting runs of their model because of a particular difficulty in its prediction as shall be noted later.

In projecting their estimated discriminant functions, Frank and Cline boldly attempt *ex ante* forecasting exercises for twenty-four years beyond their estimation interval. To do so they extrapolate total debt, interest payments, amortisation payments, total debt service, and debt service ratios for seventeen countries from 1967 to 1992. The underlying debt projections are mainly based on IBRD data on debt service payments due. They report (p. 341):

> The foundation of the projections was, in most cases, IBRD estimates of service payments due during the period 1967-1992 on the basis of debt *already* outstanding at the beginning of 1967. Upon this foundation, we assumed new loan disbursements to these countries to continue at the same gross amount (or as an alternative, at the same net amount) as it had in the recent past (in most cases the last tow or three years). The new lending was broken down into several terms categories (usually from 4 to 7 categories) based on recent experience in borrowing by source. The most recent set of loan terms of each lending source, *e.g.*, A.I.D. development loans or IBRD loans, were then applied to the appropriate categories.

Debt service ratio projections additionally require of course export projections. Three alternative assumptions for export growth are cited: a continuation of the 1960-1967 export growth trend for each individual country, a four per cent rate of export growth, and an eight per cent rate of export growth.

The results are reported in terms of the percentage of country-years for which groups of countries are forecast to encounter debt-servicing problems of varying degrees of seriousness. The three groupings are decided according to the degree of debt problem seriousness. For example, Brazil is included in "Group II" and is therefore amongst those countries predicted to "face serious problems only if export growth is low and a large volume of capital imports continue." And Mexico is classified as a "Group III" country which are seen as having the prospect of no less than zero per cent of debt-servicing problem years. However, Mexico officially rescheduled its foreign debt in 1983 and 1984 according to listings published in the World Bank's 1985 edition of its *World Development Report*. And up to recently this country has been still reckoned amongst those countries having the most serious problems of debt-servicing payments. In contrast, Tunisia, which is classified as one of "Group I" countries forecast "to be faced with serious debt-servicing problems regardless of the aid assumption used or the export growth rate," has not experienced any reschedulings until recent date.

These instances of forecast errors clearly imply more fundamental questions about the nature of this exercise. In particular, it seems questionable whether it is valid to forecast such events over twenty years with only a two-variable equation estimated with reference to just nine-years' (1960-68) information. So far as the conditionalities required are concerned, is it useful to predict that Mexico can sustain its debt-servicing capacity over twenty years only if it maintains its past debt and export growth trend?

In order to test the predictive ability of their own model, Taffler and Abassi (1984) also attempt to produce *ex ante* forecasts for 78 less developed countries during the period between the beginning of 1979 and the end of 1983 with reference to projections of their four significant variables. These are the debt contracted in any one year per capita, the debt to exports ratio, the average rate of inflation, and the domestic credit gross to domestic product ratio. In referring to the means by which it might be possible to project explanatory variables *ex ante*

in practice, they suggest that it should be possible to obtain such information by relying on sources such as the "International Economic Appraisal Service (*IEAS*)" of the Economic Intelligence Unit Ltd (*EIU*) since this source in particular (p. 554) " ... provides a large and timely standardized database of economic and financial information relating to the most LDCs." The emphasis is firmly on short-term, *i.e.*, one-year, forecasts for key variables. In this respect, they argue (p. 554) that "Access to the *IEAS* database provides a reliable data source as a starting point with which to test the true *ex ante* predictive ability of [their model] ... and also to generate forecasts of debt servicing problems." This is because a part of the *IEAS* information includes projected values produced by the *EIU* for various time horizons. These are subject to a continuous process of revision. A further complication arises from the fact that the *IEAS* data to not coincide with the statistics in the IMF's *International Financial Statistics (IFS)* and the World Bank's *World Debt Tables* on which their model is based. The results of Taffler and Abassi's *ex ante* forecasts are therefore additionally conditional on these independent forecasting processes.

The authors also identify a problem in deciding which set of predictions is the most appropriate to choose from the continuously modified components of a range of forecast intervals. They therefore observe (p. 554) that " ... since country variables are updated as better information becomes available there is difficulty in reconstructing the true foresightful position for earlier years." This is an inherent part of this particular forecast process, *i.e.*, one relying on a database which can be adjusted and altered by the producer unceasingly. However, assuming (p. 554) that " ... the *EIU* estimated half way into the year being forecast appear to match fairly closely the official statistics eventually appearing up to 2 years later," they elect to test their model's *ex ante* performance with reference to the *IEAS* database as available at the end of 1983.

The resulting short-term prediction procedure clearly contrasts with Frank and Cline's (1971) *ex ante* forecast efforts. This means that it is especially instructive

to look at Taffler and Abassi's evaluations of the usefulness of the statistical innovations and specific *ex ante* forecasts of their study with reference to the forecast errors involved. This is left to the following section.

In attempting *ex ante* forecasts, Cline (1984) carries out projections of his model's underlying variables (*i.e.*, mainly balance-of-payments and debt indicators) for the nineteen largest debtor countries from 1983 to 1986. As an illustration without any precise explanation, it is suggested (p. 237) as a basic assumption that

> ... global lending returns only gradually to its 1980-81 level after the severe 1982 contraction. Thus, the variable *EXBOR* is set at thirteen percent (total borrowing as a fraction of imports) for 1983 (the same level as in 1982), 15 percent in 1984, 17 percent in 1985, and 19 percent in 1986 (the average level for 1980-81).

The results of his *ex ante* forecasting demonstrate that there should be a reduction in debt-servicing difficulties by 1985-86 even for the major Latin American borrowers such as Argentina, Brazil, Chile and Mexico to permit restoration of their creditworthiness without a need for debt rescheduling. And he concludes (p. 237) that "The broad pattern of declining incidence of severe debt-servicing difficulty tends to confirm ... that the debt problem is one of illiquidity, not insolvency." However, an examination of the resulting forecast errors which can be identified with now known subsequent rescheduling and current data indicates that many of them may have come from inaccurate projections of explanatory variables, as in the case of Frank and Cline (1971). For instance, as shall be noted later, the question about how to predict the future value of 'reserves' is relevant in Cline's (1984) *ex ante* forecasts.

McFadden *et. al.* (1985) state that with an appropriate macroeconomic model which provides forecasts of standard macroeconomic ratios, multiyear forecast can be prepared although their accuracy is limited by the appropriateness of the model used, by the presence of time and country effects on debt management behaviour,

and by the incidence of exogenous shocks. Thus, they argue (p. 195) that "Subject to these caveats, the system should be useful for analyzing the impact of alternative policies for a few years ahead." In this respect, McFadden and his associates simulate a calculation of probabilities of repayment problems for eight selected countries from 1972 to 1985, the last three of which are out-of-sample, by employing "first-order vector autoregression" projection of the explanatory variables for short-term *ex ante* forecasting. However, there are no explicit explanations about the substantial procedures of variable projections in their paper.

7-6-2-2. EX POST FORECASTS

Feder and Just (1977) prepare forecasts for two versions of their logistic model (one of which excludes the GDP growth rate while the other drops the amortisation to debt ratio). Prediction probabilities are provided for 102 observations on public or publicly guaranteed loans granted to 27 developing countries during the 1973-74 period within a set of data relevant to countries borrowing in the Euro-dollar market. Although Feder and Just do not discuss the point explicitly, their forecasts seem to be *ex post* forecasts since data on observations in the forecast interval were extracted from an earlier paper by Feder published in 1976 while their own paper was submitted for publication in March 1976 which was at least two years later than the forecast period so that there was no need presumably for them to have projected their seven explanatory variables.

Feder, Just and Ross (1981) develop a model with the special intent of providing a framework to facilitate forecasting. Reworking the earlier Feder and Just (1977) study, they concentrate on presenting a methodology capable of projecting debt-servicing capacity by using an empirically based logit model beyond the short-run. Their paper, however, makes no attempt to discuss details of the kind of macroeconomic model that they say that they need for projecting medium- and long-run forecasts of explanatory variables. They themselves report only *ex post*

forecasts to verify that the discriminatory performance of their logit model does not significantly deteriorate for out-of-sample circumstances. This exercise relates to 135 observations for the period 1977-79, of which ten are associated with rescheduling cases.

Despite the overriding purposes of statistical models of sovereign risk as forward looking forecasting tools, Sargen (1977), Mayo and Barrett (1978), Saini and Bates (1978), and Kharas (1984) all make no effort to report forecasts outside sample periods for their respective models. Indeed, the only reference Sargen makes to the qualifications surrounding statistical country risk appraisal procedures occurs in the concluding section of his paper where he notes (p. 33):

> 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 equation, and by problems caused by the small samples used in analyses of previous rescheduling.

Similarly, given the innovative investigation of several problems found in earlier statistical studies, it is especially curious that both the Saini and Bates and the Kharas studies make no attempt to investigate the potential true forecast accuracies of their respective models.

7-6-2-3. A CUT-OFF POINT IN THE FORECAST INTERVAL

Instead of deciding directly on one critical probability as a cut-off point between forecast rescheduling and non-rescheduling country-years, Feder and Just (1977) investigate the number of corresponding error cases for different P^* cut-off points. Based on this frame, the critical probability value P^* is decided to minimise the total number of error cases for the estimation period. However, this procedure of choosing P^*, based completely on the analysis of within-sample residuals, clearly cannot guarantee that such a P^* choice will yield the same minimisation of forecast errors. Structural breaks in world economic circumstances and the situation of

individual countries might move the distribution of $\hat{P}$'s altogether so that other P^* points are more appropriate. This is effectively illustrated by Feder and Just's review of a range of acceptable P^* selections (*i.e.*, from 0.18 to 0.50) for their *ex post* forecasts.

Far more importantly, however, the extension of residual analysis preoccupations with the choice of a P^* cut-off point to forecast preparations causes useful information generated to be lost by forcing a dichotomous classification on to a given set of $\hat{P}$'s. Thus, in order to utilise more efficiently the implications of continuous $\hat{P}$ distributions, it would be useful to consider the accuracy of such predictions with reference to the purposes they serve in practice such as the design of both creditor loan portfolios and debtor-country policies. It is interesting to note Feder and Just's comments (p. 36) on the latter in this context:

> **The results of this study are obviously useful for debt servicing capacity analysis by potential lenders....**
>
> **But the results also hold some useful possibilities for borrowing countries. Increasingly, developing countries are entering commercial capital markets for funds; and, of course, the availability of these funds depends on their debt servicing capacity. The controlled regulation of important debt servicing capacity indicators can thus become an important part of government policy in reaching many other national objectives. In formulating national policies, it may also be particularly important to carefully control the probability of default since a reputation for default may seriously limit future credit possibilities.**

Similarly, Feder, Just and Ross (1981) follow the line of Feder and Just (1977) by discussing P^* with reference to their $\hat{P}$'s distributions for out-of-sample forecast period. By doing so, the authors attempt to compare forecast errors with within-sample period residuals.

In preparing *ex ante* forecasts, Cline (1984) illustrates trends of predicted probabilities ($\hat{P}$'s) for nineteen countries having the largest debts. The results indicate that all of the countries except Ecuador and Algeria show reductions in their debt-service burdens by 1985-86. This result is considered to confirm that the debt problems in 1982-83 relate to illiquidity circumstances of borrowing countries

not to insolvency situation. Apart from a judgement on this implication, such a more sensitive use of predicted probability distributions might suggest further benefits from a reduction of the information losses that otherwise result from simple binary classifications.

7-6-3. FORECASTING CONDITIONALITIES

Two major sources could be considered responsible for forecasting errors particularly in *ex ante* forecasts, *i.e.*, errors in projecting of explanatory variables and the possibility of structural breaks.

7-6-3-1. PROJECTION DIFFICULTY OF EXPLANATORY VARIABLES

As mentioned before, Frank and Cline (1971) exclude the imports to reserves ratio from a part of the forecasting runs of their model because of a difficulty in its prediction. This ratio consists of two components of the balance of payments, *i.e.*, imports and reserves. A change in reserves is the overall balancing item in a balance of payments, so it is difficult to project the future level of reserves without having first to predict all of its other components such as trade, payments for services, transfers and various categorisations of capital flows. Frank and Cline say no more other than that the " ... prediction of the reserves to imports ratio is particularly difficult". However, it is likely that the problem largely relates to the reserves component. Such an inference can be supported by the fact that they are prepared to undertake projections of exports while imports are likely to be largely endogenous determined.

Although Frank and Cline indicate projection difficulties of reserves, the following studies, the one exceptional case of Kharas (1984), use reserves-related explanatory variables. Even Feder, Just and Ross (1981) and Cline (1984), who attempt to employ indicators that are as easy as possible to predict in their model

specification, include the ratio of reserves to imports. In the case of Cline (1984), in particular, this ratio is projected for his *ex ante* forecasting exercises as pointed out earlier. However, there is no explanation as to how he forecasts the future value of reserves for each country beyond the estimation period.

With regard to the 'foreseeability' of explanatory variables in more general terms, Feder, Just and Ross try to introduce those variables which can be projected by using macroeconomic models for a medium- and long-run projection horizon. From this standpoint, the kind of monetary indicators, such as inflation rates, exchange rate changes, and the growth rate of money supply, that are introduced for the first time by Sargen (1977) to statistical sovereign risk analysis, are deliberately excluded from their explanatory variables because of limitations in projecting them for the purposes of forecasting. Cline (1984) also argues that inflation is not a satisfactory explanatory variable for his model since there is little firm basis for projecting country-by-country inflation rates in the future.

In contrast to such considerations, however, it is noticeable that Sargen asserts that his "monetary approach" variables cited above typically have relatively early publication dates so that have the advantage of being more useful as "early warning" indicators. Thus, statistical models relying on such monetary indicators may be regarded as having a special value in forecasting over short-term horizons by being able to refer to actual values of these kinds of variable.

Apart from the adequacy of monetary indicators as explanatory variables, the question as to whether other variables (mainly debt and balance-of-payments variables) can be forecast accurately over long-run horizons for all countries remains a lively issue. However, Feder, Just and Ross (1981) avoid the need to demonstrate their recommended procedure for projecting explanatory variables since they do not attempt any *ex ante* forecasting with their model. Taffler and Abassi (1984), however, provide an illustration, as noted earlier, of what can be achieved in practice by referring to the *IEAS* database prepared by the *EIU* which

provides not only an extensive list of relatively standardised indicators but short-term (one year) forecasts of key variables.

7-6-3-2. STRUCTURAL BREAK

The use of predicted values based on past trends can only produce forecasting results similar to those of the estimation period since trend analysis, in general, depends on structural stabilities. Accordingly, a country which, for example, obtains a relatively high rank in some 'creditworthiness hierarchy' within a given sample period thus might also be expected to be seen as being equally favourable to creditors in the future since predicted trend values of key variables may not be significantly different from past ones while the same estimated model is applied to all countries. Thus, but for external shocks and the effects of macroeconomic policy variables, especially with reference to a balance of payments, or, unless different trends are applied to different countries, forecasts of future debt-servicing difficulties based on simple projections of summary indicators can only extrapolate relative credit ratings.

Mayo and Barrett's (1978) study can be noted as having particularly interesting standpoints in this respect. They make no attempt to produce forecasts beyond their respective estimation intervals. Nonetheless, they argue that their models themselves contain a "forecasting mechanism". They try to specify what they intend should be an "early warning model". This is attempted by extending the forward looking power for predictions of future reschedulings by means of a five-year time horizon. Since the logit probability of rescheduling within any one year of a five-year interval is reckoned to be related to just one set of past explanatory variables, they claim that their "early warning model" does not need to project these variables in the manner found in Frank and Cline (1971). This seems illogical essentially for the reasons set out above while in purely practical terms it might be asked if the same facility applies equally well to 10- or 20-year forecast intervals.

A major issue concerning forecast errors is associated with how to deal with the existence of structural breaks during the projection period. In their *ex ante* forecasting exercises, Frank and Cline (1971) assume (p. 343) that " ... roughly the same factors which operated in the past are likely to continue in the future." However, is it rational or realistic to consider that there will be no structural shifts in foreign and domestic circumstances over twenty years? If we examine just the Frank and Cline's projection period (1967-92), it is beyond question that oil-shocks (in 1973 and 1979 approximately) have twice changed world markets for goods, services, and finance considerably and have undermined the economic situations of borrowing countries. Moreover, the surge of reschedulings in Latin American countries starting from 1983 was primarily due to changes in the world economy that could not be captured in Frank and Cline's forecasting model.

The existence of structural shifts have been demonstrated by several authors even within the size of their sample intervals. Saini and Bates (1978), in particular, examine the effects of a structural break on parameter estimates by dividing the sample period into two intervals, *i.e.*, 1960-70 and 1971-77. The 1970-71 division is chosen to reflect the advent of more flexible exchange rate regimes in the early 1970's as well as the greater concentration of balance-of-payments support loans in the 1970's. Their results suggest (p. 17) that the estimated coefficients and their associated statistics " ... are sufficiently different to indicate a shift in the parameters" between these two sub-periods. And McFadden *et. al.* (1985) report that there are substantial differences in the estimated coefficients of their model between two periods, *i.e.*, 1971-75 and 1976-82. In this case a formal likelihood ratio test for equality of coefficients in the two periods leads to the conclusion (p. 193) " ... that the coefficients of [their] model are definitely not stable over time." Although such results are not linked to the issue of out-of-sample period forecasting, they are valid enough to demonstrate the effects of structural breaks. In this sense, statistical sovereign risk models might be limited, strictly speaking, to one-period-ahead forecasts by the problem of explanatory variable projections especially with reference to the question of structural breaks. The point highlights

the limitations imposed by forecast conditionalities in practice, especially in the case of *ex ante* forecasting.

Feder, Just and Ross (1981) discuss the theoretical implications of a special dimension to these conditionalities that relates to the incidence of reschedulings between the estimation interval and the point at which a forecast is required. In particular, they suggest a method to calculate the cumulative unconditional probability that a rescheduling will happen some time within a certain period by computing a sequence of conditional probabilities which mean that there will be no rescheduling by t year but a rescheduling in $t+1$ year. This implies that without considering these conditionalities a further source of forecast error should follow. However, as in the case of misgivings about the Mayo and Barrett (1978) dependent variable formulation, such cumulative unconditional probability calculations might be of limited practical significance where attention is focused on the immediate future or on the incidence of first-time debt-servicing difficulties. In this account, some other analytical efforts may be needed for alleviating forecast conditionalities related to existing structural break problems.

7-7. FORECAST ERROR ANALYSIS

7-7-1. INTRODUCTION

Broadly speaking, differences between dependent variable predictions and realisations may refer to either observation period residuals or to forecast errors for some out-of-sample period. Sources of the first kind of error are restricted to the specification of the model, the statistical parameter estimation method, and the information used to estimate the model. They therefore measure the ability of a model to account for individual sample points and as well as to provide a basis of comparison for evaluating out-of-sample forecasts. In moving outside the estimation interval the difference between forecasts and realisations is marginally the result of structural breaks between the estimation and forecast intervals provided the values of the explanatory variables are known with certainty at the time of forecasting, *i.e.*, as in the case of *ex post* forecasting. Where that qualification is itself relaxed then, the additional sources of forecast errors relate to what are referred to a *ex ante* forecasts.

Subject to these qualifications, three broad kinds of forecast error analysis may be attempted. First, forecast errors could be investigated by means of comparing prediction errors for some out-of-sample period with observation period residuals. *Ex post* forecast comparisons could thereby be used to detect structural shifts between the observation and the forecast periods. The second alternative is to compare the prediction errors with those occurring in alternative expressions of any one model, for example, by applying it to a different period, by modifying some specification assumptions, or by changing the estimation methodologies used. Some of these variations might apply equally well of course to forecasts from other publications or from other forecast processes. Third, the significance of forecast errors could be tested against some hypotheses by means of some appropriate formal statistical methodology.

7-7-2. FORECAST ERROR EVALUATION

With regards to an analysis of within-sample residuals, Frank and Cline (1971) produce forecasts of reschedulings from their discriminant model simply on the basis of the critical discriminant score, Z^*, which yields the fewest sum of type I and type II errors (classifying a rescheduling country as non-rescheduling and *vice versa*, respectively). Of all the simulation exercises reported the best gives zero type I errors among thirteen rescheduling observations and twelve type II errors among 132 non-rescheduling observations. While in general they encounter more type II errors than type I errors, it is argued that many of them are close to years in which countries did in fact reschedule their foreign debt. They therefore report (P. 339) that

> Argentina was predicted to reschedule in 1962 and 1964 when actually reschedulings took place in 1961, 1963, and 1965. Brazil, Chile, India and Turkey are also predicted to reschedule in years immediately preceding reschedulings. The other 4 type II errors relate to Mexico which has had a very high debt service ratio but has not rescheduled.

As already noted in the previous section, the authors use their estimated model to produce *ex ante* forecasts for the period 1967 to 1992. The results of Frank and Cline's projections are reported in terms of forecasts of the percentage of country-years for which serious debt-servicing problems are indicated during the forecast period for groups of countries. Thus, "Group III" countries (*i.e.*, Mexico, Argentina, Bolivia, Iran, and Nigeria) demonstrate zero per cent probability of debt-servicing difficulties in 25 years. Although the authors were clearly not in a position to compare these forecast outcomes with realisations, it is now possible to do so. It is known that even all the "Group III" countries, with exception of Iran, experienced reschedulings several times. These forecast errors are enough to cast doubts on their 'far-forward-looking' forecasts.

In confining forecasts to a period when realisations were already available, Feder and Just (1977) can identify forecast errors outside the sample period. Their

evaluations take the form of comparisons between within-sample (1965-72) and out-of-sample (1973-74) errors.[17] Their evaluation procedure therefore provides a means of checking whether their estimated model holds equally well in the immediately succeeding interval.

With regard to within-sample errors, the least total number of errors (one type I and five type II errors) are made when the critical probability value (P^*) is 0.4 . None of the trial P^* values, however, produce more than 11 errors in a total of 238 observations. In selecting a critical probability value P^* for any given $\hat{P}$'s distribution, they seem to concentrate more attention on reducing type I errors rather than type II error cases. It is not clearly explained, however, as to why this is or what the relative costs of the two types of error might be.

Rescheduling probability predictions are also prepared for 102 observations on public and publicly guaranteed loans granted to 27 developing countries during the 1973-74 out-of-sample interval. Only in the case of eight loans to three countries are the predicted probabilities higher than 0.12. Their reaction to this is to say (p. 35) that "... the perceived default probabilities were rather low since all the lenders are commercial institutions which would not grant a loan to an excessively risky country." However, it may be more objective and rational to seek a cause just as much in terms of the extremely imbalanced frequency between rescheduling and non-rescheduling cases that typically characterise the data than to accept the lenders' subjective perceptions as the sole cause of this result.

Their two-year forecast interval of course contrasts sharply with that of Frank and Cline (1971). This may however be reckoned to be more practical by allowing more or less immediately available realisations to be used to identify forecast errors and so suggest model adjustments. Additionally, short-horizon forecasts are likely to correspond more closely to the interests of most prospective creditors.

In the case of these *ex post* forecasts, Feder and Just review considerably wider ranges of P^* alternatives. Thus, they find that if the critical probability value is taken anywhere in the range from 0.18 to 0.50, only three to five type II errors are made without any type I error cases. They conclude (p. 36) that in general "... the error rates are quite consistent with those obtained for the sample actually used on estimation of the logit model and confirm the overall good predictive performance of the estimates ..." Such procedures of course do not address the problem as to how far such *ex post* forecasts P^* would be appropriate for $\hat{P}$'s interpretations when faced with the practical challenge of *ex ante* forecasts.

In deciding on a critical Z^* value for within-sample errors, Sargen (1977) assumes that the expected cost of a type I error is three times of that of a type II error. His discriminant function thereby produces eight type I errors when the debt-service ratio is included. There is no reference to the exact number of type II errors but from examining a chart (p. 33) illustrating the relation of error rates to value of cut-off point, it seems that the type II error rates are approximately seven to nine per cent. Based on these results, he argues (p. 33) that

> the discriminant rules perform best in explaining reschedulings in South American countries ... 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 ... Reschedulings in South Asian countries, on the other hand, require some information on the adjusted debt-service ratio.

This is perhaps an instructive illustration as to how well forecasts for different countries depend on different kinds of information. As indicated in the previous section, Sargen makes no attempt to report forecasts beyond the estimation period with his discriminant function. The difficulties posed by correct projection of explanatory variables, structural changes, and reliance on small samples in respect of reschedulings are simply listed as major obstacles against an effective anticipation of future reschedulings.

Like Sargen, Mayo and Barrett (1978) and Saini and Bates (1978) make no effort to extend their statistical models outside the estimation interval. There are, however, one or two interesting differences in their evaluations of within-sample period residuals. As reviewed before, Mayo and Barrett (1978) try to extend the forward-looking power of predictions by means of a five-year time horizon in what they call an "early warning model." Since many type I errors are associated with reschedulings that occur in adjacent years to forecast rescheduling, it might be expected that their model would have a rather wider forecast range would help to reduce forecast errors. It turns out however that their within-sample period error rate is relatively high. Thus, 24 per cent of rescheduling cases up to five years in advance are predicted incorrectly although it should be added that this type I error rate corresponds to a critical probability value (P^*) aimed at equalising the number of error cases in rescheduling and non-rescheduling categories. The type II error rate is thirteen per cent.

While ignoring the forecast performance of their model, Saini and Bates concentrate on presenting empirical tests of what they see to be the principal problems and weaknesses found in earlier studies. Forecast errors in their within-sample period are used to investigate whether there is any significant difference between estimates of discriminant and logit functions, of two sub-periods (*i.e.*, 1960-70 and 1971-77), and of "modified" and "traditional" dependent variables. For instance, in the case of the modified dependent variable comprising "involuntary debt reschedulings" and "balance of payments support loans", despite substantial improvements in *t*-statistics for the explanatory variables, there appears to be no corresponding reduction in total error rates compared to the traditional dependent variable which includes just official reschedulings. And for the second sub-period (1971-77), the total error rates are reduced from nineteen per cent in the first sub-period (1960-70) to 9.5 per cent in case of the logit function. This second result is reckoned attributable to the greater use of loans for support of balance of payments situations during the second sub-period. The results show that there is no significant difference in the total

error rates between the discriminant and logit analyses. This is consistent with comparisons of estimated coefficients for explanatory variables. They thereby conclude that there is no difference between the two estimation procedures in their ability to isolate cases of debt-servicing difficulties.

Compared to the total error rates reported by Feder and Just (1977) and by Mayo and Barrett (1978), those of Saini and Bates seem to be generally unfavourable. However, strictly speaking, it may be inappropriate to compare results in this way because of additional differences in terms of sample sizes, periods covered, and variables examined. For that reason, Saini and Bates attempt to examine further their model's appropriateness by adopting some of the same procedure used explicitly by Feder and Just. The results indicate that the total error rates calculated by the logit function decline from nineteen per cent to ten per cent, while type I error rates fall from seventeen per cent to nine per cent. They therefore conclude (p. 18) that their " ... apparently poorer results are primarily due to differences in methods used in this and previous studies."

Feder, Just and Ross (1981), continuing the previous work of Feder and Just (1977) subject to minor adjustments of scope and definition of the dependent variables, similarly make a comparison between error rates for within-sample and out-of-sample periods. In the case of the first, the type II error rates are reported as being relatively low even for a critical probability values (P^*) as low as 0.1 for all three different versions of their model. This implies again highly skewed $\hat{P}$ distributions. In the event, they suggest a cut-off point at around 0.2. As they point out, however, the choice ultimately should depend upon a user's attitude towards risk and preferences as between type I and type II errors. For 135 observations for the out-of-sample period 1977-79, *ex post* forecasts are used to check if the discriminatory performance obtained for the within-sample period is significantly reduced. It is reported that the type II error rate increases overall while the type I error rate decreases as compared to within-sample results. Nevertheless, they report that the generally "somewhat higher" type II error rates

are within an "acceptable range" for the out-of-sample period, although they do not explain the basis of such a judgement.

Taffler and Abassi's (1984) forecasts for the period 1979-83 produce type I and type II error rates of 31 and 26 per cent, respectively. Uniquely in this area, they introduce a 'standard significance test' to evaluate the statistical significance of forecasts errors. The standardised normal deviate conventionally defined as

$$z = \frac{p - \pi}{\sqrt{\pi(1 - \pi)/n}},$$

where p is an observed sample proportion, π the probability of a chance correct classification, and n the number of observations. Using this equation, two hypotheses can be tested, *i.e.*,

$$(H_0{:}p_1 = \pi_1), \ \textit{against}, \ (H_1{:}p_1 > \pi_1)$$

and

$$(H_0{:}p_2 = \pi_2 = 1 - \pi_1), \ \textit{against}, \ (H_1{:}p_2 > \pi_2)$$

where π_1 is the overall observed proportion of reschedulings in the forecast interval, p_1 is the proportion of predicted reschedulings that observation shows to have been correct and π_2 and p_2 are the equivalent ratios for trouble-free years. The two maintained hypotheses are rejected at the 0.1 per cent significance level.

In extending their judgements of their model's comparative forecast performance, Taffler and Abassi refer to forecasts alternatively available from a consensus view of bankers' judgements as expressed by the "*Institutional Investor* credit risk index". In order to test the ability of the credit risk index to predict reschedulings reference is made to the "September credit rating scores" which are expressed on a scale of 0-100. For the purposes of comparisons with forecasting results from their "early warning model", the authors organise the information provided by the September ratings as follows (p. 556):

> Stage 1: Countries common to both databases were identified ...
>
> Stage 2: The September 1979 and September 1980 [*Institutional Investor*] credit rating scores were used in conjunction with the list of 1980 and 1981 rescheduling cases of the Appendix to determine an appropriate cut-off.
>
> Stage 3: This threshold was then employed to predict 1982 and 1983 reschedulings on the basis of the September 1981 and September 1982 [*Institutional Investor*] scores.
>
> Stage 4: The results were compared with the performance of the [*early warning model*] on the same restricted country set.

A cut-off threshold is decided on so as to minimise the two types of error.

A comparison of performances for the period 1980-83 shows that the statistical model forecasts more correctly than the bankers' credit risk index. The total correct prediction rates of the two systems are 71 and 64 per cent, respectively, but in the case of type II error rates, the latter has a slightly better result of 54 per cent compared with the 56 per cent on the former. Based on these results, they conclude (p. 558) that

> The relative performance of the two approaches to country risk analysis is somewhat unexpected. *A priori* it is surprising that a simple four-variable discriminant model derived from economic data of arguable quality should demonstrate good predictive ability several years after it was developed despite the major structural changes occurring in the environment in which it is applied. Secondly, it is possibly even more interesting that a rating system based on the pooled knowledge, up-to-date information and collective wisdom of up to 100 banks does not appear able to outperform the statistical approach.

Kharas (1984) examines residuals in the estimation period in order to investigate the details of the within-sample predictive power of his model. With a critical probit probability value of 0.125, which is considerably lower than other cut-off points adopted in previous studies, presumably due to the extremely low frequencies of rescheduling cases (*i.e.*, seven per cent of total observations), his model produces five type I errors (seventeen per cent) and 29 type II errors (seven per cent).[18] The five type I error cases are Argentina (1965), Indonesia (1970), Turkey (1965), Pakistan (1971), and Zaire (1975). With regard to the possible causes of these errors, Kharas (1984) argues (p. 438) that

> ... ir some cases (Argentina and Turkey) additional information not captured in the simpl: model would have raised the calculated probabilities substantially. In other cases (Zaire and Pakistan) external events will low probabilities (copper price fall and the war, respectively) actually took place.

Cline's (1984) critical probability in the estimation interval is chosen so that the total errors are minimised subject to a relatively equal percentage rate of error in the two classes of observations. The resulting 0.041 critical value is greatly lower than any other cut-off points of preceding models. This low critical point, as Cline points out (p. 230) "... appears to reflect the large imbalance between non-rescheduling cases (97 per cent of country-year observations) and rescheduling cases (three per cent) in the underlying population." Such an excessively skewed $\hat{P}$'s distribution must,however, as pointed out several times earlier, cast a doubt on models aimed at producing dichotomous forecasts. With this critical value, he examines the overall statistical performance and error rates of five alternative models, representing alternative combinations of excluded explanatory variables, for the estimation period. The results explain an average of approximately 86 per cent of non-rescheduling cases and 88 per cent of rescheduling cases. These error rates can be seen as being the more impressive given that they relate to a more recent time period than does any other previous study.

Cline examines what he sees to be a systematic difference in the predicted probability distributions between larger and smaller debtor countries. For the 31 countries with larger debts, the average value of the predicted probability of a rescheduling is 0.32 for those country-years in which reschedulings occurred. In contrast, the other 29 countries with smaller debts show an average value of 0.2. This result implies that the smaller debtors experience debt-servicing difficulties at lower levels of underlying debt burden than the larger debtors. Cline considers (p. 231) this to be rational since "most of the countries [with larger debts] ... would be judged on an informal basis by international creditors to be able to sustain relatively higher levels of debt than those [with relatively small debts] because of past debt performance and level of development ..." Aside from a discussion about it, the reference of country differences is surely something worth following up.

Of the ten type II erroneous predictions for 31 large debtor countries, three cases (*i.e.*, Bolivia in 1979, Brazil in 1981, and Chile in 1982) rescheduled their debts substantially in the year subsequent to the one when the false prediction occurred. In addition, the predicted probabilities in each of these cases increased abruptly in the year just before the actual rescheduling (*e.g.*, in case of Brazil from 0.03 in 1980 to 0.75 in 1981). These insights can be obtained by examining the trend of predicted probabilities over time. Such a trend evaluation can therefore suggest a useful additional criterion for predicting pre-rescheduling situations.

Cline's individual predicted probability ($\hat{P}$) trends for 31 major debtor countries over the within-sample period 1971-82 show that potential debt-servicing difficulties among them increased significantly in 1982 as the proportion of countries with a predicted probability above the critical level rises from sixteen per cent in 1981 to 41 per cent in 1982. This result leads him to test whether the serious creditworthiness problems of 1982 are temporary or permanent with reference to *ex ante* forecasts based on projections of balance-of-payments and debt variables for the nineteen countries having the largest debts for the out-of-sample period 1983 to 1986. The results projections indicate that all of the countries except Ecuador and Algeria would make sufficient reductions in their debt-servicing burdens by 1985-86 to permit a return to creditworthiness without the need for debt reschedulings. Cline is thereby led to the conclusion that the debt problem in 1982-83 should be regarded as one of illiquidity not insolvency. The persistence of difficulties in realty would now suggest otherwise of course. Whether the forecast error is the result of the model, or mistakes in explanatory variable projections, or faulty concepts (*i.e.*, the distinction between illiquidity and insolvency) would require further investigation. Cline's trends for predicted probabilities perhaps have an especially useful contribution to make judging how long new lending should be supported for a specific country suffering from debt-servicing difficulties. This issue may also be related to the problem of deciding on the success of recoveries to normal creditworthiness.

Reschedulings for Egypt, Portugal, and the Philippines in 1983-84 prove to be predicted correctly by his logit model. However, it fails to forecast the actual reschedulings of Venezuela and Peru in 1983. The reasons for these two forecast errors are explained as follows (p. 238):

> **In the case of Venezuela, the high level of reserves yields an extremely low probability of rescheduling. The economic information contained in this estimate is broadly that the temporary problems of Venezuela in 1984 were more a manifestation of market confidence and mismanagement than a sign of underlying economic weakness. And for Peru the low level of the indicator suggests that ... the 1983 rescheduling was mainly a phenomenon caused by region-wide adverse psychology of the capital market rather than economic fundamentals.**

Of the various model versions in the McFadden *et. al.* (1985) analysis, one that adds an "indicator of lagged repayment problems", in the form of the one-year lagged dependent variable, shows the best results in accounting for realisations within the 1971-82 estimation interval. It produces an overall score of approximately 83 per cent correctly predicted country-years with a fifteen per cent type I error rate and a 24 per cent type II error rate. The authors prepare *ex ante* forecasts by producing projections on eight significant explanatory variables by a "first-order vector autoregression". The results include probabilities of repayment problems for eight selected countries (*i.e.*, Argentina, Brazil, Chile, Republic of Korea, Mexico, Peru, the Philippines, and Venezuela) through to 1985 beyond the observation period of 1971-82. However these *ex ante* forecasts do not appear to be the subject of any forecast error analysis. The main reason for that might stem from the fact that unlike previous other studies, no attempt is made to present a procedure for choosing a P^* cut-off probability for the forecast period. According to the estimated probabilities of repayment problems exhibited in Table 7-13 of their paper (p. 197), probabilities for major Latin American countries, such as Argentina, Brazil, Chile, and Mexico, decline sharply from 1983 to 1984 but more slowly for the period 1984-85. These are to a certain extent similar results to those found in Cline (1984) except that there these countries are predicted to return to "safe" levels of debt-servicing burden from 1985 (1986 in case of Brazil). Other

comparisons are precluded by the absence of a critical point in the McFadden *et. al.* study.

7-8. SUMMARY

This chapter reviews ten major statistical analyses of sovereign risk. There appears to be no considerable differences among them so far as their methodological approaches to producing and evaluating credit ratings are concerned. They all essentially follow the same line in quantifying observed problem-free *versus* debt-problem country years in the form of a 0,1 binary dependent variable; the use of either logit or discriminant analysis models to relate this variable to explanatory variables; *ad hoc*, individually argued, selections of the latter; no-lag or one-year lag specifications; largely unstructured sample selections except for differences in the treatment of problem-free years for countries having some experience of debt problems; and forecast error evaluations in terms of type I and II errors where forecast probabilities ($\hat{P}$'s) are first turned into 0,1 forecasts of reschedulings with reference to same critical (P^*) value so that $\hat{P} > P^*$ is reckoned as a forecast rescheduling and *vice versa*. This is not to say, however, that there are no differences in a number of details and Table 7-1 summarises many of these in a tabular form.

Table 7-1 TABULAR REVIEW OF TEN MAJOR STATISTICAL SRA MODELS

NATURE OF ANALYSIS	*REFERENCES*[a]									
	F&C (1971)	F&J (1977)	S (1977)	M&B (1978)	S&B (1978)	F,J,&R (1981)	T&A (1984)	K (1984)	C (1984)	McF (1985)
[EMPIRICAL EVIDENCE]										
Nb. of observations	145	238	466	571	298	580	715	441	670	1125
Sample period	1960-68	1965-72	1960-75	1960-75	1960-77	1965-76	1967-78	1965-76	1968-82	1971-83
Nb. of countries	26	30	44	48	25	56	95	43	60	93
Nb. of reschedulings	13	21	24	28	23	40	55	30	22	413
(ratio to observations)	(9.8%)	(8.8%)	(5.2%)	(4.9%)	(7.7%)	(6.9%)	(7.7%)	(6.8%)	(5.3%)	(36.7%
(nb. of rescheduling countries)	(8)	(11)	(14)	(11)	(13)	(11)	(14)	(11)	(16)	(?)
Nb. of shortlisted indicators	8	9	8	50	11	6	60	4	11	15
(nb. of significant indicators)	(3)	(6)	(6)	(6)	(4)	(6)	(4)	(4)	(7)	(6)
Lag structure	t-1	t-1	t	t to t-5	t-1	t	t-1	t&t-1	t&t-1	t-1
Analytical methodology[b]	DA	LA	DA	LA	D,LA	LA	DA	PA	LA	LA
Total error rates	12%	3%	9%	14 %	19%	6%	9%	7%	3%	17%
(cut-off point)	?	0.4	?	?	?	0.2	?	0.125	0.041	?
(type I, type II error rates(%))	(23,11)	(5,2)	(33,8)	(25,13)	(17,19)	(15,5)	(10,9)	(17,7)	(9,13)	(15,24)
[FORECASTING EXERCISES]										
Nb. of observations	?	102	n.a.	n.a.	n.a.	135	390	n.a.	?	?
Forecast interval	1967-92	1973-74	n.a.	n.a.	n.a.	1977-79	1979-83	n.a.	1983-86	1983-85
Forecast horizon	ex-ante	ex-post	n.a.	n.a.	n.a.	ex-post	ex-ante	n.a.	ex-ante	ex-ante
Nb. of courtries	17	27	n.a.	n.a.	n.a.	?	78	n.a.	19	8
Nb. of reschedulings	?	3	n.a.	n.a.	n.a.	?	78	n.a.	19	8
(ratio to observations)	?	(2.9%)	n.a.	n.a.	n.a.	(7.4%)	(18.7%)	n.a.	?	?
(nb. of rescheduling countries)	?	?	n.a.	n.a.	n.a.	?	(32)	n.a.	?	?
Nb. of indicators used	3	6	n.a.	n.a.	n.a.	6	4	n.a.	7	8
Total error rates	n.a.	0%	n.a.	n.a.	n.a.	9%	27%	n.a.	n.a.	n.a.
(type I, type II error rates(%))	n.a.	(0,3)	n.a.	n.a.	n.a.	(10,9)	(31,26)	n.a.	n.a.	n.a.

a. F&C ; Frank and Cline
S ; Sargen
S&B ; Saini and Bates
T&A ; Taffler and Abassi
C ; Cline
F&J ; Feder and Just
M&B ; Mayo and Barrett
F,J&R ; Feder, Just and Ross
K ; Kharas
McF ; McFadden and others

b. DA ; Discriminant Analysis
PA ; Probit Analysis
LA ; Logit Analysis

n.a. not available.
? not explained.

NOTES

1. Feder and Just (1977) note (p. 30) in this connection that " ... for cases where a rescheduling agreement was arranged after service difficulties were already apparent, a default is assumed to have taken place in the year in which significant arrears occurred. In cases where an agreement was reached ahead of time, the default date is assigned to the year in which payments were first deferred."

2. India and Pakistan seem to be excluded totally from the country-year data base of Cline (1984), if it is taken into account that he omits either non-rescheduling observations in these countries.

3. They report practically that "repayments problems occur in 36.7 per cent of the country-years observed."

4. Arrears in practice are used most frequently.

5. In other words, it may imply the level of capital stock necessary to generate the tax base that will provide the government with enough revenues to service the debt.

6. The last two alternative variables are used to correct a potential error source in the form of the constant term which varies non-randomly depending on country size. Thus, either population or the level of investment (gross fixed capital formation, net foreign inflows and debt service) is employed to provide an appropriate scaling factor.

7. That is gross debt minus reserves.

8. With respect to this issue, the authors point out (p. 187) that

> Both the declining importance of official long-term lending for capital projects and the limited capacity of official institutions to guarantee debt will increase the vulnerability of developing countries to suppliers who are hypersensitive to short-term expectations regarding the riskiness of their loan portfolios. If the demand for credit by industrialized countries and oil exporters becomes more volatile (because of macroeconomic instability or oil demand shocks), the resulting volatility of debt service costs and the potential liquidity problems of developing countries are increased. This causes their creditworthiness to decline which results in increased risk premiums and stricter exposure ceilings.

9. Institutional rules on exposure of leading banks, distortions in incentives by official guarantees *etc.* are taken as examples to " ... inhibit the supply of credit to heavy borrowers even when solvency is not seriously in question ... [and] introduce a divergence between the assessment of a developing country's true creditworthiness, made on the basis of complete information, and the short-run assessment."

10. These are per capita loan commitment, inflation rate, the ratio of debt to exports, and the domestic credit to GDP ratio.

11. See the previous section 7-5-2.

12. The studies such as Efron (1975) and Press and Wilson (1977) are referred to.

13. See Pindyck and Rubinfeld (1988, pp. 310-12).

14. Of course, *t*-value estimates are not always an absolute criterion. For example, Mayo and Barrett employ several other statistical rules such as correctness and consistency of the coefficient sign and the change in the predictive capability of the equation when the variable is dropped from the model either by itself of as a group of variables.

15. It should be noted that the level of debt is classified into the first component, "country size", while the ratio of debt to population appears as an "important" variable in the fourth component, labelled "wealth".

16. Net financial flow is defined as debt disbursed in the current year minus debt service (amortisation and interest).

17. As mentioned earlier, even though the authors make no clear statement, their forecasts almost certainly take the form of *ex post* forecasting.

18. He does not actually refer to terms such as type I and II errors in his paper.

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CHAPTER 8. A REVISED APPROACH TO SOVEREIGN RISK ANALYSIS

CHAPTER 8

8-1. INTRODUCTION

Statistical methods of producing sovereign credit ratings have relied largely on statistical validations to decide what model specifications best describe circumstances associated with the incidence of debt problems in the past. Theory has been largely confined to suggesting plausible indicators of debt problems, essentially on *ad hoc* grounds, leaving it to statistical tests of significance and the signs of estimated parameters to decide what indicators should be included in models that are thought to be best fits to the data.

In seeking to establish the wider contexts of sovereign risk analysis, it is argued here that four crucial issues should be considered: (1) the broader macroeconomic circumstances of sovereign borrowing; (2) implications of uncertain events for attempts to forecast the future; (3) the procedures and the evidence used to estimate model parameters; and (4) the decision-making objectives to be served by forecasting, notably the allocations of loans between borrowers, and what this means in judging which models forecast best.

The first issue concerns the identification of the underlying sources of repayment difficulties. As indicated earlier, sovereign-debt repayment problems caused by the lack of foreign exchange to service debt obligations have to do with balance-of-payments difficulties. It follows that both domestic macroeconomic goals and policies and shocks and changes in the world economy relate to debt-servicing difficulties in the sense that all of them impact on a debtor country's balance of payments. The scope of sovereign risk analysis should thereby refer to the same broad macroeconomic events, policies and performances. Such perspectives offer the prospect of being able to look to earlier events in the sequences of cause and effect leading to debt problems than the immediate circumstances favoured by previous studies. This would greatly assist in answering the problem of forecasting explanatory variables *ex ante*, a problem that goes largely unaddressed in the literature.

Second, it should be noted that in most cases debt problems turn out to be the result of unexpected and sudden change in circumstances. Previous statistical models have a limit in opportunities to grasp such unforeseeable events within their systems. They are just as unsuitable for registering the effects of unexpected circumstances even when the unforeseeable is seen to have actually happened, because of the difficulties in monitoring the current reactions of debtor countries to unforeseeable events. In contrast, the references to earlier events in the previous paragraph provide an appropriate response to the problem of coping with unforeseeable events both with reference to earlier events in themselves and in offering an evaluation of how well an economy is being run now and therefore how well both it and its managers are likely to be able to respond to the unforeseeable. It might also perhaps help to resolve, to some extent, some doubts about parameter stabilities across countries and over time, which as Feder, Just and Ross (1981) and McFadden *et.al.* (1985) report is one of the major problems in previous statistical models.

Third, if the forecast performance of a model is to be checked for some observation period years 1 to T, then successive re-estimations of the model through the period have to be undertaken if the forecasts are to be consistent with what could have been achieved in reality. So far as the observations themselves are concerned, it seems important to be careful about the selection of problem-free countries. As Eaton and Taylor (1986) note (p. 233), "Countries providing especially very poor investment prospects might receive few loans ... Consequently they have little cause to reschedule and would appear 'safe' *ex post*"

Fourth, if the overriding goal of sovereign risk assessments is to forecast the probability of a borrowing country encountering debt-servicing difficulties, then the results should be evaluated in this same probability context, not in the form of 'yes-no' binary extremes. Next it is necessary to ask what sovereign risk assessors would do with forecast probabilities, notably in the design of loan portfolios. Forecast error analysis should then be carried out in this same context.

The above issues are essentially absent altogether in the existing literature. Before proceeding to inquire as to how they can be best tackled in future work, it is necessary to add also problems arising out of the modelling and empirical analysis that can be found in the existing literature. This is the subject of the following section..

8-2. PROBLEMS WITH EXISTING STATISTICAL MODELS

Statistical sovereign risk models are essentially aimed at identifying indicators which are closely associated with past debt-servicing difficulties and at using the results to forecast future debt problems. This procedure can be reviewed under three heads. They concern: (1) the selection of indicators worth looking at, the lag structures, and the mathematical functions that together constitute a model's specification; (2) the evidence and the procedures which are used to estimate the parameters of a model; and (3) the criteria for evaluating how well an estimated model forecasts the future. With reference to these subjects, major problems with existing statistical sovereign risk assessment models can be examined in the following.

There are four things to be concerned with so far as model specifications are concerned. These are: (1) the mathematical form of the model, (2) the quantification of the dependent variable, (3) the rationales behind proposed explanatory variables, and (4) the timings of explanatory variables in relation to the incidence of debt problems. As pointed out earlier, statistical sovereign risk models typically quantify observed problem-free *versus* debt-problem country-years in the form of a binary dependent variable (*i.e.*, 0 or 1). In relating such a variable to candidate indicators of debt problems, logit or probit analysis can be considered as the most suitable mathematical functional form, on the

grounds that these models correspond to the probabilistic nature of any decision to seek a rescheduling agreement and they produce forecasts in the correspondingly appropriate form of predicted probabilities.

When it comes to the choice of candidate indicators, however, there seems to be no explicit underlying rationales. The problem is that any indicator can not be proposed without a variety of qualifications as to its suitability. The result is that it is left to statistical tests of collections of variables, mostly individually chosen on *ad hoc* grounds, to decide on, inevitably more narrow ranges of, explanatory variables in statistically manageable and acceptable models. Perhaps not surprisingly no consensus has emerged as to what this more narrowly defined set of indicators should be. Additionally, as Kharas (1984) is therefore led to conclude (p. 417), "A major disadvantage of [this] pure empirical approach ... is the lack of theoretical underpinnings, which weakens confidence in the interpretation of the results and in their use for forecasting purposes.[1]" Sovereign risk assessors referring to the short-listed selections to be found in the ten major studies referred to in this study would encounter 28 distinct types of variables (*i.e.*, with variations as to their precise expression) of which nineteen have turned out to be statistically significant for at least one sample in the literature, as noted in the preceding chapter (see Table 7-1).

A second major area of ambiguity in model specifications concerns the timings of explanatory variables in relation to the observed incidence of repayment problems. Since it is easier to account for and find statistically acceptable results for variables relating to circumstances having an immediate bearing on a debt problem situation, many studies rely on no-lag specifications. This approach may run into difficulties if it is not clear, however, which way round the causality goes or even if there is any causality at all. For instance, some indicators might register the effects of a debt problem rather than events causing debt-servicing difficulties. Others might otherwise represent different kinds of ways in which a debt problem manifests itself. Most studies that rely on just about the only alternative found in

the literature, in the form of a one-year lag, do so in order to avoid these ambiguities. However, much the same problems may still remain given the influence of anticipations of debt problems. Furthermore, when it comes to trying to forecast debt problems *ex ante*, short lags produce difficulties given the wider gap between the latest published information and the year for which forecasts on explanatory variables are required. This is a special challenge in most developing countries due to a lack of appropriate macroeconomic models capable of producing such forecasts. Most previous statistical models are silent on this issue.

So far as the of evidence and procedures used to estimate parameters are concerned, two major issues need to be addressed. As noted, in the preceding chapter, the first concerns how to deal with the problems for estimation caused by interrelated explanatory variables (multicollinearity), by unaccountable, and yet systematic, movements in the dependent variable (serial correlation), and by country heterogeneities in cross-sectional data (heteroskedasticity). There have been some discussions of the seriousness of multicollinearity and serial correlation problems. However, these are problems that are mainly related to unstructured explanatory variable selections. Thus, there has been a tendency to consider many closely related variables while there is always the possibility of overlooking a relevant variable or a group of variables. The solutions to these problems adopted in this study have been already reviewed on page 173.

The issue of building an appropriate sample concerns mainly how to select debt-problem and problem-free country-year observations. The answers to such questions have generally depended on just what it is that a researcher wishes to investigate and most studies incorporate some discussion of what they have decided on these counts. However, attention has concentrated on debt-problem country-year observations. In contrast, the selection of problem-free countries has attracted little or no attention. Most studies have expanded their sample coverages by adding more and more problem-free countries in proportion to debt-problem countries without question. And yet there are many heterogeneities in economic and non-economic characteristics among problem-free countries. The result has

been greatly unbalanced samples between debt-problem and problem-free observations (see, for example, Table 7-1) largely as a result, prior to 1982, of the relative small number of rescheduling countries.

Last, when it comes to the methods used to judge forecast performance, it is noted first that most forecast error analyses conventionally turn a set of forecast probabilities to reschedule ($\hat{P}$'s) into a 'yes-no' binary form, so that a country is forecast to experience debt problems or not, in order to compare the results with debt problem realisations which take the same 'yes-no' binary form. This is done by selecting some critical cut-off $\hat{P}$ value (P^*) so that $\hat{P} > P^*$ is then a forecast debt problem and *vice versa*. If the relative costs of type I and II errors can be assumed, for instance, as 3 to 1 as is usually assumed, then P^* can be located so as to achieve a balance between the two that minimises the cost of such errors in terms of within-sample residuals, *i.e.*, the differences between observed and fitted values of the dependent variable for sample observations. Whether the location of resulting P^* will be the best for some forecast interval is another matter. More seriously, however, this procedure amounts to failing to make the best use of the information which is contained in $\hat{P}$ results.

Under such circumstances, users may face a number of problems in applying ready-estimated models to meet their own requirements. First, there is the problem of producing *ex ante* forecast of explanatory variables for the forecast interval. Second, the threat of structural changes means that the estimated parameters of published results have an uncertain, and perhaps often short, durability. And third, when re-estimation is considered necessary, it means that large amounts of data are required and a decision has to be made whether to stick to the same explanatory variables found in previous studies or whether to explore alternatives. The results often produce the problem in finding indicators that have correctly signed and statistically significant coefficients, in tackling interrelationships between variables that cause the signs and significances of parameter estimates to change as individual or groups of indicators are included

or left out, and in eventually finding models that can discriminate sensitively when used for forecasting.

8-3. BROADER CONTEXTS IN MODEL SPECIFICATIONS

This study investigates a number of ideas that might help to reduce these difficulties. They can be reviewed under the same three subject areas referred to above (*i.e.*, model specifications, sample selection and estimation procedures, and forecast evaluations). They concern: (1) reference to a different and unified rationale in selecting, expressing, and validating explanatory variables; (2) a reinvestigation of the evidence and the procedures used to estimate parameters; and (3) a revised approach to forecast performance evaluations that takes into account an essential objective of sovereign risk analysis, *i.e.*, how best to allocate loans between borrowers. The first issue is explored in the following section. The other two will be discussed in section 8-4.

8-3-1. IMPLICATIONS OF CHANGE AND ECONOMIC MANAGEMENT

As noted earlier, a crucial aspect to an understanding where debt problems come from is the overriding importance of the role played by unforeseeable events. Past experience has shown on so many occasions just how often unexpected things happen. The implications that this has for forecasting have been described (p. 9) in more detail by Wynn (1993) in noting:

> Of course hindsight may well lead us to discover that which we might convince ourselves the discerning observer *should* have been able to see in advance. It is more instructive, however, to consider just how difficult and expensive it is to come by information, how it is simply impossible always to see each piece of information in its proper perspective, and how it is often just one last event, added to a mass of other circumstances, that 'suddenly' changes a whole situation.

A basic policy implication follows in that what matters more is how best to cope when such a 'surprise' happens. Thus, decision-makers need to be aware that the unexpected can happen, to act accordingly in advance with that possibility in mind, and to decide what would be best to do once unforeseeable changes take place from time to time. In the contexts of sovereign lending, the guarantees provided by governments mean that interest centres on situations when even governments can not, or prefer not to, find the foreign exchange with which to service their foreign debt obligations. This will essentially have to do with balance-of-payments difficulties as discussed earlier. A borrowing country's balance-of-payments situations is affected not only by external surprises from constantly changing world trade and international financial markets but by the prior state of an economy and by the way in which domestic macroeconomic goals and policies are adjusted as reactions to changes. It is these issues that present a major challenge to the specification of statistical models of sovereign risk. And even when the unforeseeable can be seen to have actually happened, difficulties in monitoring the day to day reactions of debtor-economy policy-makers mean that sovereign risk assessors have to have a more general awareness of abilities to avoid unmanageable situations by the application of timely and appropriate policies.

8-3-2. NEEDS FOR A NEW FORMULATION OF EXPLANATORY VARIABLES

8-3-2-1. A PROXY FOR ALL THE PAST EXPERIENCE

The central part played by changes and reactions to changes, suggest different approaches to deciding what information should be consulted and how it should be interpreted. As in the case of best practice in preparing country reports and checklists, it is necessary to concentrate on asking what is known about the debtor-economy macroeconomic management histories and the sustainability of current macrocconomic policies and performances.[2] This suggests different kinds of explanatory variables formulations from the conventional ones. Two ideas can

be addressed separately. The first concerns ways in which past experience can be represented; the second concerns making the best use of all the latest available information. A proxy is proposed for the first in assuming that everything that is known about the past can be conveniently summarised simply by the latest previous credit rating, which in terms of probability predictions ($\hat{P}$'s) would take the form of $\hat{P}_{t-1}$. The implication is that the only things that could cause (today) a change of mind of what was thought (yesterday) about the past would be the discovery of new facts about the past or the use of better methods of interpreting already known facts. This kind of conceptualisation could be argued to be nothing more than a formal expression of what happens in practice. That is, when being asked for today's credit ratings, a sovereign risk assessor would presumably give the same responses that were given yesterday unless something new should suggest otherwise.

The $\hat{P}_{t-1}$ variable requires an amendment to conventional parameter estimation procedures. Because last year's forecasts of the probabilities of debt problems ($\hat{P}_{t-1}$) in any given this year (t) only become available on a continuing year-by-year basis, a continual process of re-estimation is required. However, this only corresponds to what happens in reality and, as has been noted already, such a process is required in order to examine the forecast performance of a model over a succession of years.

8-3-2-2. BEST UTILISATION OF THE LATEST INFORMATION

What it comes to the sustainability of current macroeconomic policies and performances, attention focuses on how to make the best use of all the latest available relevant information. It is argued that there are important lessons from best practices in preparing country report and checklist systems that need to be borne in mind here. They have the advantage of allowing wide-ranging and detailed inquiries into an individual economies and, in this context, suggest the use of composite variables in order to accommodate the large amounts of information

involved. The first design feature concerns the classification criteria by which the composites are defined. It is assumed here that the sequences in which events actually occur may provide an appropriate framework. Following this line, four categories of variables can be considered. The first relates to changes in world markets for trade and finance, *e.g.*, terms of trade changes, and change in world interest rates. The second category covers policy variables variously represented by *e.g.*, a central government deficit, rates of change for credit, money and real exchange rates, and the change in foreign debt. The third set of variables can register achievements in respect of more immediate policy goals, *e.g.*, saving and investment rates, the change in exports, and the foreign debt burden. Last, final performance variables can be represented by achievements in respect of, *e.g.*, the growth of per capita income, the current account balance, the overall external balance, and the inflation rate.

The result can be compared with models having conventional explanatory variable formulations which mean a narrow range of economic indicators to the complete exclusion of all other information. This may be acceptable in terms of broad generalisations but can cast doubts about capabilities to represent details that may be of vital importance in the context of individual economies. Such specifications may explain why it has not been possible to achieve consensus over which indicators fit the data best as well as why some variables have proved to be surprisingly statistically non-significant. Composite variables have the advantage of allowing information to be set its appropriate contexts. Thus, for example, since growth and inflation present targets that have to be weighed one against the other in deciding on and trying to meet policy goals, the two can not be considered separately.

8-4. REVISED ESTIMATION AND FORECAST EVALUATION PROCEDURES

This section deals with the two other opportunities for suggesting new ideas indicated earlier. They concern the evidence that should be used to estimate parameters and the way in which forecast performance should be appraised. There are two aspects to the former. The first involves the way in which applications of sovereign risk assessment models are required to produce a succession of forecasts on a year-by-year basis, making the best use of the available data which expands continually in the same way. Thus, it is that parameter estimation is not in practice the 'one-off' event (*i.e.*, for just one set of pooled cross-section and time series data), as found in previous statistical studies, but is rather a continuous process of re-estimation. The point further ties in with what was said earlier in respect of the $\hat{P}_{t-1}$ variable. It may also offer some other benefits in providing an appropriate response to the threat of structural breaks.

The second revision relates to the cross-section dimension of the data and to the need for care in selecting observations on countries considered to be problem-free. As discussed earlier, country heterogeneities could threaten the relevance of results from pooled data. In particular, given that the available debt-problem countries are severely limited prior to 1982 while problem-free countries are relatively more plentiful, expansion of sample sizes by simply adding more and more of the latter could draw in countries with debt situations that are unrelated to the incidence of debt problems.

One of the most obvious reactions to this possibility would be to eliminate countries that are unlikely to have any foreign debt problems because they have little or no foreign debt. However, the broader macroeconomic contexts of sovereign risk highlighted here suggest that the need to compare 'like with like' has to be extended beyond questions of debt-status alone. Thus, it is that country economic size and trade structure may have a bearing on the incidence of debt

problems and on the policy alternatives available by way of a response. The response investigated here is to produce a better balanced sample of debt-problem/problem-free country-year selections based on a broad range of economic criteria aimed at producing countries which are as closely similar to each other in all other respects other than their different records in respect of debt problems.

As indicated earlier, using forecast probabilities ($\hat{P}$'s) simply to predict whether debt problems will occur or not is to waste information.[3] In order to go beyond such a 'yes-no' binary forecast format, the last of the innovations suggested here brings the analysis of the forecast performance of statistical models into line with an ultimate aim of sovereign risk analysis, *i.e.*, the design of loan portfolios. Forecast probabilities are therefore used to design loan portfolios. Forecast errors can then be more appropriately evaluated by comparisons between planned portfolios and what would have been optimal had the future been known in advance.

8-5. SUMMARY

Following the review of statistical models over the preceding chapter, this chapter raises a number of issues that require further investigation. These concern, first, the reliance on empirical evidence to decide which variables are likely to produce the most reliable forecasts of future debt problems when used in no-lag or one-year lag specifications. This is to neglect the broader contexts of sovereign debt problems. Second, as far as the evidence and procedures to estimate the parameters are concerned, considerable heterogeneities across countries have been overlooked. Third, the use of forecast probabilities to predict debt problems in the same yes-no format of realisations fails to make the best use of such forecasts.

This chapter presents some responses to these issues that are the subject of the empirical analyses review the following chapter. First, the unforeseeable changes and the macroeconomic policies and performance of debtor-economies are considered important in understanding where debt problems arise. The result is seen as a need to account for past experience and to make the best use of the latest available information. Past experience can be represented conveniently and simply by a proxy in the form of last year's probability prediction ($\hat{P}_{t-1}$). Then, composite variables are seen as a means of accommodating the large amounts of information that need to be referred to in representing a broader view of debtor-economy policies and performances. Four component variable classifications are proposed in defining composites based on the sequences in which events usually occur. They are economic environment variables, domestic policy variables, more immediate performance variables, and final performance variables.

Second, with regard to the issue of evidence and procedures used to estimate parameters, two major suggestions are offered in relation to time series and cross-section sample dimensions. They are, respectively, the practical relevance of continuous re-estimation procedures on a year-by-year basis and the need for care in selecting observations on problem-free countries. The former has some virtues of alleviating structural shift problems while allowing a year-by-year evaluation of forecast performance in the manner that would be important in practice. The latter can provide a means of reducing the effects of country heterogeneities in the form of circumstances having little to do with the incidence of debt problems or their avoidance.

Third, this chapter emphasises that forecast performance evaluation should be carried out in terms that relate to use made of forecasts in practice. Loan portfolios are compared on the basis of what forecast probabilities would suggest is optimal and what would have been optimal if the future had been known in advance. This means that a forecast error in respect of, say, Brazil is placed on a different, and more correct, footing than a forecast error in respect of, say, Tuvalu.

NOTES

1. He then goes on to review (p. 417), in particular, a number of misgivings about the way in which "Several of these studies have focused on the role of short-term, foreign-exchange cash flow constraints in precipitating debt crises ... [while, additionally] there is nothing intrinsic in growth theory that would suggest greater debt problems associated with higher steady-state debt service to income levels ... [and] Yet debt service as a proportion of income (or exports) is among the most significant of the empirical indicators of debt problems."

2. Notable discussions of compromising the benefits of checklist systems and statistical methods are given in Wynn (1989).

3. There would then be no difference between countries with $\hat{P}$'s of 0.3 and of 0.9 for a cut-off point P^* of, say, 0.2 since both of them would be classified as debt-problem countries even though there could be a considerable difference in the implication and interpretation of the difference between 0.3 and 0.9.

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CHAPTER 9. EMPIRICAL TEST AND RESULTS

9-1. INTRODUCTION

As a response to the various ideas discussed in the preceding chapter, this chapter reports on a number of empirical investigations into the practicalities of revised procedures for sovereign risk analysis. The test designs highlight four major prospective areas of change: (1) balanced sample selections between debt-problem and problem-free countries so as to alleviate the problems raised by existing heterogeneities among developing countries; (2) year-by-year re-estimation procedures in accord with the way in which the time series dimension of the data set expands in reality and to the correct context for forecast applications and forecast error evaluations; (3) new perspectives of forecast error evaluation issue particularly by referring to portfolio design as one of the principal objects of sovereign risk analysis; and (4) alternative model specifications including a more realistic time lag structure and reformulations of explanatory variables so as to make the best use of past experience and all the latest available information. Other, supporting, inquiries concern the need for care in considering when debt problem occurred, alternative lag structures, and how to make the best use of what is already available in the literature, particularly in respect of explanatory variables worth investigating and test procedures that are worth consulting.

With regard to the last of these four broad issues two alternative models are specified and investigated, *i.e.*, a conventional variables model and a composite variables model. The former relies on much the same explanatory variables reported to be statistically significant by the existing major statistical sovereign risk models as well as the same rather short time lag structures. In contrast, the latter is based on an entirely different formulation of explanatory variables. These include three composite variables aimed at summarising as much of the latest information as possible and a further variable in the form of 'last' year's dependent variable forecast. In addition, it has a two-year lag structure of explanatory variables in relation to the incidence of debt problems so as to respond to data publication delays in reality.

The remaining three (test procedure) features are equally applied to both of the alternative models. Some minor amendments are also investigated. Sections 9-2 to 9-6 in this chapter review the terms of these tests and the results produced with reference to the first of the alternative model specifications (*i.e.*, the model with conventional explanatory variable formulations and lag structures). Section 9-7 then focuses on the second (composite variables) specification and its empirical test results. The last section 9-8 will summarise the empirical test results and produce major findings particularly with some comparative analyses to investigate applicabilities of the proposed model specifications and estimation procedures.

9-2. SPECIFICATIONS OF A CONVENTIONAL VARIABLES MODEL

9-2-1. IDENTIFYING A DEBT-PROBLEM COUNTRY-YEAR SET

A start to model specifications can be made by quantifying observed problem-free *versus* debt-problem country-years in the form of a binary dependent variable. The present study uses formal reschedulings as manifestations of debtor-country debt-servicing difficulties. There are two qualifications to this view that needs to be considered. First, some reschedulings are a response to problems such as aid transfers other than debt problems. Care needs to be taken in dealing with this kind of events. Second, debt problems can manifest themselves in various other forms such as balance-of-payments support loans. On this count, official reschedulings are considered the most appropriate observable and quantifiable indicators in identifying a particular kind of debt-problem situation without bias. The view is that a formal published rescheduling represents a particular degree of seriousness in a debt situation that can not be tackled by other means such as payments arrears and in extremis balance-of-payments support loans.

This empirical test is confined to the dependent variables observation period 1968 to 1981. As far as the starting year is concerned, before 1968 not only are rescheduling cases relatively rare but there are also serious gaps data availabilities for key economic series in many developing countries. In contrast, from 1982 when Mexico's problems triggered a rapid succession of similar moratoria for other debtor countries, on such a scale that it has come to be known as the debt crisis, it might be supposed that the frequency of reschedulings signalled different kinds and levels of pressures leading up to decisions to seek a formal renegotiation of debt-servicing obligations.

The starting point of sample selections is to identify those debt-problem countries which concluded rescheduling agreements during the period 1968 to 1981. Twenty five countries rescheduled their external debts at least once during that period. This conclusion is mainly based on information obtained from major previous statistical sovereign risk studies, as well as other empirical works such as Dhonte (1975), Kocrner *et.al.* (1986), and various survey reports published by the IMF and by the OECD.[1]

However, it is not easy to tie down the time at which 'debt problems' first occur even though the published date on which an agreement is signed provides one factual point of reference. In other respects, however, as Feder and Just have (1977) argued (p. 30), " ... it is difficult to pinpoint dates precisely because rescheduling is more a process than an event and, in some cases, the full details are not publicly known." Even if attention is confined to rescheduling agreement years, however, the sources cited above suggest different years for presumably the same reschedulings. Where do these variations come from? No doubt it has to do with ambiguities as to when a debt problem can be said to manifest itself and how that event stands in relation to the published timings of events like the formalities of signings at the end of negotiations or the date at which new servicing arrangements come into force. Additionally, multiple and successive reschedulings inevitably add further scope for ambiguities.

It has to be said that none of the ten major statistical sovereign risk analyses cited in this study deal with this issue with any special care. They simply display lists of rescheduling country-years which they relate to observations on independent variables, usually subject to lags. Moreover, some do not provide any clear statement about their data source while others have even cited secret sources, such as the World Bank confidential files used by Feder, Just and Ross (1981) in adding 'informal' rescheduling agreements to their sample.

Under these circumstances, the view adopted here is that the next best way of deciding on rescheduling country-years is to report information from as many sources as possible first. Every effort is then made to extract as an objective selection of rescheduling country-years as is possible. For this, the two overriding guidelines are observed. First, information from international agencies like the OECD or the World Bank is given first priority because of their relative reliability. Second, successive reschedulings are admitted and tested in the belief that debt problems may not often be resolved with the scope of a single year and if the observations for successive rescheduling periods are omitted, it would seriously aggravate the problem of imbalance between rescheduling and non-rescheduling cases. As the result of these procedures, 76 rescheduling country-year cases are identified within the group of 25 debt-problem countries referenced above. However, five sub-Sahara African countries (*i.e.*, Madagascar, Uganda, Sudan, Central African Republic and Gabon) have to be excluded because of data problems. Additionally, it seems advisable to drop a rescheduling of Liberia in 1973 (while keeping 1981 rescheduling) both because of earlier data availability difficulties and because of the unreliability of knowledge of the 1973 event given that only Frank and Cline (1971) among all the sources referenced earlier reports it. The effect is that the number of debt-problem country-year observations is reduced to 66 for 20 countries. These debt-problem countries can be classified into two groups according to whether their reschedulings occurred before or after the shock represented by the oil price hike encountered in the early 1970s. Ten

countries rescheduled their external debts before 1973 and the other ten after that. Table 9-1 gives a list of rescheduling country-years used in this analysis.

Table 9-1 CITED RESCHEDULING INSTANCES FOR THE PERIOD 1968-81

	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Chile	-	-	-	R	R	R	R	R	-	-	-	-	-	-
Peru	R	R	-	-	-	-	-	-	R	-	R	R	R	-
Indonesia	R	R	R	-	-	-	-	-	-	-	-	-	-	-
India	R	-	-	R	R	R	R	R	R	R	-	-	-	-
Pakistan	-	-	-	R	R	R	R	-	-	-	-	-	-	R
Philippines		-	R	-	-	-	-	-	-	-	-	-	-	-
Egypt	-	-	R	R	R	R	-	-	-	-	-	-	-	-
Turkey	R	-	R	-	P	-	-	-	-	-	R	R	R	R
Yugoslavia	-	-	-	R	-	-	-	-	-	-	-	-	-	-
Ghana	R	R	R	-	R	-	R	-	-	-	-	-	-	-
Argentina	-	-	-	-	-	-	-	-	R	-	-	-	-	-
Jamaica	-	-	-	-	-	-	-	-	-	-	-	R	-	R
Guyana	-	-	-	-	-	-	-	-	-	-	-	R	-	-
Bolivia	-	-	-	-	-	-	-	-	-	-	-	-	R	R
Zaire	-	-	-	-	-	-	-	R	R	R	-	R	R	R
Sierra Leone		-	-	-	-	-	-	-	-	R	-	-	R	-
Togo	-	-	-	-	-	-	-	-	-	-	-	R	R	R
Liberia	-	-	-	-	-	-	-	-	-	-	-	-	R	R
Senegal	-	-	-	-	-	-	-	-	-	-	-	-	-	R
Malawi	-	-	-	-	-	-	-	-	-	-	-	-	-	R
TOTAL (66)	(5)	(3)	(5)	(5)	(6)	(4)	(4)	(3)	(4)	(3)	(2)	(6)	(7)	(9)

Note: 'R' denotes a rescheduling country-year adopted in the empirical analysis.

With regards to the reschedulings themselves, there arises, first, the problem as to how to deal with what have been described as 'voluntary' reschedulings. The qualification can be said to apply, in particular, to reschedulings which were motivated more by a desire on the part of the creditors to provide more broadly directed development aid rather than debt relief. Examples include India in the late sixties. Although Saini and Bates (1978) and Feder, Just and Ross (1981) exclude voluntary reschedulings thus defined from rescheduling observations, this analysis does not adopt the same practice on the grounds that it is not easy to separate out voluntary reschedulings because of the potential ambiguities arising in

identification and because aid assistance is frequently related to balance-of-payments problems regardless of whether it is supplied in the form of rescheduling, balance-of-payments support loans, or otherwise.

A second issue concerns reschedulings of private debts. Published information here is generally not available, or at least until more recent years. Most of the sources offering documentation of rescheduling countries confine themselves in formal multilateral or bilateral rescheduling agreements. The empirical analysis presented here does not make such any attempt to relate to this problem on the grounds that it aims to analyse and predict sovereign-borrower reschedulings of external debt. These, it has been argued elsewhere, relate essentially to balance-of-payments situations to which private debt reschedulings have only limited relevance. That is, in situations of general balance-of-payments crises, no doubt the servicing of private debts is also affected by way of the transfer problems associated with foreign exchange shortages; on the other hand, there are no doubt many circumstances, *e.g.*, business difficulties, in which private debts are rescheduled, having nothing to do with an economy's overall balance-of-payments situation.

9-2-2. ASSIGNING DEBT-PROBLEM YEARS

As pointed out in the previous chapter, there then remains the problem of deciding when a rescheduling country actually first encountered debt-servicing difficulties. While the signings of rescheduling agreements may be dated with pinpoint accuracy, the timing of the associated debt problems can only be much more loosely specified. They can equally only be roughly related to explanatory variables, given that annual data are alone available while a year is a long time.

In general, a rescheduling agreement is arranged sometime after debt-servicing difficulties are already apparent. The problem is how many years back from a

rescheduling sign-date should a debt-problem year be assigned. Negotiation durations differ from case by case. Given the absence of reliable information on the duration of negotiations for each rescheduling, the present empirical analysis assumes that a debt-servicing problem becomes evident sometime in the year before a rescheduling sign-date. Therefore, if a country concludes a rescheduling agreement in the year *t*, year *t-1* is assigned a debt-problem year. Clearly the latitude built into this allows the separation between the manifestations of debt problems and the signing of rescheduling agreements to range anywhere over a two-year period even though the average, or most likely, gap, within the assumptions adopted, is one year.

9-2-3. EXPLANATORY VARIABLES

Before proceeding to reviews of individual explanatory variable selections, the results reported by ten major statistical studies of sovereign risk analysis are used to restrict the number of selections considered worth further investigations to those variables found to have been statistically significant and with the correct *a priori* signs in at least one instance or another within these studies. A tabulated summarisation of their overall results is set out in Table 9-2. The significance-sign extractions produce nineteen indicators although each of them differs slightly in its definition and measurement from author to author as explained in the notes to Table 9-2.

Some are sufficiently close alternatives to suggest omissions to avoid problems of collinearities between explanatory variables. Others have to be dropped because of lack of data. Thus, to begin with, a ratio of a reserves position in respect of IMF facilities to imports is excluded on the grounds that the numerator is a particular component of the alternative represented by overall non-gold reserves. There are also problems of data availabilities for this variable in the 1960s. Similarly, new debt commitments per capita, used in Taffler and Abassi (1984), can not be used

because of the lack of information on the numerator prior to 1974. Lastly, the non-oil LDC's total net external borrowing to their total exports ratio, encountered in Cline (1984), is also excluded because of data problems and because it is not country-specific, a point which is at odds with a major thrust of this work in its emphasis on comparative evidence. Thus, the total number of explanatory variables to be tested is reduced to sixteen.

Table 9-2 INDICATORS USED BY TEN MAJOR STATISTICAL SOVEREIGN RISK STUDIES AND THEIR A PRIORI EXPECTED AND RESULTING SIGNS

INDICATORS BY BROAD CATEGORIES	REFERENCES[a]									
	F&C (1971)	F&J (1977)	S (1977)	M&B (1978)	S&B (1978)	F,J,&R (1981)	T&A (1984)	K (1984)	C (1984)	McF (1985)
1. debt service/ exports (7/9)[b]	(+,+*)	(+,+*)	(+,+*)	(+,+)	(+,+)	(+,+*)		(+,+*)	(+,+*)	(+,+*)
2. total external debt/ exports or GNP(4/4)				(+,+*)			(+,+*)		(+,+*)	(+,+*)
3. amortisation/ debt (3/3)	(−,−*)	(−,−*)							(−,−*)	
4. new debt/imports or population (1/1)							(+,+*)			
5. inflationary erosion of debt/exports (0/1)									(−,+*)	
6. reserves/imports or GDP (6/9)	(−,−*)	(−,−*)	(−,−)	(−,−*)	(−,−)	(−,−*)	(−,−)		(−,−*)	(−,−*)
7. growth rate of exports (2/5)	(−,−)	(−,−*)	(−,−*)		(−,−)				(−,−)	
8. imports/GDP or GNP (2/5)	(−,?)	(−,?)		(+,−*)	+					(+,?*)
9. current or capital account balance items (5/6)		(−,−*)			(−,−*)	(−,−*)	(−,−)	(−,−*)	(−,−*)	
10. index of export fluctuations (0/2)	(+,−)	(+,−)								
11. compressibility of imports (0/1)	(+,−)									
12. reserve position of the IMF/imports (1/1)				(−,−*)						
13. growth rate of international reserves (1/1)					(−,−*)					
14. exports/GDP or GNP (1/1)						(−,−*)				
15. outward orientation index (0/1)										(−,−)
16. per capita GDP or GNP (4/8)	(−,−)	(−,−*)	(−,−)		(−,+)	(−,−*)		(−,−*)	(−,+)	(−,−*)
17. growth rate of real GNP or GDP (3/5)		(−,−)	(−,−*)				(−,−)		(−,−*)	(−,−*)
18. gross capital formation/ GDP (2/2)				(−,−*)				(−,−*)		
19. domestic saving/ GNP (0/1)									(−,−)	
20. consumer price inflation (4/4)			(+,+*)	(+,+*)	(+,+*)		(+,+*)			
21. growth rate of the money supply (2/2)			(+,+*)		(+,+*)					
22. real effective exchange rate change (1/2)			(+,+*)							(+,+)
23. net foreign assets of the banking system/money supply (0/1)					(−,+)					
24. domestic credit/ GDP (1/1)							(+,+*)			
25. non-oil LDC's total net borrowing/their total imports (1/1)									(−,−*)	
26. growth rate of real GDP in industrial countries (0/1)										(+,+)
27. real Eurodollar interest rate (0/1)										(+,−)
28. growth rate of real Third World debt (0/1)										(−,−)

Notes: Although these studies differ in both countries and time periods considered and in details in definitions of both dependent and independent variables, an attempt has made to keep indicators in a unified form and to review the signs in the same consistent way.

a.

F&C	; Frank and Cline	F&J	; Feder and Just
S	; Sargen	M&B	; Mayo and Barrett
S&B	; Saini and Bates	F,J&R	; Feder, Just and Ross
T&A	; Taffler and Abassi	K	; Kharas
C	; Cline	McF	; McFadden and others

Plus or minus signs in parentheses mean (expected sign by authors, reported sign as an empirical result) respectively.

* Statistically significant at some confidence level.
? Fluctuating signs.

b. Figures in parentheses denotes (number of significant cases / number of multiple citations).

1. Except M&B and S&B who use the service payments actually made, other studies refer to estimates of the service payments contractually due. F&C replaces debt service in rescheduling year 't' with observed service in year 't-1' when data are not available. However F&J, S, F,J,&R, and K adjust the current actual debt service using the Bittermann's rule-of-thumb that typically 25 per cent of payments due are renegotiated during the rescheduling process. Meanwhile McF calculates the service due by adding outstanding arrears at the end of the period to debt service actually paid during the period.
F,J,&R and K include debt service on private (not publicly guaranteed) external debt where available.
In case of F&C, exports are used in the form of "predicted exports in year t-1, based on a regression of the logarithm of exports on time for the five year period ending in year t-1." K utilises GDP rather than exports as a denominator for this ratio.

2. M&B and T&A use only public or publicly guaranteed debt outstanding and disbursed. C utilises net debt defined as gross debt minus reserves for the numerator. Private debt is included in C and McF where available.

3. F&C and F&J refer to debt outstanding including undisbursed while C relies on the disbursed only. They all take the form of debt / amortisation for this ratio.

4. Per capita new debt commitments contracted during the period refer to the numerator in T&A.

5. C measures the inflationary erosion of debt by multiplying total outstanding debt with " a measure of world inflation."

6. F&C, F&J, and S&B take a form of imports/reserves ratio. McF uses GDP instead of imports as the denominator and excludes monetary gold from international reserves for the numerator. Only foreign exchange asset reserves refer to the numerator in F,J,&R.

7. F&J calculate this ratio as an average of the eight-year annual rates of exports growth between 't-8' and 't-1' while F&C compute this ratio "on the base of four-year averages over an eight year period proceeding the year of observation." S adopts three-year average annual rate of exports growth for the period 't-2' to 't'. In case of S&B, they suggest a "growth rate averaged over 3 years" for this indicator. C unlike others introduces real exports growth rates by saying that "The export growth variable is calculated as the ratio of average real exports in years t and t-1 to that average for years t-2 and t-3. Real exports are calculated by dividing the dollar value of exports by the unit value index of exports of industrial countries (thereby reflecting the real purchasing value of export earnings rather than an index of export quantity)."

8. F&C and F&J use GNP instead of GDP as the denominator.

9. F&J divide "net foreign capital inflows (short and long term), including direct investments and grants" by debt service payments.
S&B use a five-year cumulative current account balance as the numerator and exports in the latest year as the denominator.
F,J,&R produce two ratios with regards to this indicator by splitting the numerator into non-commercial foreign exchange inflows (i.e., net medium- and long-term loans from governments and international organisations, capital grants, workers' remittances and net current transfers) and commercial foreign exchange inflows (i.e., net medium- and long-term loans from commercial sources and direct investment net of repatriated direct investment income). As the denominator debt service payments are used like F&J.
T&A compute this indicator as the ratio of three years' cumulative trade balance to imports of goods only.
K reports this indicator as the ratio of capital inflows net of amortisation to GDP.
C uses current account deficit as the numerator and exports as the denominator.

10. F&C devise this variable as the average absolute percentage deviation from an eight-year trend proceeding the year of observation. F&J rely on the same measurements but using equally weighted deviation rather than weighted average of deviations as in F&C.

11. F&C define non-compressible imports as " intermediate goods, capital goods, and basic foodstuffs." Denominator is total imports.

16. S&B, K, and C use GDP rather than GNP.
F,J,&R and McF use real terms of GNP. In particular, F,J,&R neutralise this variable by dividing with US per capita GNP.

17. F&J and C adopt real growth rate of GDP per capita instead of real GDP or GNP. And F&J calculate an average of annual rates of growth between 't-5' and 't-1'. S computes this ratio as an average of eight-year annual rates of growth between 't-8' and 't-1'. T&A use geometric mean change of real GNP growth rate over three years.

18. Gross fixed capital formation is adopted as the denominator.

20. S calculates eight-year annual average change rate of consumer price index as for exports and real GNP growth rate. T&A also as for real GNP growth rate use geometric mean change over three years.

21. As for money supply growth, S reports eight-year average annual rate of M1 growth.

22. S calculates this variable as "a three-year average of the difference between domestic and the US wholesale price index inflation rates, less the rate of domestic currency depreciation vis-a-vis the dollar."
McF attempts to investigate the real exchange rate movements with "the difference between the rate of consumer price inflation and the sum of exchange rate depreciation and the growth rate of the US GNP deflator."

24. T&A transform this variable into $(1 + DC/GDP)^{-1}$ where *DC/GDP* denotes the ratio of domestic credit to GDP.

So far as definitional differences are concerned, every effort has made to identify and follow a majority view and to favour alternatives that allow relative simplicity and consistency when it comes to data compilations. Additionally, the sixteen indicators can be categorised, in a way that is found in none of these studies, but for the sake here of comparing the coverages achieved, into four groups, *i.e.*, debt variables, balance-of-payments variables, income and expenditure variables, and monetary variables. Reviews of the definition, measurement, *a priori* expected sign, and data sources of each of these variables in turn now follow.

A. DEBT VARIABLES

(1). Debt Service Ratio (DSR)

DSR is defined as the ratio of total debt services to exports. Debt services are confined to interests and principal payments on external public debt. This analysis avoids an adjustment of the service payments actually paid, which has been adopted by some studies in the name of Bittermann's 'rule-of-thumb' method, on the grounds that in the circumstances where precise information on debt service due for the rescheduling periods does not exist, such an adjustment would cause another factor to bias the result. Exports include goods and non-factor services in the national accounts measured in a current price. The data for total debt services and exports are obtained from the *World Tables* (1976). As in others, the coefficient of this ratio is expected to have a positive sign. It implies that the probability that a country seeks a rescheduling increases as the debt service ratio rises.

(2). Total external debt to exports ratio (EDX)

Total external debt incorporates outstanding and disbursed of public debt. It is expected to be difficult to get private debt records in the circumstances where commercial bank lendings are very limited in 1960s. This ratio is also measured on the basis of the *World Tables* (1976) data. The sign of the coefficient is anticipated to be positive where as this ratio increases the more likely a country will be a candidate for rescheduling.

(3). Amortisation to total external debt ratio (AMD)

The definition and data source for total external debt and amortisation are the same as indicated above. This empirical analysis supposes this variable to have *a priori* negative sign. It is based on the assumptions that, as Frank and Cline (1971) report (p. 332), "A low value for this indicator suggests that a country has predominantly long term debt liabilities. A country in this situation does not have very much short-run flexibility in reducing in debt service commitments by temporary reduction of borrowing. Thus

ceteris paribus such a country is more likely to reschedule. The absence of short-term liabilities also indicates that a country does not have significant access to short-term commercial credit facilities, i.e. the country is not particularly "creditworthy". A lack of a good credit reputation makes it difficult for a country to obtain quick access to additional credits when shortfalls in exchange earnings occur and rescheduling of debt becomes a more attractive alternative to alleviate foreign exchange crises." Feder and Just (1977) and Cline (1984) also follow the same line as Frank and Cline. And all three studies report this variable carries the correct sign with a statistically significant coefficient.

E. BALANCE OF PAYMENTS VARIABLES

(4). Reserves to imports ratio (REM)

It takes the form of reserves to imports ratio being reversed to that of Frank and Cline. Reserves include all categories of reserves except gold as McFadden *et. al.* (1985) use. This ratio is cited directly from the *IFS* Year Book (1987). As other users, it expects a negative sign implying that the country with high reserves relative to imports is unlikely to be in debt-servicing difficulties.

(5). Exports growth rate (GWX)

Although Cline measures exports growth rate in real terms, this analysis relies on current price exports like others. The source of exports in goods and non-factor services is the same with that in DSR. The growth rate is measured by average of the three-year annual rates of growth for the period of year *t-3* to year *t-1* proceeding the debt-problem year as in Sargen (1977). It is assumed for this variable to have a negative sign so that a country with a high growth rate is less likely to experience debt-servicing difficulties since foreign exchange earnings in the near future to increase.

(6). Imports to GDP ratio (MGD)

This ratio is accepted on an assumption that the higher it is, the more difficult a country becomes in reducing the imports so as to lessen a burden of the balance-of-payments problems. Therefore, it is anticipated *a priori* to show a positive sign. However, such an assumption might be arguable as some other authors suggest. Precise discussions about this arguable *a priori* expectation will be dealt with in the later section with reference to an empirical result. Imports incorporate goods and non-factor services in the national account of current price as reported in the *World Tables* (1976).

(7). Current account balance to exports ratio (CUX)

Amongst various alternatives for this balance of payments items-related variable as explained briefly in the notes of Table 9-2, current account balance is adopted as the numerator like Cline on the grounds that it reflects a country's overall domestic macroeconomic performance and capability to cope with external shocks and that the current account deficit broadly equals the full amount of new financing required which can be balanced in capital account. Another two alternatives of this variable are also tested. They are the ratio of current account balance to GDP (CGD) and annual change rate of current account balance (GCU). Current account balance is based on the data of the *IFS* Year Book (1987). This variable supposes to carry a negative sign.

(8). Relative change rate in reserves (GWR)

For this indicator, all forms of reserves are considered as used in Saini and Bates. International reserves are obtained from the *IFS*. It is assumed that the higher this ratio is the less a country suffers from debt-servicing difficulties.

(9). Exports to GDP ratio (XGD)

The definition and data source of exports and GDP are the same as explained above. The higher ratio of exports to GDP could mean the more vulnerability to the change of world economic environments, thus the higher probability to reschedule. However, in general, outward economies are considered to be able to retain a relatively stronger position in their balance of payments and to obtain higher creditworthiness in international financial market compared with inward economies. In this respect, of the two countries with equally high debt service ratios or debt to GDP ratio, the country having the highest exports to GDP ratio would have the most foreign exchange left over after debt service payments relative to its GDP. Feder, Just and Ross (1981) as the only study to introduce this variable report that its coefficient is statistically significant in ten per cent significance level with a negative sign. The present analysis also assumes that a country with a high ratio of exports to GDP would associate with low probability of debt-servicing problems.

C. INCOME AND EXPENDITURE VARIABLES

(10). GDP per capita (PGD)

GDP of current price is applied for calculations of this indicator. Population is cited from various issues of the *IFS*. Basic assumption for this indicator is that a higher level of per capita income should imply higher levels of nonessential consumption. This allows a country to have more flexibility in spending more resources for debt service payments and, thus, a lower probability of debt-servicing problems.

(11). Real GDP growth rate (GGD)

It measures annual growth rate of real GDP rather than GDP per capita. Its *a priori* sign is expected to be negative on the grounds that a decline in

economic growth would increase needs of more foreign capital inflows to smooth the path of consumption over time and, hence, make debt payments burden heavier. This ratio is directly obtained from the *IFS* Year Book (1987).

(12). Gross capital formation to GDP ratio (VGD)

Kharas (1984) appears to use the investments including the stock investments in terms of the national accounts while Mayo and Barrett (1978) introduce the gross fixed capital formation only. The present empirical analysis applies the gross capital formation including the stock investments like Kharas. This ratio is also obtained directly from the *IFS* Year Book (1987). It is assumed that a country with a higher gross capital formation to GDP ratio has more potential capacity to increase resources in the future and thus is less likely to experience debt-servicing difficulties.

D. MONETARY VARIABLES

(13). Inflation rate (CPI)

The annual change of consumer price index is adopted for this indicator. This indicator is directly cited from the *IFS* Year Book (1987). Inflation usually affects the demand for foreign capital through its adverse impact on the trade accounts by growing trade deficit. Thus, high inflation country is more likely to involve debt problems.

(14) Money supply growth rate (GMS)

Money supply includes money and quasi-money as defined in the *IFS* Year Book (1987). This variable expects a positive sign by being generally associated with consequent increase in domestic inflationary pressures.

(15) Domestic credit to GDP ratio (DCG)

Domestic credit is obtained from the country pages in the *IFS* Year Book (1987). It is also anticipated to have a positive sign in the same way as above two variables.

(16). Real effective exchange rate change (GRE)

Nominal exchange rates are taken from the *IFS* Year Book (1987). For obtaining a country's relative price levels, consumer price index of each country is divided by that of the United States. The *Supplement Series on Prices No.2* of the *IFS* is used for consumer price index of the countries. The higher rate of this variable means a country's overestimated exchange rate so that it might deteriorate the trade balance. Thus, it expects a positive sign.

9-2-4. ADOPTION OF LOGIT ANALYSIS

As discussed earlier, statistical models of debt-servicing problems have relied exclusively on a binary dependent variable. Thus, the functional forms of the specifications used correspond to either discriminant or logit analysis. Although there are additionally a number of conceptual reasons that greatly favour logit analysis as opposed to discriminant analysis as means of isolating cases of debt-servicing difficulties, this empirical analysis also relies on the logit method because it tests overall performance by using log-likelihood ratio statistics and because it produces forecasts directly in the form of debt-problem probabilities.

9-2-5. LAG STRUCTURE

Lag structures have important implications for the balance struck between building an understanding of past experience and serving the needs of forecasting as discussed in the previous chapter. The first requirement suggests keeping lags

as short as possible so as to investigate circumstances as close as possible to events labelled debt problems. This requirement makes forecasting more difficult, however, in view of publication delays. The shorter the lag the wider the interval of time over which explanatory variables have to be forecast and thus the more serious forecasting errors are likely to be when attempting to predict debt problems *ex ante*.

The conventional explanatory variables model here relies on two alternative timings of explanatory variables, *i.e.*, a one-year lag (t-1) and contemporaneous no-lag structure (t) where the year preceding a rescheduling agreement signing (at time $t+1$) is regarded as a debt-problem year (t). This is done mainly in order to test the conventional way of timings usually used by previous studies and to examine the results between the two lag-structure alternatives.

9-3. FRAMEWORK OF EMPIRICAL INVESTIGATIONS

9-3-1. COMPOSING A BALANCED SAMPLE

While the availabilities of debt-problem country-year observations are severely limited, the potential numbers of problem-free countries are relatively so large that various selections might be possible. Most statistical sovereign risk analyses appear to assume that the greater the coverages of problem-free country-years, the better. However, as already pointed out, such unrestricted expansions may well raise some problems given the considerable diversities in the economic and financial characteristics of different countries. To start with the obvious first, it seems clear that countries having little or no foreign debt can not experience foreign-debt problems. The economic histories of such countries must therefore be irrelevant to these inquiries. Additionally, however, it seems advisable to

compare like with like so far as is possible. Thus, there are other characteristics having a bearing on the incidence of debt problems and policy reactions once they are encountered. Size, for example, may greatly influence the politically and economically feasible alternatives in times of difficulties. Alternatives can not be entirely allowed for by scaling variables with reference to, say, GDP. It is size, for example, in terms of scale of resources that has been an important factor in enabling communist China to be a creditor despite its level of development while many commodity exporters keep large parts of their revenues invested abroad and, to this extent, are also creditors.

It might be reckoned impossible to devise a perfectly balanced country sample where every rescheduling country-year observation corresponds to an exactly paired non-rescheduling observation. However, in order to build the best feasible comparable sample component to complement the debt-problem country group, countries free of debt-problems are selected according to several criteria. Four major kinds of consideration include geographical location, similarity in principal economic indicators, position in country classification systems of world financial organisations (such as the World Bank), and data availabilities.

For geographical considerations attempts are made to choose the same number of countries from the same region as found in the debt-problem country set. The rationale for this is that countries that share a broadly common history and environment, in general, tend to have similar economic and political structures, styles of economic management, and so on. In this respect, for example, although a Latin American country might match well with a Mediterranean country in terms of economic indicators, a more plausible pairing might be sought in the same region of Latin America.

The economic characteristics that are consulted include country size, size of market or purchasing power, level of development, degree of openness to world markets, and debt situation. Appropriate indicators of these characteristics could

be said to consist of, variously, population, level of GDP, GDP per capita, the ratio of external trade to GDP, the level of external debts, the ratio of external debts to exports, the debt service ratio, and the nature and diversity of exports, and so on.

In addition to these economic indicators, existing country classification systems published by the International Monetary Fund (IMF) and the World Bank are also referred to. In the case of the first, the December 1979 edition of the IMF's *World Economic Outlook* introduced a country classification in the presentation of its statistical appendix. This has been gradually extended and refined over subsequent issues. If attention is confined to the appropriate contemporaneous issues, it is found, for example, that Peru, Indonesia, and Egypt, as part of this study's rescheduling country group, are described as "net oil exporters". In this case, comparable non-rescheduling "net oil exporters" might include Bolivia, Mexico and Syria. In practical terms, if geographical distribution and economic characteristics are at odds, therefore, this kind of country classification system can be usefully taken into account. A World Bank country classification set out in its *World Development Report* of 1981 can be used to similar effect. This relies on a two-way split (1) by per capita income and (2) by structure of production, subject to separate categories for populous South Asia, least developed and oil exporting countries.

Problem-free countries with populations of less than one million or with communist regimes or with data availability difficulties as in many African countries are excluded first. Among the criteria for pairing debt-problem and problem-free countries, geographical location takes precedence. To this end, it is decided that two non-rescheduling countries should come from Latin America, three from the Mediterranean and North African region, four from Asia, and one from sub-Saharan Africa when composing a balanced sample for the first ten debt-problem countries group which rescheduled before the first oil shock. However, some problems arise in selecting South Asian countries. This is because

there are insufficient numbers of qualifying problem-free countries in South Asia. Some are relatively small and others are communist countries. Thus, despite its regional heterogeneity Korea, which strictly belongs to East Asia, is included in this group on the grounds that it was in the early stage of economic development in 1960s with a persistent need to borrow foreign capital. A much the same difficulty is also encountered with respect to composing the second group of problem-free countries. This is mainly because African countries are not available for selection because of gaps in data availabilities.

Then, economic characteristics and country classification criteria are applied to choose a most appropriate debt-problem country. Given that a country can probably be matched well enough with one debt-problem country for one economic indicator but with some other country in respect of others, some systematic method is needed. In this sense, the same geographical countries are classified into two groups according to their position in a 'country-ranking-ladder' for each economic indicator (as illustrated well in the *World Development Report* (1985) of the World Bank) as a means of avoiding wholly subjective country selections. The first group of 'probable countries' corresponds to those of which rankings are five levels above or below a debt-problem country. The second group of 'possible countries' consists of those whose rankings are six to ten levels above or below it. And the 'probable countries' are given two points while the 'possible countries' have one point, as a way of weighting. Additionally, if a problem-free country belongs to the same country-classification group as a debt-problem country with respect to at least one of the two country classification systems cited above, three points are given. Then, a problem-free country with the highest total scores is considered to be well paired. As an illustration, Table 9-3 demonstrates how a debt-problem country Argentina finds its pairing problem-free country Brazil. In this case, Brazil marks the highest scores of the Latin American candidate countries by appearing four times in the 'probable-country' group and three times in the 'possible-country' group and by belonging to the same 'country-classification' group.

Table 9-3 AN ILLUSTRATION OF COUNTRY PAIRING PROCEDURE (IN THE CASE OF ARGENTINA)

* ARG (SM, MEM) *

ECONOMIC INDICATOR	POP	GDP	GDPp	ETD	ETD/EXP	DSR	ETT/GDP	TOTAL SCORES
PROBABLE COUNTRY GROUP		MEX BRZ VEN	VEN MEX BRZ	VEN	ECU PAR	BRZ	BRZ MEX PAR	*. BRZ (SM, MEM) (4)X2+(3)X1+3=14 *. MEX (SM, NOE) (3)X2+(4)X1+3=13 *. VEZ (OM, OEC) (3)X2+(2)X1+0= 8 *. PAR (PM, ONI) (2)X2+(2)X1+0= 6
POSSIBLE COUNTRY GROUP	MEX BRZ VEN		ECU PAR GUA	ECU MEX BRZ	HON ELS VEN MEX BRZ	MEX ECU PAR	GUA	*. ECU (OM, NOE) (1)X2+(3)X1+0= 5 *. GUA (PM, ONI) (0)X2+(2)X1+0= 2 *. HON (PM, ONI) (0)X2+(1)X1+0= 1 *. ELS (PM, ONI) (0)X2+(1)X1+0= 1

Note : Abbreviations refer to those in Tables 9-4 and 9-5.

If circumstances among countries are too close, priorities are given to particular indicators of the level of GDP per capita, the level of external debt, the ratio of external debt to exports, and the ratio of external trade to GDP on the grounds that the level of development[2] constitutes a major determinant of restrictions on policy choices and that the level of external debt burden and the relative contribution of foreign resources or foreign exchange earnings to income are closely associated with a borrowing country's vulnerability to world trade and international financial markets. For the comparisons, annually averaged economic indicators from 1967 to 1982 are used.

In line with the principles noted above, total 40 countries of 20 debt-problem and 20 problem-free selections are shown in Table 9-4. And Table 9-5 illustrates major economic references utilised in composing these balanced sample countries.

Table 9-4 BALANCED COMPARATIVE COUNTRY SET

RESCHED. GROUP A. (1968-72)		NON-RES. GROUP A.		RESCHED. GROUP B. (1973-81)		NON-RES. GROUP B.	
Chile	(CHL)	Mexico	(MEX)	Argentina	(ARG)	Brazil	(BRA)
Peru	(PER)	Ecuador	(ECU)	Jamaica	(JAM)	Honduras	(HON)
Indonesia	(IDN)	Korea	(KOR)	Guyana	(GUY)	Paraguaya	(PAR)
India	(IDA)	Sri Lanka	(SRI)	Bolivia	(BOL)	Venezuela	(VEN)
Pakistan	(PAK)	Malaysia	(MAL)	Zaire	(ZAI)	Zambia	(ZAM)
Philippines	(PHL)	Thailand	(THA)	Sierra Leone	(SLE)	Niger	(NGR)
Egypt	(EGY)	Morocco	(MOR)	Togo	(TOG)	El Salvador	(ELS)
Turkey	(TRK)	Syria	(SYR)	Liberia	(LIB)	Nigeria	(NGA)
Yugoslavia	(YUG)	Greece	(GRE)	Senegal	(SEN)	Guatemala	(GUA)
Ghana	(GHA)	Kenya	(KEN)	Malawi	(MLW)	Tunisia	(TUN)

Table 9-5 MAJOR INDICATORS FOR BALANCED SAMPLE COUNTRIES

	POP. (mill.)	GDP (bill.)	GDP cap. ($ US)	ETD (mill.)	ETD/EXP	DSR	ETT/GDP	WB (IMF) Classs.
RESCHED. GROUP A								
Chile	10.14	13.96	1335	3292	1.48	0.22	0.38	P.M. (ONI)
Peru	15.09	11.20	716	3180	1.35	0.25	0.38	P.M. (NOE)
Indonesia	131.83	35.52	252	8365	1.76	0.09	0.40	O.L. (OEC)
India	596.94	96.73	156	12208	2.55	0.16	0.13	P.L. (LWC)
Pakistan	87.01	14.13	169	5432	4.40	0.28	0.26	P.L. (LWC)
Philippines	42.94	18.47	416	2757	0.64	0.09	0.39	S.M. (ONI)
Egypt	37.16	14.48	372	6250	1.88	0.28	0.47	S.M. (NOE)
Turkey	39.30	33.95	824	5711	2.25	0.19	0.18	S.M. (ONI)
Yugoslavia	21.26	31.64	1452	2638	0.45	0.07	0.47	S.M. (MEM)
Ghana	9.90	8.47	772	718	1.05	0.06	0.30	P.M. (ONI)
NON-RES. GROUP A								
Mexico	59.15	88.19	1387	16471	1.54	0.32	0.20	S.M. (NOE)
Ecuador	6.94	5.55	732	1224	0.81	0.14	0.47	P.L. (NOE)
Korea	34.88	30.32	823	7432	0.99	0.13	0.57	S.M. (MEM)
Sri Lanka	13.44	3.13	229	744	1.17	0.13	0.45	P.L. (LWC)
Malaysia	11.89	11.75	922	1998	0.29	0.04	0.91	P.M. (NOE)
Thailand	41.08	16.84	386	1587	0.33	0.04	0.45	P.M. (ONI)
Morocco	17.26	8.88	487	3141	1.50	0.17	0.47	P.M. (ONI)
Syria	7.43	6.96	868	992	0.84	0.13	0.44	O.M. (NOE)
Greece	9.13	21.76	2339	2405	0.74	0.12	0.39	S.M. (MEM)
Kenya	13.48	3.58	248	922	0.79	0.07	0.62	P.M. (LWC)
RESCHED. GROUP B								
Argentina	25.77	61.06	2295	5202	0.99	0.21	0.17	S.M. (MEM)
Jamaica	2.01	2.21	1081	719	0.69	0.11	0.81	P.M. (ONI)
Guyana	0.79	0.40	500	298	1.08	0.10	1.29	O.L. (ONI)
Bolivia	4.99	2.40	461	1142	1.99	0.18	0.85	P.M. (NOE)
Zaire	23.44	3.72	154	1950	1.43	0.09	0.74	P.L. (LWC)
Sierra Leone	2.97	0.73	229	173	1.07	0.12	0.55	P.L. (LWC)
Togo	2.22	1.28	552	314	1.39	0.10	0.58	P.L. (LWC)
Liberia	1.56	0.58	360	287	0.76	0.07	1.20	P.M. (NOE)
Senegal	4.89	1.67	328	418	0.67	0.07	0.71	P.M. (LWC)
Malawi	5.16	0.67	124	314	2.02	0.14	0.53	L.L. (LWC)
NON-RES. GROUP B								
Brazil	104.64	130.74	1171	18167	1.55	0.24	0.16	S.M. (MEM)
Honduras	3.07	1.42	434	425	0.74	0.07	0.66	P.M. (ONI)
Paraguay	2.68	2.07	702	302	1.17	0.11	0.30	P.M. (ONI)
Venezuela	12.38	30.62	2283	4177	0.36	0.07	0.55	O.M. (OEC)
Zambia	4.94	2.56	505	1122	1.22	0.18	0.64	P.M. (ONI)
Niger	4.58	1.07	218	175	0.77	0.06	0.41	L.L. (LWC)
El Salvador	3.94	2.06	499	281	0.41	0.05	0.63	P.M. (ONI)
Nigeria	66.95	39.00	521	2041	0.45	0.05	0.34	O.M. (OEC)
Guatemala	6.00	4.27	670	301	0.33	0.05	0.42	P.M. (ONI)
Tunisia	5.65	4.21	703	1524	1.24	0.14	0.66	P.M. (NOE)

Note: All the figures refer to the annual average from 1967 to 1982.

POP. Population from International Financial Statistics (IFS)
GDP cap. GDP per capita calculated with IFS data.
ETD/GDP. External outstanding and disbursed official debt divided by GDP. Data on debt from World Tables of the World Bank('76).
ETD/EXP. External outstanding and disbursed official debt divided by exports of goods and non-factor services.
Exports data from IFS various issues.

DSR. Debt service on external outstanding and disbursed official debt divided by exports of goods and non-factor services.

ETT/GDP. External Trade including exports and imports of goods and non-factor services divided by GDP.
Data from IFS supplements series on trade ('88).

WB class. Based on a developing country classification system adopted in World Development Report ('81, p.65) of the World Bank.
S./P./O. Semi-industrial, Primary producing, or Oil exporting.
M./L. Middle- or Low-income countries.

IMF clss. Based on World Economic Outlook classifications ('82, p. 140) especially with respect to trade structure.
OEC. Oil exporting countries.
NOE. Net oil exporters.
MEM. Major exporters of manufactures.
LWC. Low income countries.
ONI. Other oil importers.

9-3-2. VARIOUS TEST STRUCTURES

As indicated in the section of lag structure, the conventional variables model used here attempts to test the empirical data set in two directions with reference to a time lag structure, *i.e.*, one-year lag and no-lag structure. These lag distinctions mean that in the case of the contemporaneous no-lag structure (model version *(B)*) rescheduling country-year observations correspond to the period of 1968 to 1981 and, hence, independent variable observations range from 1967 to 1980. And in the case of one-year lag (model version *(A)*), reschedulings relate to the period 1969 to 1981 and explanatory variables to the period 1967 to 1979.

Each of the alternative lag models is fitted to various different sample sets. These may be distinguished under two broad headings. The first sub-set variations

correspond variously to the ways in which different restrictions are placed on the use of problem-free observations drawn from debt-problem countries. This can be best explained in terms of the conditions under which various country-year observations are dropped from the sample. In the case of version *(1)*, no observations are omitted. So, all the rescheduling and non-rescheduling observations of debt-problem countries are included. Version *(2)* omits problem-free observations on rescheduling countries beyond the end of any rescheduling country-year sequence. The rationale behind version *(2)* is that country-year observations after a debt-problem occurrence still contain debt-servicing difficulty characteristics since they are likely to be affected by debtor policy reactions in general, by debt management policies in particular, and by changes in creditor perceptions once debt-problems have occurred. Finally, version *(3)* consists of strictly balancing pair of observations such that each debt-problem country-year observation is paired off with just one, selected, problem-free country-year observation.

For each of the sample structures above, two other alternative ways of dealing with restrictions on the numbers of problem-free countries are considered. The first version *(I)* is composed of equally balanced sets of debt-problem and problem-free countries. Thus, debt-problem countries have the same number of exactly balanced problem-free countries. In the second version *(II)*, more than one non-rescheduling country is additionally paired with each rescheduling country. Such further modification is introduced to examine whether the performance of the model can be improved by this particular opportunity to adjust to the cross-section dimension of the sample. However, unlike the composition in version *(I)*, the same degree of care can not be paid to a second selection of additional problem-free countries mainly because it becomes rather more difficult to chose between two or three developing countries which could be directly compared to each rescheduling country. The two lag specifications coupled with first three and then further two alternative kinds of samples produce a total of twelve alternative estimation results.

9-3-3. YEAR-BY-YEAR RE-ESTIMATION PROCEDURE

In practice sovereign risk assessment models are used to produce a succession of forecasts, year by year. The available data thereby expands continually. This means that parameter estimation is not the 'once-and-for-all' kind of activity implied in published studies but in rather an on-going process of re-estimation. For this reason, the empirical tests reported here focus on a year-by-year re-estimation procedure. Evaluations of forecast performance can then follow on the same annual basis.

This may have its own virtues. First, it may be regarded as an appropriate response to the threat of structural breaks that several published statistical sovereign risk studies have acknowledged to be a serious problem. Second, appraisals as to how well a model fits the data for individual country-year observations can only be made consistently for fitted values of the dependent variable at the margin, *i.e.*,. for any one, new, year. This is because fitted within-sample values are conditional on all the data used to estimate the model so that residuals beyond some forecast interval are influenced by some (later) observations which are not available in practice. Such additional residuals (beyond some year t) are therefore not comparable with the observation set that would actually be available at year t.

As indicated earlier, the estimation period of this empirical test ranges from 1967 to 1981. However, annual re-estimations for the earliest part of the observation period would be statistically meaningless, to some extent, due to the small size of the available samples. To overcome this problem, the present results are based on a 'blocked' data set to be estimated as a whole before carrying out year-by-year re-estimations. It sets up first the debt-problem and problem-free country-year observations for the period 1967-1972 as an initial data set, *i.e.*, for a period preceding the first oil-shock. Table 9-6 provides a summary of the different estimation investigations and the consequential sample coverages.

Table 9-6 EMPIRICAL TEST STRUCTURE OF THE CONVENTIONAL VARIABLES MODEL

ESTIMATION PERIOD				67-72	67-73	67-74	67-75	67-76	67-77	67-78	67-79	67-80	67-81
A. (One-year lag)	(1)	I	#	19	23	27	30	34	37	39	45	52	61
			*	80	100	120	154	192	234	260	352	432	520
			¬	0.24	0.23	0.23	0.19	0.18	0.16	0.15	0.13	0.12	0.11
		II	#	19	23	27	30	34	37	39	45	52	61
			*	156	195	234	274	314	354	394	434	474	524
			¬	0.12	0.11	0.12	0.11	0.11	0.10	0.10	0.10	0.11	0.12
	(2)	I	#	17	21	24	27	30	33	33	36	38	40
			*	56	64	70	88	108	130	130	196	238	290
			¬	0.30	0.33	0.34	0.31	0.28	0.25	0.25	0.18	0.16	0.14
		II	#	17	21	24	27	30	33	33	36	38	40
			*	110	126	138	148	156	176	176	226	248	290
			¬	0.15	0.17	0.17	0.18	0.19	0.19	0.19	0.16	0.15	0.14
	(3)	I	#	19	23	27	30	34	37	39	45	52	61
			*	38	46	54	60	68	74	78	90	104	122
			¬	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
		II	#	19	23	27	30	34	37	39	45	52	61
			*	74	90	106	116	128	136	144	158	174	187
			¬	0.26	0.26	0.25	0.26	0.27	0.27	0,27	0.28	0.30	0.32
B. (No-lag)	(1)	I	#	24	28	32	35	39	42	44	50	57	66
			*	100	120	140	176	216	260	286	384	468	560
			¬	0.24	0.23	0.23	0.20	0.18	0.16	0.15	0.13	0.12	0.12
		II	#	24	28	32	35	39	42	44	50	57	66
			*	195	234	273	313	353	393	433	473	513	563
			¬	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.11	0.11	0.12
	(2)	I	#	19	22	24	26	28	30	30	33	35	37
			*	64	70	74	92	112	134	134	173	251	307
			¬	0.30	0.31	0.32	0.28	0.25	0.22	0.22	0.16	0.14	0.12
		II	#	19	22	24	26	28	30	30	33	35	37
			*	127	139	147	153	157	173	173	223	265	307
			¬	0.15	0.16	0.16	0.17	0.18	0.17	0.17	0.15	0.13	0.12
	(3)	I	#	24	28	32	35	39	42	44	50	57	66
			*	48	56	64	70	78	84	88	100	114	132
			¬	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
		II	#	24	28	32	35	39	42	44	50	57	66
			*	93	109	125	135	147	155	163	177	193	211
			¬	0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.28	0.30	0.31

Notes: # Number of debt-problem observations.
* Number of total observations.
¬ Proportions of debt-problem observations.

9-4. EVALUATIONS OF PARAMETER ESTIMATIONS

9-4-1. RESULT OF PARAMETER ESTIMATIONS

The procedure of selecting an empirically acceptable set of explanatory variables for each of the above test alternatives consists of three steps. First, after estimating the logit function for each of the sixteen indicators individually, variables carrying the correct sign *a priori* are chosen. A second estimation process then follows referring only to these correctly-signed variables resulting from the first estimation process. The usual tests are then applied to these variables as a group to provide a selection of variables showing the correct sign and a statistically significant coefficient at the ten per cent significance level for a one-tailed *t*-test.[3] Then, finally, various combinations among those variables are tested to provide the best overall fit to the data for an explanatory variable set including as many statistically significant variables as possible. Collinearity problems among variables are checked by investigating partial correlation coefficients throughout.

The resulting explanatory variable sets are summarised in Table 9-7. The variables, and their further abbreviated (two-letter) code identifiers, in the Table refer, respectively, to the three debt variables, *i.e.*,

the debt service ratio (DS);
the ratio of total external debt to exports (ED); and
the amortisation to external debt ratio (AM),

the six balance of payments components, *i.e.*,

the reserves to imports ratio (RE);
the exports growth rate (GW);
the ratio of imports to GDP (MG);
the ratio of current account balance to GDP (CU);
the international reserves growth rate (GR); and
the exports to GDP ratio (XG),

the three income and expenditure variables, *i.e.*,

GDP per capita (PG);
the real GDP growth rate (GG); and
the ratio of capital formation to GDP (VG),

and the four monetary variables, *i.e.*,

the inflation rate (CP);

the money supply growth rate (GM);

the domestic credit to GDP ratio (DC); and

the change rate of real effective exchange rate (GE).

Each of the twelve test structures follows the same sequences in testing and selecting various combinations of explanatory variables.

Table 9-7 SELECTED VARIABLES IN THE CONVENTIONAL VARIABLES MODEL

ESTIMATION PERIOD			67-72	67-73	67-74	67-75	67-76	67-77	67-78	67-79	67-80	67-81
A. (One-year lag)	(1)	I	ED VG CP DC	DS VG CP DC	DS AM VG CP DC	DS AM RE VG CP DC	ED RE VG	ED RE VG	ED RE VG	ED RE GG	ED RE GG	ED RE GG
		II	ED VG CP DC	DS VG CP DC	DS AM VG CP DC	DS AM RE VG CP DC	ED RE VG	ED RE VG	ED RE XG VG	ED RE GG	ED RE GG	ED RE GG
	(2)	I	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED CP DC	ED RE CP DC	ED RE CP DC	ED RE CP DC
		II	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED RE CP DC	ED RE CP DC	ED RE CP DC	ED RE CP DC	ED RE CP DC
	(3)	I	ED VG CP DC	ED VG CP DC	ED RE GG CP DC	ED CU VG CP DC	ED CU VG CP DC	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED RE VG CP	ED RE VG CP
		II	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED VG CP DC	ED CU VG CP DC	ED VG CP DC	ED RE VG CP DC	ED RE VG CP DC	ED RE VG CP DC
B. (No-lag)	(1)	I	ED GW VG CP DC	ED RE GW CP	ED RE GW VG CP	ED RE GW VG CP DC	ED RE VG CP	ED RE CP	ED RE CP	ED RE VG CP	ED RE GG CP	ED RE GG VG CP
		II	ED XG VG CP DC	ED XG VG CP DC	ED RE GW VG CP DC	ED RE GW VG CP DC	ED RE XG VG CP	ED RE XG CP DC	ED RE XG VG CP	ED RE VG CP	ED RE VG CP	ED RE GG VG CP
	(2)	I	RE CU VG CP	ED RE VG CP	ED RE VG CP	ED RE CU VG CP DC	ED RE CU VG CP DC	ED RE VG CP	ED RE CU VG CP DC	ED RE PG CP	ED RE VG CP DC	ED RE VG CP DC
		II	ED RE VG CP	ED RE VG CP	ED RE VG CP DC	ED RE VG CP DC	ED RE VG CP DC	ED RE VG CP	ED RE VG CP DC	ED RE PG CP	ED RE CP	ED RE VG CP DC
	(3)	I	ED RE GG CP	ED RE GG CP DC	ED RE GG VG CP DC	ED GW CU GG VG CP DC	ED RE VG CP DC	ED GG VG CP DC	ED RE VG CP DC	ED RE PG VG CP DC	ED RE PG CP	ED RE PG GG CP
		II	ED GW GG VG CP DC	ED XG VG CP DC	ED RE GW VG CP DC	ED RE GW VG CP DC	ED RE GW VG CP DC	ED GW XG GG VG CP DC	ED GW XG PG VG CP DC	ED RE VG CP DC	ED RE GW PG VG CP DC	ED RE PG GG CP DC

Abbreviations:

DS: Debt service ratio.
AM: Amortisation to debt ratio.
GW: Exports growth rate.
XG: Exports to GDP ratio.
GG: Real GDP growth ratio.
CP: Inflation rate.
DC: Domestic credit to GDP ratio.
ED: Total external debt to exports ratio.
RE: Reserves to imports ratio.
CU: Current account balance to GDP ratio.
PG: GDP per capita.
VG: Investment to GDP ratio.
GM: Money supply growth rate.

As far as the results of the initial round of individually estimated parameters are concerned, nine variables produce instances of a parameter having the correct sign *a priori* over all of the estimation results. These include the debt service ratio (DS), the ratio of external debt to exports (ED), the reserves to imports ratio (RE), the exports to GDP ratio (XG), the real GDP growth rate (GG), the ratio of capital formation to GDP (VG), inflation rate (CP), money supply growth rate (GM), and the domestic credit to GDP ratio (DC). The results for debt-related and monetary variables are therefore relatively more encouraging. Among the correctly-signed variables, five, *i.e.*, DS, ED, XG, VG and CP, persistently show a statistically significant coefficient through all the exercises.

In contrast, only the ratio of imports to GDP (MG) consistently yields incorrectly-signed results. The remaining six variables have the correct or wrong signs depending on alternative sub-sets of the variables. The imports to GDP ratio (MG) always appears as having statistically significant negative signs (so higher ratio is associated with a reduced likelihood of debt problems) in all the versions. Similar results have been reported already by other studies. For example, Frank and Cline (1971) and Feder and Just (1977) reject the imports to GNP ratio as an indicator in reporting their final empirical tests on the grounds that implausible (negative) coefficient estimates are obtained.[4] As opposed to this, Mayo and Barrett (1978) have different views on the *a priori* sign of this ratio and write (p. 85):

At first, it would appear that the negative sign for the ratio of imports to GDP is inaccurate. However, this ratio can be viewed as a proxy for the degree of "openness" or maturity of the economy, and the more open or mature the economy, the less likely it is to reschedule.

In contrast, Saini and Bates (1978) report both negative and positive signs in their estimated functions including this variable.[5] In the case of the McFadden *et. al.* (1985) study, the ratio of imports to GDP has a negative sign in the first of their two sub-periods, 1971-75, but changes sign in the second, 1976-82. This is simply said (p. 193) to imply that "open economies with a higher ratio of imports to GDP have fewer problems in the earlier period but more problems in the later period."

In many developing countries, a considerable part of imports consists of capital and intermediate goods reflecting the effects of import substitution. To this extent, thus, their imports are essentially non-compressible so that they can not easily be reduced in time of balance-of-payments crisis without slowing economic growth. To this extent a higher ratio of imports to GDP may mean it is more difficult for a developing country to meet debt-servicing obligations and so increases the likelihood of debt problems. However, change in short-run circumstances might suggest a different situation. When world trade is favourable to developing-country exports (as in the late of 1960s and the early 1970s, for instance), the more creditworthy countries who favoured 'outward' looking policy in favour of 'open' economies increased their imports with foreign exchange earned from the export sector. This produces a higher imports to GDP or GNP ratio for those countries having higher credit ratings. This effect might be consistent with the empirical results reported above. However, the sign of the estimated coefficient of this ratio should be expected to be plus in the long-run and within the broader context of sovereign risk analysis.

When parameters are estimated for only those variables reported to have the correct sign in the individual estimation procedure, all the variables except the debt service ratio (DS), the amortisation to debt ratio (AM), and the exports to GDP ratio (XG) retain their correct signs in most of the combinations. Such changes

of signs appear to imply that those variables might have collinearity problems with other, and combinations of, variables. XG and AM have a wrong plus sign when estimated with debt-related variables (especially the debt to exports ratio). As may be expected, there seems to be collinearity problems between two of the debt-related variables, the debt service ratio (DS) and the external debt to exports ratio (ED).[6] While the latter produces statistically significant coefficients persistently through the various exercises, the former retains its significance usually only when the latter is excluded. Their partial correlation coefficients range from 0.53 to 0.69. Similar results are obtained in the case of relations between the inflation rate (CP) and the money supply growth rate (GM) and between the ratio of imports to GDP (MG) and the exports to GDP ratio (XG). They show even relatively higher partial correlation coefficients, ranging between 0.66 to 0.97 and 0.85 to 0.98 respectively. Thus, explanatory variable selections are restricted throughout by excluding one or the other of these pairs of correlated variables.

As reported in Table 9-7, among various model versions through year-by-year re-estimations the most frequently selected variables are the ratio of external debt to exports (ED), the ratio of capital formation to GDP (VG), inflation rate (CP), and the domestic credit to GDP ratio (DC) given that the resulting explanatory variables sets vary depending on the estimation period and test alternatives.

As far as year-by-year comparisons for any one set of estimation results are concerned, *i.e.*, as a re-estimation sequence proceeds, no major patterns can be distinguished. Among the variables which remain generally consistently statistically significant there are ED, DC, VG, and CP. Most combinations of variables change little from one year to the next and yet there are a variety of variables that either appear only for a number of years, or disappear and reappear in any one sequence, or appear only for one or two years. These latter instabilities underline the need for continuous re-estimations in order to be sure of making the best use of conventional variables, even though the samples change so very marginally from one year to the next.

9-4-2. EVALUATIONS OF OVERALL FITS TO THE DATA

The overall statistical performance of a logit model is judged somewhat differently than in the case of conventional regression analysis, where an estimated *F*-statistic can be used to test the statistical significance of a group of explanatory variables. One alternative measure of statistical performance is available in the *Chi*-squared statistic in a logit model. The test statistic is in the form of minus two times the log-likelihood ratio ($-2 \times LLR$)[7]. This has the *Chi*-squared distribution with the appropriate degrees of freedom.[8] On the basis of this statistical criterion,

it is noted that the null hypothesis that all the coefficients are zero is rejected at the one per cent significance level for all of the test results.

For the purposes of comparisons of overall fits to the data between various test results, other criteria such as *R*-squared and the percentage of correct predictions (*PCP*) are applied. The latter is the ratio of the correctly predicted country-year cases to the total cases for within-sample residuals. Correct predictions are registered with reference to a threshold probability, P^*, above which a country-year is predicted to reschedule and *vice versa* for below. An optimal cut-off probability point P^* is assumed to be one that minimises the 'variance' between a given cut-off point and predicted probabilities ($\hat{P}$'s).

Table 9-8 summarises results for the $-2 \times LLR$, *R*-squared, and *PCP* test statistics for all the various estimated results alternatives using the explanatory variable set listed in Table 9-7.

Table 9-8 OVERALL FITS TO THE DATA IN THE CONVENTIONAL VARIABLES MODEL

ESTIMATION PERIOD				67-72	67-73	67-74	67-75	67-76	67-77	67-78	67-79	67-80	67-81
A. (One-year lag)	(1)	I	#	21.04	31.45	43.17	49.91	43.44	47.95	49.77	60.73	71.74	89.55
			*	0.26	0.33	0.39	0.36	0.25	0.23	0.22	0.19	0.18	0.19
			¬	0.79	0.82	0.83	0.84	0.82	0.84	0.84	0.86	0.87	0.88
		II	#	35.87	50.40	67.99	71.29	57.13	60.99	65.67	65.17	73.46	89.60
			*	0.30	0.37	0.42	0.38	0.26	0.24	0.24	0.18	0.17	0.19
			¬	0.88	0.93	0.91	0.91	0.89	0.90	0.90	0.89	0.88	0.88
	(2)	I	#	17.25	23.67	30.81	38.01	41.59	50.35	48.90	73.37	79.33	85.73
			*	0.30	0.35	0.40	0.40	0.38	0.38	0.37	0.40	0.37	0.35
			¬	0.80	0.80	0.81	0.91	0.83	0.82	0.82	0.87	0.88	0.90
		II	#	30.86	41.73	53.00	55.45	52.63	61.06	61.06	74.72	80.28	85.73
			*	0.34	0.39	0.45	0.43	0.38	0.36	0.36	0.37	0.36	0.35
			¬	0.87	0.87	0.89	0.89	0.87	0.86	0.86	0.89	0.89	0.90
	(3)	I	#	27.45	35.19	43.26	47.53	50.30	53.58	57.93	60.63	65.78	81.42
			*	0.62	0.66	0.62	0.65	0.60	0.60	0.62	0.58	0.50	0.53
			¬	0.89	0.89	0.87	0.88	0.85	0.88	0.88	0.87	0.82	0.83
		II	#	47.17	59.39	69.17	66.96	62.25	68.75	71.45	80.24	84.10	100.8
			*	0.69	0.71	0.67	0.60	0.49	0.50	0.49	0.48	0.43	0.47
			¬	0.95	0.94	0.92	0.92	0.89	0.88	0.87	0.85	0.82	0.83
B. (No-lag)	(1)	I	#	34.39	40.68	55.62	66.51	62.18	62.26	62.83	83.25	89.48	113.1
			*	0.35	0.33	0.38	0.37	0.29	0.25	0.23	0.23	0.22	0.24
			¬	0.82	0.82	0.84	0.84	0.84	0.86	0.86	0.87	0.88	0.89
		II	#	51.51	66.66	86.68	90.43	85.54	83.83	91.51	90.45	93.62	112.9
			*	0.35	0.39	0.42	0.38	0.32	0.28	0.27	0.23	0.21	0.24
			¬	0.90	0.91	0.92	0.91	0.90	0.90	0.90	0.90	0.89	0.89
	(2)	I	#	26.03	34.79	39.64	53.88	61.14	65.99	68.96	86.30	93.63	102.9
			*	0.36	0.44	0.47	0.54	0.53	0.47	0.50	0.47	0.45	0.44
			¬	0.86	0.84	0.85	0.87	0.88	0.87	0.91	0.89	0.92	0.92
		II	#	36.92	47.72	57.64	61.75	68.56	77.30	77.30	87.09	91.13	102.9
			*	0.38	0.40	0.45	0.45	0.48	0.49	0.49	0.46	0.42	0.44
			¬	0.84	0.90	0.92	0.91	0.91	0.91	0.91	0.90	0.91	0.92
	(3)	I	#	41.52	51.75	57.99	68.09	65.77	63.26	66.35	72.46	82.37	101.2
			*	0.70	0.70	0.70	0.76	0.68	0.62	0.62	0.58	0.56	0.59
			¬	0.92	0.88	0.91	0.91	0.90	0.88	0.89	0.86	0.83	0.87
		II	#	58.21	64.07	65.16	83.91	94.29	98.37	105.9	105.6	117.2	131.8
			*	0.60	0.59	0.65	0.59	0.58	0.61	0.62	0.54	0.53	0.53
			¬	0.88	0.90	0.92	0.90	0.88	0.90	0.90	0.87	0.88	0.86

Notes: # $-2 \times LLR$.
* *R*-squared.
¬ Percentage of correct predictions (*PCP*).

It is noted that Table 9-8 shows model version *(B)* as having higher log-likelihood ratio, *R*-squared, and *PCP* results than model version *(A)* across the various sub-versions. This may imply that the contemporaneous lag structure has better performance, at least within-sample, than a one-year lag structure. As far as comparisons among results for versions *(1)* to *(3)* are concerned, in most cases version *(3)* performs best while version *(1)* is the least satisfactory.[18] Last, regarding model versions *(I)* and *(II)*, there seems to be no great difference with respect to any of the three test criteria. Although the *R*-squared and *PCP* results are similar, version *(II)* is better than version *(I)* in terms of the log-likelihood ratio. However, in the case of version *B-(3)*, version *(1)* always demonstrates better *R*-squared than version *(II)*. It could mean that there would be no considerable improvements as more problem-free observations are added to a directly balanced sample.

9-5. EVALUATIONS OF FORECAST PROBABILITIES

9-5-1. PREPARATION FOR FORECASTS

A key objective of model building as a means of expressing an understanding of the past is to forecast the future. Since in practice forecasts are required on a year-by-year basis, it is only sensible to use the flow of new information, year-by-year, to re-estimate on the same basis. Forecast performance can then be consistently evaluated at the margin, *i.e.*, for any one, new, year. Thus, the estimated model for the period 1967-1972, for example, is used first to yield the forecast probabilities of rescheduling in 1973. This forecast structure is thereafter extended over the forecast interval on a year-by-year basis. The use of actuals for explanatory variables means that these the out-of-sample annual forecasts constitute an *ex post* process.

The selection of the countries to be forecast is no doubt an important issue when it comes to evaluating forecast performance. In particular, since the present empirical analysis examines the effects of a balance between debt-problem and problem-free countries, some countries can not be included in model estimations for some alternatives. However, all the 40 countries listed Table 9-4 are included in order to utilise their forecast results for the portfolio loan design evaluations explained in section 9-6. It follows that the total country-year observation set for the forecast interval amounts to 400 (*i.e.*, 10 years x 40) country-years. This includes 47 observations (twelve per cent) that are rescheduling cases.

As far as the forecast error evaluation methods themselves are concerned, several methods are examined. These include total error rates, statistical tests of forecast error distributions, the root-mean-square forecast error, and portfolio design evaluations. The first three may be considered conventional procedures while the last will constitute a hitherto untried idea.

9-5-2. FORECAST ERROR EVALUATIONS

As may be expected, most of the actual debt-problem observations have a high forecast probability while most of the problem-free observations have a relatively low one. To gain further insight into the forecast performance of the model along the conventional lines found in most previous studies, it is necessary to choose a threshold probability, P^*. Then, for any given P^*, there are two possible types of error: (1) a type I error, which could be assumed to be a case where a country has a forecast probability ($\hat{P}$) lower than P^* but actually rescheduled; and (2) a type II error, for which it follows that a country has a predicted probability higher than P^* but did not reschedule. Specifically, a cut-off probability P^* is selected so that the total error rate is minimised subject to composition preferences that would follow from an ability to specify the relative costs of type I and II errors. (Presumably it is usually more expensive error to have a loan that has to be

rescheduled than to miss business refused because of a high $\hat{P}$ forecast that would otherwise have been welcomed had it been known that a country would not reschedule. Some studies have assumed a cost ratio of three to one.)

The numbers of type I/II and total errors are summarised in Table 9-9 in a form that pools the results for the whole forecast interval for each model version. Total error rates range from 0.10 to 0.15. The best results are obtained from the results of the version *(B)-(3)-(I)*. This produces eleven type I errors and 30 type II errors. As in the case of the results of overall fits to data, within-sample, reviewed in the previous section, version *(B)* produces better forecast performances than version *(A)* and version *(3)* has the lowest error rates of this category of versions while there is no big difference between version *(I)* and *(II)* overall.

In general, type I error rates retain relatively high levels, ranging from 0.23 to 0.36 of forecast reschedulings. However, this kind of forecast error evaluations can not be compared with the results of other statistical sovereign risk studies mainly because the ultimate choice of a cut-off probability P^* is something that will vary depending on a user's attitude towards risk and on his preference between type I/II errors. For instance, if the relative costs of type I and II errors were weighted in the manner followed by many published studies, type I error rates would decrease to a lower level while type II error rates increase.

A more important question, however, concerns whether this conditional forecast is acceptable at a specific level of significance. At this point, the standard significance test for sample proportions can be applied as in Taffler and Abassi (1984) in order to test whether each model version has predictive ability. The test statistic is

$$z = \frac{(p - \pi)}{\sqrt{\pi(1 - \pi)/n}},$$

where z is the standardised normal deviate, p the sample proportion, π the probability of chance classification, and n number of observations. Referring to Table 9-9 which demonstrates the ten-year forecasting results, one p-proportion, p_1, would be the ratio of correctly-predicted reschedulings to total predicted cases to reschedule (in the version of *A-(1)-(1)*, for example, $p_1 = (47 - 17)/[(47 - 17) + 32] = 0.48$). A second proportion, p_2, registers the same success rate in respect of problem-free predictions and realisations (in the same version, $p_2 = (353 - 32)/[(353 - 32) + 17] = 0.95$). The respective chance classification probabilities π_1 and π_2 are 0.12 (47/400) and 0.88 (353/400) respectively. Then, the maintained hypotheses $p_1 = \pi_1$ and $p_2 = \pi_2$ can be tested against the alternative hypotheses $p_1 > \pi_1$ and $p_2 > \pi_2$ respectively with reference to the two test statistics $z_1 = (p_1 - \pi_1)/\sqrt{\pi_1(1 - \pi_1)/n_1}$ and $z_2 = (p_2 - \pi_2)/\sqrt{\pi_2(1 - \pi_2)/n_2}$. The null hypotheses are rejected for all the versions at the 0.1 per cent significance level of a one-tailed test since $Pr(z > 3.09) = 0.001$. Thus, it may be concluded that all the versions in this empirical analysis have true *ex post* predictive capabilities.

As another means to evaluate a model's forecast performance, the 'root-mean-square-error' (*RMSE*) is used as a quantitative summary measure of how closely forecasts track a rescheduling history. The *RMSE* for the dependent variable is defined as

$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(\hat{P}_i - \overline{P}_i)^2}$$

where $\hat{P}$ denotes a forecast probability, $\overline{P}$ refers to the corresponding actual value of the dependent variable (*i.e.*, 1 or 0), and N is the number of observations. Table 9-9 illustrates the *RMSE* for each version as an averaged figure for the entire

ten-year forecast interval. Since the lower the *RMISE* the better the forecast performance, version (*B*) is again superior to version (*A*). But, unlike previous results, version *(3)* produces the highest figures among this group of version variations. Version *(II)* has consistently better results than version *(I)*.

Table 9-9 FORECAST ERROR ANALYSIS IN THE CONVENTIONAL VARIABLES MODEL

			TOTAL ERRORS			STANDARD SIG. TEST		RMSE
			type I	type II	TOE (%)	z1	z2	
A. (One-year lag)	(1)	I	17	32	49 (12)	8.94	3.88	0.303
		II	17	38	55 (14)	8.26	3.79	0.298
	(2)	I	17	42	59 (15)	7.87	3.71	0.371
		II	17	41	58 (15)	7.94	3.71	0.340
	(3)	I	16	30	46 (12)	9.45	4.05	0.554
		II	16	36	52 (13)	8.76	3.96	0.425
B. (No-lag)	(1)	I	12	33	45 (11)	10.15	4.63	0.302
		II	14	38	52 (13)	9.07	3.79	0.295
	(2)	I	16	34	50 (13)	8.98	3.97	0.348
		II	12	36	48 (12)	9.80	4.61	0.324
	(3)	I	11	30	41 (10)	10.76	4.82	0.563
		II	13	37	50 (13)	9.43	4.39	0.400

Notes: Results refer to the whole forecast interval (1973-82). Thus, total cases are 400 including 47 rescheduling observations.

TOE Number of total errors. Figures in parentheses denote total error rates in percentage.

z1 & z2 Standardised normal deviates (see texts).

RMSE Root-mean-square-error expressed in an average.

9-6. FORTFOLIO DESIGN EVALUATIONS

As pointed out earlier, most forecast error analyses in the major statistical sovereign risk studies conventionally attempt to transform $\hat{P}$ forecasts values into a debt-problem or problem-free form since debt-problem realisations are in this binary form. However, such analysis overlooks better uses that can be made of forecast probabilities in practice, and notably in deciding on a lender's loan portfolios. Forecast error analysis should then be performed in this same context, *i.e.*, comparisons between planned $\hat{P}$-based portfolios and what would have been optimal had the future been known in advance.

The present analysis produces loan portfolio designs based on forecast probabilities for the same 40 countries identified earlier. These are referred to as 'forecast-based' (*F-B*) loan allocations. This can then be compared with 'hindsight-optimal' (*H-O*) loan allocations, given *both* some view of what is optimal *and* had realised distributions of reschedulings been known in advance. To measure the extent of the difference between the two Theil's inequality coefficient is used.

9-6-1. ACTUAL AND HINDSIGHT-OPTIMAL LOAN ALLOCATIONS

Given a lack of precise information on how commercial banks assess country creditworthiness and the basis of their past allocations of sovereign loans among borrowers, it is supposed that actual loan commitments to a country represent a market maximum of what a country could obtain and make use of. The assumption is that bankers know the supply-side of the financial market situation best, even though some individual banks could make serious mistakes in their portfolio policies, while borrowers only borrow funds for which they have some use.

Loan commitments from official creditors, such as the World Bank, usually have an economic aid component in that they are made on terms more favourable than those obtainable through normal market transactions. The supply and demand considerations may thus be reckoned as being separate from private bank portfolio allocations. Loan commitments from official sources are therefore excluded in identifying the actual allocations of sovereign loans.

In turning to 'hindsight-optimal' portfolio designs, it is noted that if banks had realised in advance which borrowing countries would experience debt-servicing difficulties in the near future, it might be argued that they would not have made any loans to them at all. The amount of these loans might then have been distributed among problem-free borrowers. This is the basis of an assumed *H-O* loan allocations, *i.e.*, what problem-free countries actually received augmented by a re-allocation of what it would have been thought wise not to have given the debt-problem countries if their realised difficulties had been known in advance. Thus, the actual (observed) new commitments for debt-problem countries are summed up and then re-allocated to problem-free countries in proportion to the relative sizes of their new commitments. As illustrated in Table 9-10, India, Zaire, and Sierra Leone which rescheduled their external debts in the given year of 1977 are given no new loans in terms of this allocation.

9-6-2. FORECAST-BASED LOAN ALLOCATIONS

In using $\hat{P}$ results to design of loan portfolios, it is simply assumed that the higher a $\hat{P}$ value is, the less credit will be given and *vice versa*. Clearly this information can only be used in the contexts of the relative *sizes* of the borrowing capacities of recipient countries. One way of coping with this problem is to rely on past loans as a guide to the scale of future loan requirements. The 'crude' portfolio design used here adjusts each country's observed new loan commitments for the previous year by a factor of $(1 - \hat{P}_{t+1})$. Thus, loans are allocated by

'borrowing potential', as signalled by the previous year's actual loan allocations, adjusted by $\hat{P}_{t+1}$ results so that for $\hat{P}_{t+1} = 1$ the *F-B* allocation is zero while for $\hat{P}_{t+1} = 0$ the allocation is unchanged. For instance, as seen in Table 9-10, the *F-B* allocation for Chile is 156 (U.S. million dollars), *i.e.*, the outcome of 295×0.53 .

For an illustration, Table 9-10 shows actual, *H-O* and *F-B* loan allocations by using the $\hat{P}$'s from the results version *(B)-(1)-(1)* estimated for the period 1967-76 for forecasting 1977.

Table 9-10 AN ILLUSTRATION OF PORTFOLIO DESIGN (IN 1977)

	ACTUAL ('76) ALLOCATION	$(1-\hat{P})$	F-B ('77) ALLOCATION	ACTUAL ('77) ALLOCATION	H-O ('77) ALLOCATION
Chile	295 (1.37)	0.53	156 (0.98)	559 (2.13)	561 (2.14)
Peru	930 (4.31)	0.52	484 (3.05)	561 (2.14)	564 (2.15)
Indonesia	1436 (6.65)	0.76	1091 (6.86)	385 (1.47)	386 (1.47)
India*	2 (0.01)	0.39	1 (0.01)	2 (0.01)	0 (0.00)
Pakistan	127 (0.59)	0.23	29 (0.19)	126 (0.48)	126 (0.48)
Philippines	896 (4.15)	0.84	753 (4.68)	662 (2.52)	666 (2.54)
Egypt	478 (2.21)	0.59	282 (1.76)	738 (2.81)	741 (2.83)
Turkey	564 (2.61)	0.73	412 (2.57)	486 (1.85)	489 (1.86)
Yugoslavia	51 (0.24)	0.84	43 (0.27)	19 (0.07)	19 (0.07)
Ghana	22 (0.10)	0.60	13 (0.08)	7 (0.03)	7 (0.03)
Mexico	4866 (22.54)	0.64	3114 (19.41)	8459 (32.24)	8502 (32.40)
Ecuador	237 (1.10)	0.84	199 (1.24)	622 (2.37)	625 (2.38)
Korea	1017 (4.71)	0.80	814 (5.07)	1505(5.73)	1512 (5.76)
Sri Lanka	67 (0.31)	0.72	48 (0.30)	10 (0.04)	10 (0.04)
Malaysia	217 (1.01)	0.84	182 (1.15)	294 (1.12)	295 (1.12)
Thailand	100 (0.46)	0.84	84 (0.53)	338 (1.29)	340 (1.29)
Morocco	605 (2.80)	0.85	514 (3.20)	1128 (4.30)	1134 (4.32)
Syria	41 (0.19)	0.79	32 (0.20)	39 (0.15)	39 (0.15)
Greece	248 (1.15)	0.78	193 (1.22)	384 (1.46)	386 (1.47)
Kenya	11 (0.05)	0.80	9 (0.06)	15 (0.06)	15 (0.06)
Argentina	1460 (6.76)	0.77	1124 (7.04)	1237 (4.72)	1244 (4.74)
Jamaica	67 (0.31)	0.64	43 (0.27)	63 (0.24)	63 (0.24)
Guyana	49 (0.22)	0.78	38 (0.24)	9 (0.03)	9 (0.03)
Bolivia	259 (1.20)	0.73	189 (1.18)	270 (1.03)	271 (1.03)
Zaire*	183 (0.85)	0.55	101 (0.63)	103 (0.39)	0 (0.00)
Sierra Leone*	9 (0.04)	0.62	6 (0.04)	26 (0.10)	0 (0.00)
Togo	209 (0.97)	0.82	171 (1.07)	135 (0.51)	135 (0.52)
Liberia	9 (0.04)	0.81	7 (0.04)	43 (0.16)	43 (0.16)
Senegal	53 (0.24)	0.70	37 (0.23)	42 (0.16)	43 (0.16)
Malawi	26 (0.12)	0.70	18 (0.11)	87 (0.33)	88 (0.33)
Brazil	5561 (25.76)	0.82	4560 (28.54)	5242 (19.98)	5269 (20.08)
Honduras	39 (0.18)	0.78	30 (0.19)	38 (0.15)	38 (0.15)
Paraguay	14 (0.06)	0.84	12 (0.07)	25 (0.10)	26 (0.10)
Venezuela	1133 (5.25)	0.85	963 (6.02)	2059 (7.85)	2069 (7.88)
Zambia	99 (0.46)	0.72	71 (0.45)	69 (0.26)	69 (0.26)
Niger	1 (0.00)	0.83	1 (0.00)	2 (0.01)	2 (0.01)
El Salvador	0 (0.00)	0.81	0 (0.00)	0 (0.00)	0 (0.00)
Nigeria	0 (0.00)	0.85	0 (0.00)	0 (0.00)	0 (0.00)
Guatemala	0 (0.00)	0.84	0 (0.00)	0 (0.00)	0 (0.00)
Tunisia	207 (0.96)	0.81	168 (1.05)	455 (1.74)	458 (1.74)

Notes: This portfolio design is produced by using the estimated results of version (B)-(1)-(I). Amounts are in million of U.S. dollars. Figures in parentheses denote the proportion of loan allocation to each of the total amounts in percentage. All the figures are rounded.

* Rescheduling country in 1977.

9-6-3. THEIL'S INEQUALITY COEFFICIENTS FOR PORTFOLIO DESIGNS

The present empirical analysis evaluates forecast errors by means of the differences between *F-B* and *H-O* portfolio allocations. As a result of the lack of the data on loan commitments for some counties this can be done only from 1975 (in case of version *(A)* from 1976). These differences are quantified in terms of Theil's inequality coefficient (U). In terms of the terminologies of the present study, this is defined as

$$U = \frac{\sqrt{\sum (FA_i - HA_i)^2}}{\sqrt{\sum (FA_i)^2} + \sqrt{\sum (HA_i)^2}},$$

where the FA's refer to the *F-B* allocations and HA's are the *H-O* allocations.[9] It is noted that U will always fall between 0 and 1. If $U = 0$, $FA_i = OA_i$ for all i and there is a perfect fit. If $U = 1$, on the other hand, the predictive performance of the model is as bad as it possibly could be.[10]

In Table 9-11, a Theil's inequality coefficient is presented for every estimation results version over the forecast period of 1975-82. Although there is no significant difference in their performances among the various versions, the no-lag model (version *(B)*) produces, in general, better results with a relatively lower value rather than the one-year lag model (version (*A*)). And of the three versions of *(1)* to *(3)*, version*(3)* has a lower coefficient. Version *(I)* and *(II)* report very similar results.

Table 9-11 THEIL'S INEQUALITY COEFFICIENTS FOR PORTFOLIO DESIGNS OF THE CONVENTIONAL VARIABLES MODEL

FORECAST INTERVAL			'75	'76	'77	'78	'79	'80	'81	'82
A. (One-year lag)	(1)	I	N.A.	0.453	0.318	0.451	0.572	0.506	0.481	0.515
		II	N.A.	0.231	0.265	0.159	0.297	0.248	0.231	0.394
	(2)	I	N.A.	0.235	0.257	0.147	0.196	0.206	0.151	0.335
		II	N.A.	0.232	0.258	0.155	0.171	0.196	0.154	0.335
	(3)	I	N.A.	0.266	0.251	0.120	0.126	0.147	0.111	0.147
		II	N.A.	0.251	0.249	0.117	0.129	0.148	0.112	0.148
B. (No-lag)	(1)	I	0.419	0.351	0.332	0.512	0.363	0.352	0.363	0.358
		II	0.147	0.120	0.228	0.289	0.118	0.205	0.238	0.351
	(2)	I	0.203	0.130	0.216	0.123	0.121	0.174	0.319	0.339
		II	0.146	0.116	0.221	0.139	0.129	0.173	0.329	0.339
	(3)	I	0.159	0.115	0.219	0.119	0.132	0.163	0.165	0.124
		II	0.141	0.125	0.220	0.124	0.114	0.167	0.168	0.123

N.A. Not available.

9-7. SPECIFICATIONS OF A COMPOSITE VARIABLES MODEL

9-7-1. MORE PRACTICAL TIME LAG STRUCTURE

As reported above, specifications adopting contemporaneous timings of explanatory variables produce better estimation results and forecasts in general. This may be reckoned as in accord with the a critical role played by the unforeseeable in events leading to debt problems. This may imply that it is more immediate events that appear to be the more successful indicators of debt

problems. The informational needs are thus that much more demanding (if not impossible), when it comes to trying to forecast *ex ante*, however. A no-lag model is already at a considerable disadvantage in this given the gap between the latest published information and the need for *ex ante* forecasts of explanatory variables. The gap is especially difficult to bridge in the context of most of developing countries given the lack of appropriate macroeconomic models capable of producing *ex ante* predictions of explanatory variables. Although most previous statistical models do not have any explicit consideration of this point, it is clearly a serious one.

Decisions on the timing of explanatory variables in relation to the incidence of debt problems therefore result in a choice between a model's forecasting capability and the quality of fits to data over the estimation period. The choice also affects the kind of explanatory variables required since the lagging of explanatory variables to be able to get closer to published information when forecasting means moving even further away from the unforeseeable. This requires a reconsideration of what is that we expect a model to tell us. But to tackle the lag issue first the alternative model in this section refers to a two-year lag. Even a two-year lag leaves a gap of one or two years between a forecast interval ($t+1$) and published data given that publication delays by the major international data sources such as the *International Financial Statistics* of the IMF range between one and two years (at least) with variations according to countries and indicators.

9-7-2. UTILISATION OF PAST EXPERIENCE AND NEW INFORMATION

9-7-2-1. EMPLOYING A SUMMARISED TERM FOR PAST EXPERIENCE

While a no-lag model can rely on a more obvious choice of indicators of debt problems, the resort to longer lag structures means looking to different themes in the selection and formulation of explanatory variables. It is argued here that this

requires making the best use of past experience and the latest available information to provide information on the managerial capabilities in debtor economies in general and the sustainabilities of current policies and performance in particular.

A special facility for summarising past information is adopted in the form of 'last' year's forecast probability ($\hat{P}_{t-1}$). The assumption is that this can act as a proxy for accumulated past information which would have been expressed in the previous year as the forecast debt-problem probability. This represents all that was known then and remains all that *continues* to be known about the past, unless new (past) facts are discovered or known facts can be looked at with new insights.

9-7-2-2. CONSTRUCTING COMPOSITE VARIABLES

In seeking ways of making the fullest use of additional information as each new year is added to the observation set, composite variables are used in order to accommodate as many variables as possible. This then represents a major departure from the procedures used to select, express, and validate explanatory variables in previous statistical sovereign risk analyses. There the selection of explanatory variables is essentially *ad hoc* and statistical results are relied on to discriminate between what is acceptable and what is not. In contrast, the composites here unambiguously relate to the broader contexts of debt problems in terms of the sustainabilities of current macroeconomic policy and performance, indicated by conventional macroeconomic variables. A second major theme behind considering what variables may have a bearing on the eventual incidence of debt problems is that these influences may have a much wider scope than is generally supposed in the relatively narrow range of indicator tested in any one of the individual studies in the previous literature. The opportunities presented by the flexibilities and scope of composite variables are therefore used to full advantage to refer to a much wider range of possible influences on debt problems. In general, it can perhaps be argued in this that the one reason why so many plausible indicators of debt problems have proved to be empirically irrelevant in

previous studies is that they have not been looked in the right context. Different amalgamations are therefore used to represent the different kinds of influences of different categories of variables. The results could be regarded as a variant of the use made of principal components in the earlier studies by Dhonte (1975) and Taffler and Abassi (1984). Rather these have the contributions of variables to each successive component determined entirely by what works best empirically, to leave results which are typically difficult to interpret or describe in theoretical terms, the composites adopted here have clearly defined theoretical rationalisations. They could therefore be regarded as structured, or constrained, variants of a principal components approach.

When it comes to the classification of macroeconomic variables for defining the composites, the sequences in which events actually take place, as reviewed in the previous chapter, are used to suggest what is most appropriate. As a starting point, a country can be thought of as adopting various economic policies as reactions to existing, and changes in, external and internal environments and various targets for the future state and achievements of the economy. Results can be expected to be registered later on, as determined by both circumstances and economic polices. Such economic performance can be examined under two heads depending on the length of time for effects to manifest themselves. In particular, the distinction is drawn between more 'immediate' and more 'eventual' performance results. The overall effect is to produce a four-way variable categorisation as indicated by the following labels: (1) economic environment variables; (2) policy variables; (3) first-round performance variables; and (4) the final performance variables.[11]

The first is considered to have low priority given that external shocks such as global recession and major commodity and factor price changes, like increases in oil prices and world real interest rates, can be regarded as conditions that apply more or less generally to the kind of developing countries that are of interest to this study. It is therefore difficult to see how to describe them in terms of

country-specific indicators that are in keeping with the thrust of this empirical test in its emphasis on comparative evidence. Thus, the present composite variables model concentrates on the remaining three composites. So far as the component indicator selections in these respects are concerned, the essential point of reference is conventional macroeconomic theory, subject to the constraints imposed by data availabilities. A total of thirteen indicators are selected for trial investigations of the three composites.[12] These are listed as follows. The definition, measurement, and data sources of each of the component variables, for example, exports, money supply, and public debt, are the same as those used in respect of the variables described earlier in specifications of conventional models.

1. COMPOSITE OF THE *POLICY VARIABLES*[13]
   a. Money supply growth rate
   b. Growth rate of domestic credit
   c. Real effective exchange rate change
   d. Change in the ratio of imports to GDP
   e. Growth rate of total public debt

2. COMPOSITE OF THE *EARLY PERFORMANCE VARIABLES*
   a. Domestic saving to GDP ratio[14]
   b. Gross capital formation to GDP ratio
   c. Exports growth rate
   d. Total external debt to exports ratio

3. COMPOSITE OF THE *FINAL PERFORMANCE VARIABLES*
   a. Growth rate of GDP per capita
   b. Current account balance to exports ratio
   c. Net increase in reserves to exports ratio
   d. Inflation rate

9-7-3. STRUCTURE OF THE COMPOSITE VARIABLES MODEL

The amended specifications represented by a two-year lag and the reformulations of explanatory variables in the form of three composite variables and $\hat{P}_{t-1}$ are investigated using the same test structures described earlier. These apply both to the specifications represented by the quantification of the dependent variable and the mathematical form of the model and also to the evidence and estimation procedures used such as year-by-year re-estimations, different degrees of sample balance (*i.e.*, results versions *(I)* and *(II)*), and the various extents to which problem-free observations are excluded from debt-problem countries (*i.e.*, results versions *(1)-(3)*). The estimation and forecast evaluation procedures, with reference to both within-sample and out-of-sample performances, are also essentially the same.

The construction of the composite variables raises in itself some additional issues. These can be considered under the separate headings of estimations and forecasts. The first relates to producing a logit model fit of each collection of variables within each composite to observations on the dependent variable so as to estimate their weight of contributions. The second part of the analysis uses these weights to forecast the composites. Since the composite variables model has a two-year lag structure, each of the three composite variables in a year t will be formed by a fit to observations on the underlying component indicators (*i.e.*, five in case of the first composite, four in the second, and four in the third) in a year $t-3$. The logit functions for the composite variables thereby are

$$\hat{Y}_t^{pol} = \frac{1}{1 + e^{-(\hat{a}_0 + \hat{a}_i X_{i,t-3}^{pol})}}, \tag{1}$$

$$\hat{Y}_t^{epf} = \frac{1}{1 + e^{-(\hat{b}_0 + \hat{b}_i X_{i,t-3}^{epf})}}, \tag{2}$$

$$\hat{Y}_t^{cpf} = \frac{1}{1 + e^{-(\hat{c}_0 + \hat{c}_i X_{i,t-3}^{cpf})}}, \tag{3}$$

where $\hat{Y}_t^{pol}$, $\hat{Y}_t^{epf}$, and $\hat{Y}_t^{cpf}$ denote fitted values of respective composites of the policy variables (X_t^{pol}), the first-round performance variables (X_t^{epf}), and the final performance variables (X_t^{cpf}), and e is the exponential base. These fitted values of composite variables are conceptualised to respond to the latest available information as discussed earlier. Then, this new information set contained in the equations (1)-(3) should be considered in association with past experience which is summarised in a form of $\hat{P}_{t-1}$. The present model assumes that they are related in a linear sequence. Therefore, the final logit function to produce a forecast probability in a year t ($\hat{P}_t$) will be[15]

$$\log_e \frac{P_t}{1-P_t} = \beta_0 + \beta_1 Y_t^{pol} + \beta_2 Y_t^{epf} + \beta_3 Y_t^{cpf} + \beta_4 P_{t-1}. \qquad (4)$$

9-7-4. PERFORMANCE EVALUATIONS OF THE COMPOSITE VARIABLES MODEL

9-7-4-1. WITHIN-SAMPLE PERFORMANCE

The present work does not attempt to choose contributions to composite variables in terms of statistical significance judged exclusively with reference to t-statistics. This is mainly because it is contended that the explanatory variables may have implications only in the contexts of comprehensive model structures not on a strictly individual basis. Additionally, this reflects the aim in the present model to make the best use of all available new information so that again the quality of fits to the data are judged in terms of overall fits. (Appendix A illustrates the estimates and standard errors of parameters of the equation (4).)

As far as the model's performances with reference to the overall fits to the data within-sample period are concerned, minus two times the log-likelihood ratio ($-2 \times LLR$), R-squared, and the percentage of correct prediction (PCP) are applied as already used earlier. The results are demonstrated in Table 9-12.[16]

Results sub-alternatives (*i.e.*, versions *(1)-(3)* and *(1)-(II)*) refer to the same test structures as used in the model with conventional explanatory variable formulations. According to the *Chi*-squared test on $-2 \times LLR$, the null hypothesis that all the coefficients are zero is rejected at the one per cent significance level for all the model versions. Among results for versions *(1)* to *(3)*, version *(3)* (which omits all the problem-free observations from the rescheduling country group) performs best in most of cases in terms of *R*-squared. But there is no notable difference in terms of *PCP* results. And between results versions *(1)* and *(II)*, the *R*-squared of version (*I*) is higher than the other, while no great difference is found in terms of *PCP*'s. These results are very similar to those encountered in the case of the conventional variables model.

If the overall within-sample performances of the present model are compared with those of the conventional model (Table 9-12 *vs.* Table 9-8), the former can not be said to have results that are notably better overall. In the case of version *(3)-(II)*, on the contrary, the composite variables model reports better results.

Table 9-12 OVERALL FITS TO DATA IN THE COMPOSITE VARIABLES MODEL

ESTIMATION PERIOD				67-76	67-77	67-78	67-79	67-80	67-81
C. (Two-year lag)	(1)	I	#	36.50	35.94	30.71	40.62	45.01	55.31
			*	0.34	0.26	0.18	0.17	0.14	0.15
			¬	0.88	0.88	0.86	0.87	0.88	0.88
		II	#	41.88	40.97	37.94	43.13	45.60	54.80
			*	0.30	0.25	0.18	0.16	0.14	0.15
			¬	0.89	0.90	0.87	0.89	0.89	0.88
	(2)	I	#	48.62	53.74	54.43	78.30	71.38	72.24
			*	0.69	0.57	0.57	0.58	0.47	0.42
			¬	0.90	0.88	0.88	0.90	0.89	0.90
		II	#	43.94	54.41	55.34	66.23	71.61	72.24
			*	0.50	0.51	0.52	0.47	0.47	0.42
			¬	0.87	0.87	0.86	0.89	0.90	0.90
	(3)	I	#	32.48	36.65	37.07	39.04	43.74	46.45
			*	0.74	0.76	0.78	0.72	0.69	0.63
			¬	0.91	0.92	0.92	0.90	0.90	0.89
		II	#	35.40	40.83	39.02	46.12	51.81	56.03
			*	0.49	0.50	0.48	0.49	0.49	0.51
			¬	0.87	0.87	0.88	0.89	0.89	0.88

Notes: # $-2 \times LLR$.
* *R*-squared.
¬ Percentage of correct predictions (*PCP*).

9-7-4-2. FORECAST PERFORMANCE EVALUATIONS

Since forecasting also proceeds on a year-by-year basis, forecast performances are accordingly assessed at these same extending margins year by year. As indicated earlier, due to unavailable parameter estimates during period of 1967-75 forecast probabilities can only be produced from 1977. Forecasts here are also *ex post* results throughout. In order to facilitate comparisons with results reported for earlier test structures, these composite variables results are also processed using the same conventional forecast error evaluation procedures. These include the calculation of total error rates, the standard significance test, and the root-mean-square-error test. The results are summarised in Table 9-13.

Among the test version alternatives *(1)* to *(3)*, version *(3)* reports the best forecast performance with reference to conventional error evaluation criteria other than root-mean-square-errors by showing the lowest total error rates and and the highest standardised normal deviate. In contrast, there seems to be no significant difference between the results for versions (*I*) and (*II*). These conclusions are essentially similar to those reached in respect of within-sample performances. However, if compared with the outcomes of the conventional variables model illustrated in Table 9-9, the present composite variables model produces a somewhat worse forecast performances with a higher range of total error rates (0.15 to 0.21), increased root-mean-square-errors, and decreased estimates of standardised normal deviate. However, all the test versions of the composite variables model can be considered to have true *ex post* predictive capabilities at the five per cent level of a one-tailed standard significance test since $Pr(z > 1.64) = 0.05$, even though in the case of the conventional variables model a significance level of 0.1 per cent was achieved.

Table 9-13 FORECAST ERROR ANALYSIS IN THE COMPOSITE VARIABLES MODEL

			TOTAL ERRORS			STANDARD SIG. TEST		RMSE
			type I	type II	TOE (%)	z1	z2	
C. (Two-year lag)	(1)	I	16	30	46 (19)	4.29	2.09	0.346
		II	16	23	39 (16)	5.09	2.21	0.342
	(2)	I	17	35	52 (21)	3.47	1.78	0.500
		II	16	34	50 (20)	3.89	1.99	0.536
	(3)	I	13	24	37 (15)	5.96	2.77	0.626
		II	12	23	35 (14)	6.40	2.97	0.449

Notes: Results refer to the whole forecast interval (1977-82). Thus, total cases are 240 including 32 rescheduling observations.

TOE Number of total errors. Figures in parentheses denote total error rates in percentage.

z1 & z2 Standardised normal deviates.

RMSE Root-mean-square-error expressed in an annual average.

When it comes to results judged in terms of portfolio design criteria, the same methods as described in the section 9-6 are applied here. In particular, the definitions and measurements of the 'hindsight-optimal' (*H-O*) loan allocations and the 'forecast-based' (*F-B*) loan allocations remain the same. Forecast errors are also identified and judged in terms of differences between the two loan allocations. And the Theil's inequality coefficient is employed to measure degrees of difference. Table 9-14 shows coefficients ranging from 0.121 to 0.641.

Version *(3)* has the best performance among the three test alternatives *(1)* to *(3)* having the lowest coefficients. And although in some cases version (*II*) reports better performance rather than version (*I*), there is no great difference between

them in most of the cases. The composite variables model yields worsened performances compared to the conventional variables model in terms of this coefficient (see Table 9-11 and 9-14).

Table 9-14 THEIL'S INEQUALITY COEFFICIENTS FOR PORTFOLIO DESIGNS OF THE COMPOSITE VARIABLES MODEL

FORECAST INTERVAL			'77	'78	'79	'80	'81	'82
C. (Two-year lag)	(1)	I	0.599	0.638	0.641	0.509	0.534	0.563
		II	0.250	0.257	0.235	0.309	0.513	0.481
	(2)	I	0.361	0.471	0.495	0.508	0.327	0.391
		II	0.199	0.348	0.303	0.523	0.345	0.391
	(3)	I	0.276	0.189	0.165	0.274	0.122	0.166
		II	0.275	0.189	0.164	0.264	0.121	0.169

9-8. SUMMARY AND FINDINGS

The aim of the empirical tests reported here is to investigate the problems for practical users of statistical sovereign risk models reviewed in chapter 8. These concern the implications of an uncertain world and the management of debtor-economics, how to make the best utilisation of past experience and new information, and how to use forecast probabilities ($\hat{P}$'s) as sovereign credit ratings to design loan portfolios and thereby to evaluate forecast errors. Attention is focused on four new ideas in particular. The first effort emphasises the need for care in selecting observations on heterogeneous problem-free countries. The result is a better balance between debt-problem and problem-free countries. The second departure from previously favoured practices is to estimate parameters and to produce forecast probabilities ($\hat{P}$'s) in a way which is consistent with what has to

happen in practice, *i.e.*, on a year-by-year basis. The third change introduces the question of portfolio design and the perspectives that this suggests for evaluating forecast performance. The final concern relates to new explanatory variable formulations, including three composite variables and a proxy for all past experience ($\hat{P}_{t-1}$) and the opportunities these offer, in a two-year lag structure, for easing the informational needs of forecast preparations.

The structures used to examine these points have a number of features. First of all, conventional formulations of explanatory variables and lag structures (*i.e.*, *(A)* one-year lag or *(B)* no-lag) used by previous statistical studies are estimated anew using balanced sample selections, year-by-year re-estimation procedures, and portfolio forecast error evaluations. Six alternative sets of results are produced for each of the two lag structures. These refer to three alternative ways of dealing with problem-free observations in debt-problem countries, *i.e.*, *(1)* including all the observations, *(2)* omitting the observations beyond the end of any rescheduling country-year sequence, or *(3)* excluding all the problem-free observations, and two alternative ways of allowing the inclusion of further problem-free countries (*i.e.*, *(I)* strictly paired or *(II)* expanded problem-free country selections). The second specification (model version *(C)*) relies on composite explanatory variables formulations and a two-year lag structure. This is also estimated using the same six test alternatives.

The results show that, in general, the no-lag model produces the best results in terms of overall fits to the data as well as various out-of-sample *ex post* forecast performance criteria including portfolio designs. This may perhaps be taken as evidence of the crucial role played by the unforeseeable in events leading to debt problems on the grounds that these problems seem to be more closely related to immediate events. The cost of such specifications is the added problems that they cause when it comes to forecasting. With regard to the exclusion of problem-free observations from observations on countries that at some time or another encounter debt problems, the samples which omit all of them generally presents

slightly better results except in the case of some estimates of the conventional variables model. This suggests that many problem-free observations on debt-problem countries contain debt-problem characteristics. This implies the need for special care in selecting such observations. As far as the expansion of problem-free countries is concerned, the results show no great differences. This appears to indicate that there are few benefits in increasing sample sizes by adding more and more problem-free countries in proportion to debt-problem countries within a sample. This is contrary to the goal implied in this respect by the sample expansions to be found in successive previous studies, despite a fixed 'stock' of debt-problem cases for any given period.

The best of the estimated models is used to compare the forecast performances of what might be referred to as re-estimations *versus* conventional 'one-off' estimation procedures. The steady deterioration in the quality of forecasts by the conventional procedure through the period (except the case of Theil's inequality coefficient) can be seen in Table 9-15. It is also clear that the re-estimation procedure produces better forecast performances with regards to all of the criteria used here to judge a model's forecast capability. The results can be considered to support the importance of year-by-year expansions of a data set in estimating and forecasting. Although such results may perhaps be expected *a priori*, they can be regarded as evidence of not only the limitations of conventional methods over extended forecast horizons but also of the importance of the former in the balance between past and new information.

Table 9-15 COMPARISON OF FORECAST PERFORMANCE EVALUATIONS BETWEEN RE-ESTIMATION AND CONVENTIONAL PROCEDURES

FORECAST INTERVAL	'75	'76	'77	'78	'79	'80	'81	'82
* RE-ESTIMATION PROCEDURE								
NB. OF ERRORS	2 (1,1)	3 (1,2)	5 (1,4)	6 (0,6)	5 (2,3)	7 (2,5)	5 (2,3)	8 (2,6)
RMSE	0.645	0.773	0.541	0.567	0.529	0.466	0.414	0.571
TIC	0.159	0.115	0.219	0.119	0.132	0.163	0.165	0.124
* CONVENTIONAL PROCEDURE								
NB. OF ERRORS	4 (1,3)	5 (1,4)	7 (1,6)	8 (0,8)	8 (2,6)	10 (3,7)	11 (2,9)	11 (3,8)
RMSE	0.670	0.711	0.637	0.657	0.632	0.642	0.703	0.820
TIC	0.321	0.315	0.332	0.250	0.276	0.256	0.296	0.264

Note: Version *(B)-(3)-(I)* is used for the comparisons.

NB. OF ERRORS: Total number of errors. Figures in parentheses are number of type I and type II errors respectively.
RMSE : Root-mean-square-error.
TIC : Theil's inequality coefficients.

If attention moves on to performance comparisons between the conventional variables models and those for the composite variables model, the latter does not produce improved results generally. However, this can be also anticipated *a priori* given that the composite variables model is specified for a two-year lag throughout. In order to investigate this proposition further, a no-lag version of the same composite explanatory variables model (version *(D)*) is also tested. Estimation and forecast comparisons for no-lag and two-year lag versions of the best of the composite variables sub-alternatives are presented in Table 9-16. As may be anticipated, the no-lag results are better throughout. Indeed these results show the lowest Theil's inequality coefficients and the best fits to data for all the test results presented in this study. It therefore seems that the rather poorer forecast performances of the the composite variables model are caused by longer lags rather

than inadequacies of specification in other respects. These results may again serve as a warning to sovereign credit rating assessors of the crucial trade-off between estimation and forecast results for different explanatory variables lags, especially when these variables have to be estimated themselves in reality.

Table 9-16 FORECAST PERFORMANCE COMPARISONS BETWEEN THE TWO LAG STRUCTURES FOR THE COMPOSITE VARIABLES MODEL

ESTIMATION PERIOD (FORECAST INTERVAL)	'67-'76 ('77)	'67-'77 ('78)	'67-'78 ('79)	'67-'79 ('80)	'67-'80 ('81)	'67-'81 ('82)
* TWO-YEAR LAG ALTERNATIVE (C)						
R-squared	0.74	0.76	0.78	0.72	0.69	0.63
PCP	0.91	0.92	0.92	0.90	0.9[illegible]	0.89
RMSE	0.617	0.672	0.759	0.463	0.624	0.623
TIC	0.276	0.189	0.165	0.274	0.122	0.166
* NO-LAG ALTERNATIVE (D)						
R-squared	0.85	0.61	0.86	0.81	0.79	0.78
PCP	0.95	0.90	0.96	0.94	0.91	0.93
RMSE	0.563	0.358	0.504	0.572	0.527	0.699
TIC	0.178	0.154	0.085	0.206	0.153	0.123

Note: Version *(3)-(I)* is used for the comparisons.

PCP : Percentage of correct predictions.
RMSE : Root-mean-square-error.
TIC : Theil's inequality coefficient.

The performance of the composite variables model here can not be strictly compared with results reported in previous studies because of many differences in estimation procedures and forecast evaluation methods. However, it would be interesting to compare the loan allocations suggested by the composite variables model with those suggested by forecast probabilities ($\hat{P}$'s) from other statistical models. This could provide further insights into its suitability as source of forecasts. For this exercise the statistical models published by Cline (1984) and

McFadden *et. al.* (1985) are selected as the best 'off-the-peg' results available.[17] Since both of these model estimates relate to observation periods ending in 1982, the forecasts referred to here are all *within-sample* results.

Their model specifications and the parameter estimates are first applied to produce $\hat{P}$'s for the 40 forecast target countries used here. With these $\hat{P}$'s, forecast-based (*F-B*) loan allocations are produced by following the same procedures used throughout the study thus far. The hindsight-optimal (*H-O*) loan allocations are of course the same. Again, comparisons between portfolio designs are quantified in terms of Theil's inequality coefficient. Since the two alternative models have no-lag or one-year lag explanatory variables, a no-lag version of the composite variables model (*i.e.*, model version *(D)*) is also included for comparisons. The results are set out in Table 9-17. (See appendix B for detailed loan allocations.)

The Cline model performs worst results by showing the highest coefficients over the whole forecast period. In contrast, the McFadden *et. al.* model yields better performances than the composite variables model version *(C)* except for the years 1979 and 1981. This result is perhaps all the more remarkable given 'within-sample' advantages of the forecasts from the former. Additionally, when compared with the performance of the composite model with the same lag structure, the results of the McFadden *et.al.* model are better only for years 1978 and 1980. These results overall, subject to all the qualifications involved, would seem to support the considerable potential of the composite variables model, especially given its special advantage in its intended two-year lag version.

Table 9-17 COMPARISON OF THEIL'S INEQUALITY COEFFICIENTS OF THE PORTFOLIO LOAN ALLOCATIONS BY THE VARIOUS MODELS

FORECAST INTERVAL		'77	'78	'79	'80	'81	'82
* COMPOSITE VARIABLES MODEL	(C)	0.276	0.189	0.165	0.274	0.122	0.166
	(D)	0.178	0.154	0.085	0.206	0.153	0.123
* CLINE'S MODEL		0.415	0.236	0.371	0.297	0.436	0.312
* MCFADDEN'S MODEL		0.205	0.119	0.177	0.164	0.185	0.131

Note: Model version *(C)* has a two-year lag structure.
Model version *(D)* has a no-lag structure.

NOTES

1. They are *Economic and Financial Surveys on Export Credits and Debt* by IMF, and *Financing and External Debt of Developing Countries* by the OECD.

2. In using U.S. dollar exchange rates alone to produce the means by which country incomes can be compared, there remains a problem as explained (p. 27) by Jorge and Irma (1988) as follows:

> International comparisons of gross output and its components are usually based on nominal terms, as obtained by converting their values in national currencies to a common currency (usually U.S. dollar) by means of the exchange rates. However, these comparisons have been found wanting, as they deviate substantially from comparisons based on the purchasing power of currencies. As many studies have shown, the purchasing power of the currencies of low-income countries, relative those of high-income countries, is often two or three times as great as their exchange rates would indicate. Therefore, if exchange rate comparisons are used, they will lead to a large underestimation of the real income of low-income countries. It has also been found that exchange rate comparisons distort certain kinds of structural comparisons because the deviation of purchasing power parties from exchange rates is not uniform for all kinds of goods.

Further studies could therefore usefully give more attention to this point by using purchasing-power-parity results in deciding sample selections.

3. One-sided tests are used since there are *a priori* arguments indicating the hypothesised sign of each coefficient.

4. In particular, Feder and Just (1977) point out that this ratio turns out to be positive especially when export fluctuations (measured as the average absolute percentage deviation from an eight-year trend in exports like Frank and Cline (1971)) are included.

5. See Saini and Bates (1978, pp. 21-22).

6. This is because a country with a high level of external debt, in general, becomes more likely to pay larger debt service rather than a country with small amount of debts if other circumstances (in particular, debt maturity structure) are equal.

7. Likelihood ratio is defined as *Lo/Lmax* where *Lo* means initial value of maximum likelihood function of the logit equation and *Lmax* denotes its maximum value.

8. See Pindyck and Rubinfeld (1988) for a discussion of these statistics.

9. In the original equation of Theil's inequality, actual realised allocations are used rather than 'hindsight-optimal' allocations here.

10. This is because when $U = 1$, 'forecast-based' allocations are always 0 while 'hindsight-optimal' allocations are nonzero, or nonzero 'forecast-based' allocations are made when 'hindsight-optimal' allocations are zero. See Theil (1961, 1966). Since this coefficient falls between 0 and 1, it can provide a more appropriate measuring tool in terms of the equality comparisons rather than other similar methods.

11. Similar kinds of categorisations can be seen in studies dealing with general issues of overall macroeconomic policy and performance evaluations such as Donovan (1982, 83, 84), Khan and Knight (1983), and Wynn (1993).

12. Component indicators that are found persistently to have a wrong sign *a priori* in any collection of component variables are excluded.

13. Although the ratio of government budget deficit to GDP should be included in this composite as a major expression of fiscal policy decisions, it has to be dropped mainly because of gaps in the available published record and ambiguous definitions of government deficits particularly in relation to coverages of central and local government and of public sector involvement in organisations such as parastatals.

14. This indicator is calculated by subtracting the consumption to GDP ratio cited from the *IFS* (1986, p. 160) from one.

15. Since initiating values for the P_{t-1} variable for the first set of observations are unavailable, a below modified equation which excludes the parameter of P_{t-1} from the equation (4) is used for supplementing them mainly because of an intention to keep a similarity in the functional forms as possible.

$$\log_e \frac{P_t}{1 - P_t} = \alpha_0 + \alpha_1 Y_t^{pol} + \alpha_2 Y_t^{epf} + \alpha_3 Y_t^{cpf}.$$

16. The results for the estimation period 1967-75 are omitted because parameter estimates can not be obtained in many model versions in that period. Convergence of maximum likelihood estimation of the logit model can not be achieved even after 20 iterations.

17. This is because they are the latest statistical models using a logit analysis of ten major empirical studies reviewed here (see Table 7-1).

18. Any reduction in the number of observations will, of course, itself influence estimated *R*-squared results. The difference between R^2 and $\overline{R}^2$ in this respect is, however, only marginal for the sample sizes involved here. As an example, the R^2 value of 0.53 for the period 1967-81 and the smallest sample size of 122 (see Table 9-6, p. 248), corresponding to *(A)-(3)-(I)* results (line 14), only falls to a $\overline{R}^2$ value of 0.514 using the formula

$$\overline{R}^2 = 1 - \frac{n-1}{n-k-1} (1-R^2) = 1 - \frac{122-1}{122-4-1} (1-0.53) = 0.514$$

where n is the sample size and k the number of explanatory variables. This is a change of only 3 per cent. As a further illustration of the point, root-mean-square-error results, which are already corrected for sample sizes, may be cpmpared with R^2 results for the last column of Table 9-8 (*i.e.*, the period 1967-81) as follows:

	One-year lag						No-lag					
	(1)		(2)		(3)		(1)		(2)		(3)	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
n	520	524	290	290	122	187	560	563	307	307	132	211
R^2	.19	.19	.35	.35	.53	.47	.24	.24	.44	.44	.59	.53
RMSE	.29	.29	.28	.28	.34	.34	.28	.28	.24	.24	.32	.32

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CHAPTER 10. CONCLUSIONS

CHAPTER 10

10-1. SUMMARY AND CONCLUDING REMARKS

The growing external debt of developing countries since the early 1970s was accompanied by increasing concern about the ability of borrowing countries to service their accumulated external obligations on schedule. A considerable expansion in the literature on the subject of a borrowing economy's debt-servicing capacity in general was related to both the economic and debt management policies of borrowers and the lending policies of creditors alike. The expansion in loans to sovereign governments or to ventures bearing the guarantee of host governments concentrated attention on sovereign risk evaluation systems in particular. Country reports, checklists, and statistical models have long constituted the three major strands to these systems. The last holds the special attraction of being able to provide an objective means of testing the association of individual indicators with the observed incidence of debt problems.

However, in practice investigations of statistical sovereign risk evaluation systems have tended to be confined to trial and error tests of *ad hoc* selections of indicators. The lack of theoretical underpinnings poses considerable doubts in principle about their out-of-sample capabilities. The additional possibility that unforeseeable events play a large part in causing debt problems together with the considerable heterogeneities between both debt-problem countries and problem-free countries further underlines the threat of structural breaks. Such misgivings may go a long way to explaining why the results of surveys of sovereign risk appraisal methods show that sovereign risk assessors have always depended more on country reports and checklists than on statistical methods. In practice, given the skills of experienced personnel, the first allows wide-ranging and detailed inquiries into a debtor economy while the second allows some of the qualities of comparative evidence and summary quantitative evaluations to be added to the otherwise unwieldy results of country reports.

The thesis aims at responding to these points in emphasising, in particular, the implications of unforeseeable events and broader macroeconomic and management contexts of debt-servicing difficulties. The link is in the sustainability of balance-of-payments positions especially when subjected to changes in the world economy and inappropriate domestic policy initiatives.

By way of background, the thesis starts with a discussion of the definition and contexts of sovereign risk. Thus, chapter 2 highlights first that the major contexts of sovereign debt problems in relation to the macroeconomic policy and performance perspectives of balance-of-payments difficulties. The distinction between risk and uncertainty is additionally seen as highlighting the role of unforeseeable events in the precipitation of debt problems and the need therefore to be able to judge the capability of debtor-economy management teams to cope with unexpected change.

A historical overview of foreign capital inflows is provided in chapter 3. The attention is focusing on the impact of continuously changing external environments on international financial markets and debt-servicing difficulties. This is based on a consideration that what was relevant 'yesterday' with reference to the nature of foreign capital inflows, their terms, and their uses remain so generally 'today'. In this sense, chapter 3 underlines that both the benefits and costs of relying on foreign savings remain much the same as ever. In particular, hindsight seems to suggest that the global debt problems encountered in 1982 can be traced to various events through the 1970s and notably various external shocks (*i.e.*, the two oil price hikes, high interest rates, and global recession), and the mismanagement of debtor economies and an over-confidence on the part of private banks that was encouraged by earlier successes in re-cycling the surpluses of oil exporters unmatched by care in understanding the broader implications of the rising indebtness of borrowers in later year.

CHAPTER 10

In chapter 4 it is argued that the role of foreign capital inflows in developing countries can serve a variety of purposes. Clearly, first and foremost, foreign resources can promote an economic development by supplementing insufficient domestic savings even though there is only one resource gap to be filled, contrary to the ideas expressed in 'two-gap' theory. They can also act as an 'absorber' against either internal or external shocks, enabling borrowing countries to adjust their spending gradually in reallocating resources to cope with a new environment. In contrast, the use of foreign resources has its risks. This is because of increasing financial dependence and rising debt-servicing obligations. These can become unmanageable in the face of external shocks or economic mismanagement or, as is usually the case, a combination of both, the first often exposing susceptibilities to the second. One particular example of the last is the way in which foreign resources can provide an excuse for delaying the policy reforms required for appropriate adjustment. Its *change* and *reaction* that matter most therefore in determining the success with which foreign resources are used and thereby a borrower's debt-servicing capacity.

When it comes to the management of foreign capital inflows in practice, chapter 5 emphasises that no simple rule can be devised for designing debt management policies for all the country circumstances for all time. Reviews of the further implications of the debt cycle hypothesis and the many considerations having a bearing on an optimal or a sustainable debt situation make it clear that it is impossible to summarise these conditions in the form of just one 'rule of thumb'. Again it is seen that a country's debt-servicing capacity depends much more on broader macroeconomic considerations beyond the analysis of, say, a simple financial relationship between export earnings and debt service payments.

Reviews of currently used, or at least currently available, sovereign risk assessment procedures are presented in chapters 6 and 7. Chapter 6 highlights what kind of lessons can be learnt from country report and checklist systems in relation to the wider contexts of sovereign risk analysis. In particular, it is noted

that the checklist systems could provide a useful screening device in the form of a concise quantitative measure that makes good use of cross-country comparisons. As befits the main aims of the thesis, the scope and style of statistical sovereign risk models are investigated in greater detail in chapter 7. In reviewing the methods and applications of ten major statistical models, concern focuses on whether their results have the kind of out-of-sample capabilities required by sovereign risk assessors in practice. It is argued that many doubts remain concerning rationales behind the selection of explanatory variables, model specifications relating these selections to the observed incidence of debt problems, the evidence and the procedures used to estimate models, and the methods used in preparing forecasts and in evaluating forecast error.

Chapter 8, then, highlights major aspects of existing statistical sovereign models requiring further investigation. They can be summarised as: (1) too heavy a reliance on empirical evidence in selecting what has to be, for statistical reasons, a narrow range of explanatory variables; (2) a neglect of the implications of the effects of unforeseeable events, heterogeneities across countries, and the way in which the time series dimension of the data evolves in practice; (3) the information that is wasted in reducing forecast probabilities to a 'yes-no' binary in order to compare forecasts with 'yes-no' debt problem realisations.

Chapter 8 presents three broad responses to these issues. First, with reference to the debt problem implications of unforeseeable change and macroeconomic policies and performance, it is argued that model specifications should make the best use of past experience and all the latest available information. On the first count, it is suggested that a last year's forecast probability of rescheduling ($\hat{P}_{t-1}$) could serve as a proxy while composite variables are used as a means of accommodating more information. Second, balanced samples between debt-problem and problem-free countries and year-by-year parameter re-estimation procedures are used as adjustments to both the cross-section and time series dimensions of sample selections. The aim is to investigate the problems

posed by country heterogeneities, the kind of model estimations that are possible in practice, and structural breaks. Third, based on the assumption that the ultimate aim of sovereign risk assessors is to allocate loans between borrowers, it is argued that the evaluation of forecast performance should be carried out in this same context.

The empirical tests reviewed in chapter 9 are founded on these suggestions. The data relate to a total of 40 developing countries, balanced so as to match 20 debt-problem countries and 20 problem-free countries over a period of sixteen years (1967-82).

The empirical test results, in general, support the various suppositions proposed by this thesis. Four broad conclusions can be drawn. First, the composite variables model, using both two-year lagged composites aggregating all latest available information and a proxy for all that was known earlier in the form of the previous period's debt-problem forecast probability ($\hat{P}_{t-1}$), produces, despite its longer lags, both within-sample and out-of-sample performances that are comparable to conventional specifications. Moreover, results for a no-lag version of this same model turn out to be better than any other model alternatives, including two models used 'off-the-peg' in the form of results available in Cline (1984) and McFadden *et. al.* (1985). Thus, such specifications suggest the usefulness of references to the broader macroeconomic contexts of debt problems and the implications of unforeseeable events. In particular, they serve as a reminder to risk assessors of the crucial trade-off between within-sample fits to data and out-of-sample forecasting capabilities.

Second, the addition of more problem-free countries to relatively more scarce debt-problem countries seems to make no great difference to estimation and forecast results. This implies that better balances between debt-problem and problem-free countries can be used to reduce ambiguous results threatened by country heterogeneities, especially in terms of economic size and trade structure.

Additionally, the empirical test results show that most problem-free observations taken from debt-problem countries contain debt-servicing difficulty characteristics. This may cast some doubts again on the results produced by unstructured pooled time-series and cross-section data.

Third, year-by-year parameter re-estimations have important implications both for coping with structural breaks and for forecast results analyses. Given that, as may be expected, estimation results vary depending on estimation periods (see Table 9-7), the re-estimation procedure throws a different light on individual within-sample country results compared to those obtained from the conventional 'one-off' estimations relied on by published statistical studies. The re-estimation procedure provides a more realistic view of what can be achieved in reality.

Finally, the study attempts to broaden evaluations of the results of statistical sovereign risk analysis by using produced forecast probabilities ($\hat{P}$'s) to design loan portfolios, an essential objective of sovereign risk analysis in practice. Such results provide a means of evaluating forecast performance in these, more appropriate, same contexts.

The results can not be seen to be exhaustive and final, however. Even in more general terms, while statistical methods may provide useful insights they should not be considered a perfect substitute for in depth qualitative sovereign risk analyses. The attempts here could be rather regarded as some modest contribution to understanding and interpreting the wider contexts of sovereign risk analysis. Many things remain to be explored in further work.

10-2. FURTHER RESEARCH

In this final section, attention is now turned to the potential for further research implied by the results presented in this study. First, the composite variables model here needs to be explored beyond the estimation period 1967-1982. This is all the more so in view of dramatic changes in both markets for international finance and debtor-economy situations. The latter especially includes the heavy burdens presented by debt stocks. Additionally, various other alternatives to rescheduling agreements such as the swaps and debt reductions have been used as a means of resolving the debt crisis. Different dependent variable quantifications could be therefore used to allow for more sensitive expressions of debt problems by the use of other discrete variable formulations or conventional balance-of-payments variables.

Second, with regards to use of the composite variables, other kinds of composite indices such as have been employed in checklist systems can be tried. This could suggest feasible ways to add different kinds of information, including both quantifiable and non-quantifiable variables, which influence a borrowing country's decision to reschedule its external debt when facing balance-of-payments difficulties. This may require looking at alternative ways of measuring, aggregating, and weighting component variables within the composites. It may also suggest the possibility of applying other statistical techniques such as 'non-parametric factor analysis'.

Third, this study suggests only one of the ways in which forecast probabilities of debt problems ($\hat{P}$'s) can be used to design, rather simple, loan portfolios. Much work can be done to introduce more sophisticated portfolio design criteria, as well as to investigate the implication of debt-problem forecasts for deciding interest charges and loan maturities.

APPENDICES

APPENDIX A. ESTIMATES AND STANDARD ERRORS OF THE PARAMETERS IN THE COMPOSITE VARIABLES MODEL

ESTIMATION PERIOD				67-76	67-77	67-78	67-79	67-80	67-81
C. (Two-year lag)	(1)	I	C	-3.436	-3.457	-2.439	-3.737	-3.851	-3.916
				(1.329)	(1.038)	(1.504)	(0.540)	(0.643)	(0.666)
			POL	-	-	8.481	0.169	2.752	2.821
				(-)	(-)	(9.818)	(3.855)	(5.008)	(5.353)
			EPF	7.894	7.312	5.292	4.758	4.418	4.121
				(3.490)	(2.856)	(2.230)	(1.750)	(1.434)	(1.266)
			CPF	4.368	5.467	5.534	5.877	4.766	5.041
				(3.123)	(4.503)	(3.792)	(2.403)	(1.924)	(1.808)
			T-1	1.867	2.365	0.808	0.989	1.104	1.714
				(1.179)	(1.369)	(2.038)	(1.652)	(1.339)	(1.148)
		II	C	-4.887	-4.694	-3.533	-3.810	-3.866	-3.926
				(1.014)	(1.974)	(0.891)	(0.469)	(0.596)	(0.679)
			POL	-	-	2.775	0.314	2.274	2.894
				(-)	(-)	(7.546)	(3.875)	(5.036)	(5.403)
			EPF	8.037	7.652	6.348	5.388	4.321	4.089
				(2.489)	(2.968)	(2.219)	(1.818)	(1.447)	(1.271)
			CPF	4.790	4.869	6.484	6.407	5.364	5.031
				(4.012)	(4.219)	(4.153)	(2.472)	(2.026)	(1.801)
			T-1	1.295	1.793	0.257	0.738	1.544	1.743
				(1.094)	(1.334)	(2.041)	(1.697)	(1.319)	(1.150)
	(2)	I	C	-9.368	-6.329	-6.361	-5.729	-4.901	-5.070
				(3.183)	(1.724)	(1.726)	(1.157)	(0.862)	(0.827)
			POL	1.761	3.221	3.228	3.772	4.431	6.323
				(5.231)	(4.352)	(4.365)	(4.127)	(3.615)	(3.909)
			EPF	8.608	7.202	7.237	10.20	4.801	4.409
				(4.063)	(3.660)	(3.675)	(3.401)	(1.816)	(1.601)
			CPF	11.001	4.509	4.532	2.731	4.693	5.434
				(5.828)	(2.775)	(2.779)	(2.803)	(2.587)	(2.334)
			T-1	7.865	5.083	5.123	5.808	3.453	3.574
				(3.345)	(2.251)	(2.249)	(2.346)	(1.681)	(1.571)
		II	C	-4.862	-5.223	-5.262	-4.633	-4.815	-5.070
				(1.229)	(1.169)	(1.172)	(0.788)	(0.832)	(0.827)
			POL	0.411	3.152	3.172	3.088	4.324	6.323
				(3.855)	(3.810)	(3.825)	(3.323)	(3.561)	(3.909)
			EPF	2.891	3.867	3.885	4.810	4.955	4.409
				(2.835)	(2.239)	(2.246)	(1.956)	(1.867)	(1.601)
			CPF	6.916	5.597	5.615	4.646	4.602	5.434
				(4.042)	(2.560)	(2.568)	(2.423)	(2.571)	(2.334)
			T-1	5.698	4.288	4.339	3.305	3.416	3.574
				(2.858)	(1.974)	(1.971)	(1.797)	(1.712)	(1.571)

ESTIMATION PERIOD				67-76	67-77	67-78	67-79	67-80	67-81
			C	-35.18	-24.38	-32.29	-15.14	-14.41	-11.51
				(30.10)	(13.27)	(19.56)	(6.645)	(5.386)	(3.571)
		I	POL	47.06	32.24	38.46	9.746	15.80	16.30
				(47.59)	(23.24)	(26.88)	(7.974)	(11.60)	(7.557)
			EPF	4.680	5.380	4.090	6.094	4.339	3.544
				(4.288)	(3.771)	(3.036)	(3.107)	(2.538)	(2.464)
			CPF	11.42	3.975	12.38	5.081	1.672	1.721
				(14.39)	(6.137)	(10.74)	(4.476)	(4.894)	(3.661)
			T-1	10.10	7.791	11.83	7.937	6.276	4.707
				(5.995)	(4.120)	(6.322)	(3.933)	(2.967)	(2.468)
(3)									
			C	-5.510	-7.019	-6.522	-5.927	-6.066	-6.171
				(1.745)	(1.964)	(1.788)	(1.618)	(1.549)	(1.569)
		II	POL	1.462	3.827	4.218	1.787	4.046	5.071
				(5.197)	(4.703)	(4.085)	(3.758)	(3.754)	(3.580)
			EPF	4.952	6.596	6.354	4.625	4.767	4.575
				(4.092)	(3.145)	(2.855)	(2.283)	(2.141)	(2.100)
			CPF	6.609	8.459	7.085	6.438	5.185	3.698
				(4.464)	(3.915)	(3.261)	(2.687)	(2.315)	(2.079)
			T-1	1.638	0.529	0.197	2.634	1.648	1.622
				(3.942)	(2.651)	(2.504)	(2.171)	(2.012)	(2.007)

Note : Figures in parentheses denote standard errors.

Abbreviations:

C	Constant terms.
POL	Composite of the policy variables.
EPF	Composite of the more immediate performance variables.
CPF	Composite of the final performance variables.
T-1	Forecast probability before one year ($\hat{P}_{t-1}$).
-	Dropped due to carrying the wrong sign *a pricri*.

APPENDIX B. PROPORTIONAL LOAN ALLOCATIONS BY THE VARIOUS MODELS

* LOAN ALLOCATIONS (PERCENTAGE) FOR 1977 *

	(A)	(B)	(C)	(D)	(E)	(F)
Chile	2.13	2.14	1.68	0.43	1.20	1.08
Peru	2.14	2.15	4.91	4.10	0.50	3.23
Indonesia	1.47	1.47	10.37	7.20	8.56	5.76
India	0.01	0.00	0.32	0.01	0.02	0.01
Pakistan	0.48	0.48	0.18	0.17	0.24	0.17
Philippines	2.52	2.54	2.33	4.56	6.37	4.32
Egypt	2.81	2.83	3.23	2.34	0.28	1.49
Turkey	1.85	1.86	0.11	2.78	1.60	2.74
Yugoslavia	0.07	0.07	0.71	0.26	0.34	0.30
Ghana	0.03	0.03	0.00	0.11	0.07	0.10
Mexico	32.24	32.40	18.61	23.18	5.27	20.25
Ecuador	2.37	2.38	0.13	1.21	1.71	1.22
Korea	5.73	5.76	4.91	5.16	5.70	4.68
Sri Lanka	0.04	0.04	0.91	0.33	0.30	0.30
Malaysia	1.12	1.12	5.22	1.09	1.57	1.15
Thailand	1.29	1.29	0.07	0.51	0.72	0.53
Morocco	4.30	4.32	1.29	3.09	1.51	2.34
Syria	0.15	0.15	0.68	0.20	0.11	0.19
Greece	1.46	1.47	3.27	1.20	1.04	1.52
Kenya	0.06	0.06	0.04	0.06	0.07	0.05
Argentina	4.72	4.74	9.79	2.84	10.54	8.46
Jamaica	0.24	0.24	1.13	0.33	0.06	0.32
Guyana	0.03	0.03	0.16	0.24	0.04	0.12
Bolivia	1.03	1.03	0.59	1.27	1.30	0.99
Zaire	0.39	0.00	4.52	0.92	0.14	0.45
Sierra Leone	0.10	0.00	0.20	0.04	0.03	0.03
Togo	0.51	0.52	0.04	1.07	1.47	1.32
Liberia	0.16	0.16	0.00	0.04	0.02	0.03
Senegal	0.16	0.16	0.32	0.26	0.09	0.24
Malawi	0.33	0.33	0.03	0.13	0.06	0.09
Brazil	19.98	20.08	21.47	27.36	39.11	27.78
Honduras	0.15	0.15	0.03	0.20	0.25	0.17
Paraguay	0.10	0.10	0.30	0.07	0.10	0.06
Venezuela	7.85	7.88	0.68	5.74	8.22	7.17
Zambia	0.26	0.26	0.66	0.49	0.21	0.39
Niger	0.01	0.01	0.00	0.00	0.00	0.00
El Salvador	0.00	0.00	0.63	0.00	0.00	0.00
Nigeria	0.00	0.00	0.04	0.00	0.00	0.00
Guatemala	0.00	0.00	0.00	0.00	0.00	0.00
Tunisia	1.74	1.74	0.42	1.03	1.17	0.96

Notes: (A) Actual commitments allocations.
(B) 'Hindsight-Optimal' (*H-O*) loan allocations.
'Forecast-Based' (*F-B*) loan allocations via $\hat{P}$'s from:
(C) The composite variables model with a two-year lag (version *(C)*).
(D) The composite variables model with a no-lag (version *(D)*).
(E) Cline's (1984) model. And (F) McFadden *et.al.*'s (1985) model.

APPENDICES

* LOAN ALLOCATIONS (PERCENTAGE) FOR 1978 *

	(A)	(B)	(C)	(D)	(E)	(F)
Chile	3.57	3.62	0.93	2.01	1.21	2.01
Peru	0.47	0.00	2.31	2.00	0.41	1.56
Indonesia	4.54	4.62	14.31	1.56	2.46	1.47
India	0.00	0.00	0.64	0.01	0.01	0.01
Pakistan	0.21	0.21	0.01	0.09	0.09	0.10
Philippines	3.47	3.53	2.49	2.71	4.12	2.84
Egypt	2.04	2.07	2.31	2.91	0.14	1.63
Turkey	1.10	0.00	1.56	1.89	0.09	1.94
Yugoslavia	0.03	0.03	1.21	0.08	0.10	0.10
Ghana	0.06	0.06	0.00	0.03	0.02	0.02
Mexico	22.07	22.42	21.87	30.69	10.53	25.26
Ecuador	1.12	1.14	0.80	2.56	4.10	2.79
Korea	6.72	6.83	5.39	6.17	8.64	6.66
Sri Lanka	0.00	0.00	0.20	0.04	0.07	0.04
Malaysia	2.23	2.27	3.53	1.20	1.94	1.36
Thailand	1.06	1.08	0.12	1.39	2.19	1.58
Morocco	2.68	2.72	3.34	4.58	0.66	2.91
Syria	0.03	0.03	0.33	0.16	0.13	0.14
Greece	1.46	1.48	2.46	1.11	2.54	2.25
Kenya	0.15	0.16	0.85	0.06	0.10	0.06
Argentina	5.96	6.06	4.60	3.63	8.19	6.69
Jamaica	0.25	0.25	1.08	0.25	0.05	0.28
Guyana	0.03	0.03	0.27	0.03	0.01	0.02
Bolivia	0.83	0.84	1.05	1.06	1.46	0.82
Zaire	0.32	0.33	0.19	0.42	0.15	0.07
Sierra Leone	0.18	0.19	0.12	0.10	0.07	0.08
Togo	0.53	0.54	0.21	0.55	0.16	0.68
Liberia	0.29	0.30	0.06	0.18	0.07	0.14
Senegal	0.34	0.34	0.51	0.17	0.06	0.16
Malawi	0.09	0.09	0.06	0.36	0.55	0.27
Brazil	24.23	24.62	25.32	21.11	34.13	22.35
Honduras	0.22	0.23	0.04	0.16	0.22	0.15
Paraguay	0.27	0.27	0.09	0.10	0.17	0.11
Venezuela	7.22	7.33	0.00	8.47	13.62	11.53
Zambia	0.37	0.37	0.77	0.27	0.05	0.19
Niger	0.10	0.10	0.00	0.01	0.02	0.01
El Salvador	0.01	0.01	0.32	0.00	0.00	0.00
Nigeria	4.64	4.71	0.21	0.00	0.00	0.00
Guatemala	0.00	0.00	0.04	0.00	0.00	0.00
Tunisia	1.10	1.12	0.40	1.87	1.48	1.71

Notes: (A) Actual commitments allocations.
(B) 'Hindsight-Optimal' (*H-O*) loan allocations.
'Forecast-Based' (*F-B*) loan allocations via $\hat{P}$'s from:
(C) The composite variables model with a two-year lag (version *(C)*).
(D) The composite variables model with a no-lag (version *(D)*).
(E) Cline's (1984) model. And (F) McFadden *et.al.*'s (1985) model.

APPENDICES

* LOAN ALLOCATIONS (PERCENTAGE) FOR 1979 *

	(A)	(B)	(C)	(D)	(E)	(F)
Chile	2.39	2.63	1.45	3.59	4.63	3.65
Peru	2.11	0.00	3.61	0.37	0.12	0.36
Indonesia	3.67	4.03	6.76	4.58	6.81	4.56
India	0.01	0.01	0.01	0.00	0.00	0.00
Pakistan	0.28	0.31	0.18	0.06	0.02	0.06
Philippines	2.47	2.72	4.30	3.59	5.09	3.76
Egypt	2.31	2.54	2.13	1.91	0.04	1.00
Turkey	6.22	0.00	2.61	1.08	0.52	1.15
Yugoslavia	0.00	0.00	0.25	0.03	0.04	0.05
Ghana	0.00	0.00	0.10	0.05	0.08	0.08
Mexico	23.01	25.25	21.57	21.66	1.85	14.07
Ecuador	2.19	2.40	1.15	1.15	1.70	1.30
Korea	7.00	7.68	4.94	6.96	6.88	8.34
Sri Lanka	0.15	0.17	0.32	0.00	0.00	0.00
Malaysia	0.58	0.64	1.07	2.31	3.49	2.83
Thailand	1.54	1.69	0.48	1.10	1.62	1.36
Morocco	1.38	1.52	2.75	2.65	0.71	1.66
Syria	0.09	0.10	0.16	0.03	0.01	0.02
Greece	1.76	1.93	1.18	1.51	1.46	2.33
Kenya	0.11	0.12	0.05	0.16	0.15	0.15
Argentina	5.50	6.04	7.33	6.06	9.32	8.12
Jamaica	0.12	0.00	0.29	0.24	0.06	0.29
Guyana	0.10	0.00	0.19	0.03	0.02	0.02
Bolivia	0.49	0.54	1.19	0.75	0.09	0.43
Zaire	0.30	0.00	0.78	0.29	0.27	0.18
Sierra Leone	0.11	0.12	0.04	0.18	0.06	0.15
Togo	0.03	0.00	0.99	0.53	0.12	0.25
Liberia	0.04	0.04	0.04	0.30	0.07	0.26
Senegal	0.21	0.23	0.25	0.34	0.06	0.30
Malawi	0.14	0.16	0.11	0.09	0.05	0.05
Brazil	19.73	21.65	26.74	24.21	37.81	24.14
Honduras	0.26	0.29	0.19	0.23	0.28	0.23
Paraguay	0.16	0.18	0.07	0.28	0.42	0.30
Venezuela	7.44	8.17	5.30	7.39	11.19	10.88
Zambia	0.62	0.69	0.46	0.37	0.03	0.26
Niger	0.16	0.18	0.00	0.10	0.15	0.11
El Salvador	0.00	0.00	0.00	0.01	0.01	0.01
Nigeria	6.70	7.35	0.00	4.68	3.85	6.17
Guatemala	0.00	0.00	0.00	0.00	0.00	0.00
Tunisia	0.58	0.64	0.97	1.14	0.94	1.11

Notes: (A) Actual commitments allocations.
(B) 'Hindsight-Optimal' (*H-O*) loan allocations.

'Forecast-Based' (*F-B*) loan allocations via $\hat{P}$'s from:
(C) The composite variables model with a two-year lag (version *(C)*).
(D) The composite variables model with a no-lag (version *(D)*).
(E) Cline's (1984) model. And (F) McFadden *et.al.*'s (1985) model.

APPENDICES

* LOAN ALLOCATIONS (PERCENTAGE) FOR 1980 *

	(A)	(B)	(C)	(D)	(E)	(F)
Chile	2.22	2:34	2.12	2.54	3.90	2.75
Peru	2.63	0.00	2.14	2.24	3.46	1.91
Indonesia	4.41	4.64	1.48	3.80	6.03	3.92
India	2.98	3.14	0.01	0.01	0.01	0.01
Pakistan	0.65	0.69	0.48	0.19	0.02	0.09
Philippines	2.30	2.42	2.51	2.62	3.89	2.48
Egypt	3.20	3.37	2.82	2.31	1.21	1.38
Turkey	1.47	0.00	1.79	5.75	2.42	5.25
Yugoslavia	1.85	1.94	0.07	0.00	0.00	0.01
Ghana	0.00	0.00	0.03	0.00	0.00	0.00
Mexico	14.64	15.42	32.45	24.00	1.17	16.62
Ecuador	1.59	1.68	2.38	2.31	3.57	2.23
Korea	8.25	8.69	5.78	7.42	7.15	8.28
Sri Lanka	0.63	0.66	0.04	0.16	0.25	0.13
Malaysia	2.35	2.48	1.13	0.62	0.96	0.74
Thailand	1.82	1.92	1.28	1.63	2.31	1.78
Morocco	2.05	2.16	4.19	1.36	0.34	0.83
Syria	0.11	0.11	0.15	0.09	0.10	0.09
Greece	5.60	5.90	1.46	1.86	1.93	2.70
Kenya	0.03	0.03	0.06	0.11	0.17	0.10
Argentina	7.64	8.05	4.80	5.87	9.04	8.12
Jamaica	0.07	0.07	0.24	0.12	0.04	0.12
Guyana	0.10	0.10	0.03	0.10	0.01	0.05
Bolivia	0.52	0.00	1.03	0.47	0.16	0.32
Zaire	0.33	0.00	0.36	0.21	0.47	0.21
Sierra Leone	0.07	0.00	0.10	0.11	0.05	0.09
Togo	0.03	0.00	0.48	0.03	0.01	0.01
Liberia	0.02	0.00	0.16	0.04	0.03	0.03
Senegal	0.10	0.10	0.16	0.22	0.06	0.18
Malawi	0.08	0.09	0.34	0.15	0.07	0.08
Brazil	19.28	20.31	20.04	16.69	26.15	18.24
Honduras	0.13	0.14	0.15	0.28	0.37	0.24
Paraguay	0.06	0.06	0.10	0.17	0.26	0.16
Venezuela	7.17	7.55	7.69	7.90	12.22	10.91
Zambia	0.98	1.03	0.26	0.65	0.25	0.50
Niger	0.41	0.44	0.01	0.18	0.24	0.18
El Salvador	0.03	0.03	0.00	0.00	0.00	0.00
Nigeria	3.60	3.79	0.00	7.16	10.99	8.70
Guatemala	0.03	0.04	0.00	0.00	0.00	0.00
Tunisia	0.57	0.60	1.70	0.61	0.67	0.59

Notes: (A) Actual commitments allocations.
(B) 'Hindsight-Optimal' (*H-O*) loan allocations.
'Forecast-Based' (*F-B*) loan allocations via $\hat{P}$'s from:
(C) The composite variables model with a two-year lag (version *(C)*).
(D) The composite variables model with a no-lag (version *(D)*).
(E) Cline's (1984) model. And (F) McFadden *et.al.*'s (1985) model.

APPENDICES

* LOAN ALLOCATIONS (PERCENTAGE) FOR 1981 *

	(A)	(B)	(C)	(D)	(E)	(F)
Chile	1.98	2.04	3.68	2.39	4.10	2.44
Peru	2.12	2.19	0.47	2.67	4.85	1.91
Indonesia	5.44	5.61	4.78	4.73	8.11	4.14
India	0.78	0.81	0.00	3.09	5.45	2.39
Pakistan	0.93	0.00	0.05	0.66	0.12	0.27
Philippines	2.02	2.09	3.63	2.45	4.01	2.12
Egypt	3.71	3.83	1.57	3.41	3.47	1.72
Turkey	1.03	0.00	1.10	0.19	0.13	0.76
Yugoslavia	0.72	0.75	0.03	1.95	1.84	2.38
Ghana	0.04	0.04	0.06	0.00	0.00	0.00
Mexico	19.56	20.18	21.97	15.57	3.74	14.95
Ecuador	0.94	0.97	1.14	1.69	2.88	1.47
Korea	7.48	7.72	7.05	8.56	7.16	8.43
Sri Lanka	0.46	0.47	0.00	0.65	0.44	0.42
Malaysia	3.18	3.28	2.39	2.51	4.29	2.59
Thailand	1.27	1.31	1.12	1.94	2.23	1.79
Morocco	2.79	2.87	2.24	1.96	0.10	1.06
Syria	0.00	0.00	0.02	0.11	0.07	0.10
Greece	3.04	3.13	1.12	5.89	5.45	7.44
Kenya	0.32	0.33	0.15	0.03	0.03	0.02
Argentina	6.03	6.22	6.39	7.45	14.08	10.37
Jamaica	0.63	0.00	0.26	0.07	0.03	0.06
Guyana	0.04	0.05	0.03	0.10	0.02	0.05
Bolivia	0.29	0.00	0.73	0.41	0.12	0.32
Zaire	0.06	0.00	0.27	0.34	0.39	0.19
Sierra Leone	0.08	0.09	0.18	0.07	0.02	0.04
Togo	0.00	0.00	0.45	0.03	0.02	0.01
Liberia	0.00	0.00	0.31	0.02	0.00	0.01
Senegal	0.06	0.00	0.32	0.10	0.01	0.06
Malawi	0.07	0.00	0.07	0.08	0.03	0.04
Brazil	19.84	20.46	24.92	17.10	5.51	17.34
Honduras	0.25	0.26	0.23	0.13	0.10	0.10
Paraguay	0.43	0.44	0.28	0.06	0.10	0.05
Venezuela	4.38	4.52	6.83	7.57	13.22	9.32
Zambia	0.29	0.30	0.36	1.00	0.18	0.62
Niger	0.10	0.11	0.10	0.44	0.38	0.37
El Salvador	0.00	0.00	0.01	0.03	0.02	0.03
Nigeria	8.88	9.16	4.57	3.89	6.64	4.06
Guatemala	0.11	0.12	0.00	0.04	0.06	0.04
Tunisia	0.64	0.66	1.12	0.60	0.59	0.52

Notes: (A) Actual commitments allocations.
(B) 'Hindsight-Optimal' (*H-O*) loan allocations.
'Forecast-Based' (*F-B*) loan allocations via $\hat{P}$'s from:
(C) The composite variables model with a two-year lag (version *(C)*).
(D) The composite variables model with a no-lag (version *(D)*).
(E) Cline's (1984) model. And (F) McFadden *et.al.*'s (1985) model.

APPENDICES

* LOAN ALLOCATIONS (PERCENTAGE) FOR 1982 *

	(A)	(B)	(C)	(D)	(E)	(F)
Chile	2.38	2.39	2.55	2.18	4.16	2.23
Peru	3.46	3.48	2.29	1.94	3.10	1.28
Indonesia	8.58	8.64	4.07	6.03	11.24	5.23
India	2.36	2.37	0.01	0.78	1.49	0.65
Pakistan	0.81	0.81	0.06	0.90	0.53	0.51
Philippines	2.06	2.08	2.67	2.18	3.23	1.85
Egypt	3.36	3.39	1.66	3.69	0.60	1.84
Turkey	0.68	0.00	5.29	1.14	0.14	0.74
Yugoslavia	0.81	0.82	0.00	0.79	0.81	0.93
Ghana	0.00	0.00	0.00	0.04	0.03	0.04
Mexico	19.34	19.49	22.51	21.29	6.21	22.26
Ecuador	0.28	0.28	2.33	0.96	1.11	0.78
Korea	6.30	6.35	7.48	8.25	6.01	7.70
Sri Lanka	0.53	0.54	0.16	0.50	0.56	0.33
Malaysia	5.13	5.17	0.65	3.49	6.52	3.38
Thailand	1.12	1.13	1.65	1.39	1.72	1.26
Morocco	2.07	2.09	1.22	1.85	0.04	1.15
Syria	0.11	0.11	0.09	0.00	0.00	0.00
Greece	1.79	1.80	1.89	3.20	1.95	3.91
Kenya	0.08	0.08	0.12	0.32	0.13	0.23
Argentina	7.91	7.97	6.09	3.57	11.79	8.15
Jamaica	0.11	0.11	0.13	0.68	0.18	0.42
Guyana	0.00	0.00	0.09	0.04	0.00	0.02
Bolivia	0.03	0.03	0.44	0.01	0.29	0.00
Zaire	0.04	0.04	0.31	0.05	0.08	0.03
Sierra Leone	0.00	0.00	0.10	0.08	0.01	0.05
Togo	0.00	0.00	0.01	0.00	0.00	0.00
Liberia	0.00	0.00	0.04	0.00	0.00	0.00
Senegal	0.09	0.00	0.21	0.06	0.01	0.04
Malawi	0.02	0.00	0.10	0.06	0.02	0.03
Brazil	19.58	19.73	18.29	18.89	12.76	17.68
Honduras	0.05	0.05	0.28	0.26	0.11	0.19
Paraguay	0.22	0.22	0.18	0.45	0.90	0.38
Venezuela	4.98	5.02	8.11	4.85	9.25	5.84
Zambia	0.36	0.36	0.66	0.28	0.03	0.17
Niger	0.07	0.07	0.16	0.10	0.12	0.08
El Salvador	0.18	0.18	0.00	0.00	0.00	0.00
Nigeria	4.45	4.49	7.45	8.89	14.13	9.91
Guatemala	0.20	0.21	0.00	0.12	0.08	0.12
Tunisia	0.48	0.48	0.61	0.69	0.66	0.58

Notes: (A) Actual commitments allocations.
(B) 'Hindsight-Optimal' (*H-O*) loan allocations.
'Forecast-Based' (*F-B*) loan allocations via $\hat{P}$'s from:
(C) The composite variables model with a two-year lag (version *(C)*).
(D) The composite variables model with a no-lag (version *(D)*).
(E) Cline's (1984) model. And (F) McFadden *et.al.*'s (1985) model.

APPENDIX C. FORECAST PROBABILITIES TO RESCHEDULE BY THE VARIOUS MODELS

* 1982 *

	(A)	(B)	(C)	(D)	(E)	(F)
Chile	0.291	0.001	0.995	0.921	0.005	0.224
Peru	0.920	0.996	0.983	0.999	0.308	0.585
Indonesia	0.140	0.042	0.072	0.206	0.021	0.337
India	0.150	0.652	0.731	0.880	0.100	0.425
Pakistan	0.987	0.951	0.976	0.946	0.733	0.624
Philippines	0.138	0.166	0.065	0.169	0.243	0.371
Egypt	0.782	0.763	0.975	0.985	0.924	0.658
Turkey*	0.999	0.974	0.997	0.999	0.935	0.503
Yugoslavia	0.460	0.007	0.059	0.086	0.468	0.113
Ghana	0.978	0.999	0.422	0.965	0.593	0.334
Mexico	0.899	0.002	0.987	0.980	0.850	0.216
Ecuador	0.142	0.051	0.198	0.259	0.469	0.427
Korea	0.651	0.023	0.203	0.423	0.629	0.291
Sri Lanka	0.730	0.717	0.670	0.921	0.421	0.500
Malaysia	0.015	0.001	0.018	0.022	0.030	0.268
Thailand	0.267	0.073	0.006	0.025	0.356	0.315
Morocco	0.905	0.971	0.933	0.922	0.993	0.715
Syria	0.658	0.021	0.777	0.756	0.686	0.284
Greece	0.460	0.001	0.027	0.279	0.696	0.113
Kenya	0.312	0.696	0.116	0.561	0.799	0.501
Argentina	0.999	0.324	0.999	0.999	0.074	0.068
Jamaica	0.862	0.128	0.539	0.745	0.861	0.538
Guyana*	0.736	0.948	0.422	0.853	0.966	0.751
Bolivia	0.997	0.999	0.970	0.867	0.523	0.997
Zaire	0.973	0.996	0.994	0.998	0.329	0.613
Sierra Leone	0.768	0.960	0.779	0.926	0.938	0.575
Togo	0.866	0.998	0.847	0.980	0.173	0.800
Liberia*	0.634	0.677	0.039	0.139	0.852	0.543
Senegal*	0.699	0.701	0.972	0.817	0.955	0.524
Malawi*	0.819	0.972	0.978	0.975	0.889	0.671
Brazil	0.999	0.999	0.999	0.999	0.695	0.386
Honduras	0.408	0.457	0.027	0.284	0.803	0.491
Paraguay	0.001	0.001	0.255	0.969	0.000	0.383
Venezuela	0.021	0.001	0.012	0.027	0.001	0.082
Zambia	0.809	0.799	0.303	0.806	0.954	0.585
Niger	0.226	0.945	0.360	0.351	0.473	0.499
El Salvador	0.389	0.457	0.016	0.010	0.721	0.362
Nigeria	0.006	0.072	0.012	0.031	0.247	0.231
Guatemala	0.057	0.040	0.010	0.024	0.654	0.247
Tunisia	0.249	0.031	0.141	0.327	0.510	0.376

(A) The conventional variables model with a one-year lag (version *(A)-(3)-(I)*).
(B) The conventional variables model with a no lag (version *(B)-(3)-(I)*).
(C) The composite variables model with a two-year lag (version *(C)-(3)-(I)*).
(D) The composite variables model with a no-lag (version *(D)-(3)-(I)*).
(E) Cline's (1984) model.
(F) McFadden *et.al.*'s (1985) model.
* Rescheduling country in 1982.

* 1983 *

	(A)	(B)	(C)	(D)	(E)	(F)
Chile*	0.165	0.002	0.923	0.832	0.009	0.242
Peru*	0.998	0.992	0.993	0.719	0.161	0.526
Indonesia	0.092	0.181	0.056	0.525	0.310	0.379
India	0.443	0.575	0.580	0.627	0.091	0.436
Pakistan	0.953	0.993	0.945	0.964	0.680	0.730
Philippines	0.223	0.382	0.188	0.583	0.757	0.423
Egypt	0.931	0.861	0.978	0.531	0.848	0.659
Turkey	0.999	0.973	0.999	0.857	0.945	0.589
Yugoslavia*	0.637	0.008	0.185	0.568	0.630	0.136
Ghana	0.067	0.012	0.456	0.603	0.233	0.167
Mexico*	0.933	0.933	0.948	0.910	0.972	0.278
Ecuador*	0.525	0.089	0.148	0.627	0.877	0.426
Korea	0.576	0.003	0.474	0.460	0.554	0.282
Sri Lanka	0.652	0.695	0.975	0.488	0.438	0.565
Malaysia	0.020	0.001	0.236	0.397	0.057	0.297
Thailand	0.195	0.039	0.027	0.481	0.282	0.315
Morocco*	0.978	0.978	0.869	0.898	0.993	0.772
Syria	0.747	0.017	0.724	0.498	0.683	0.267
Greece	0.695	0.001	0.083	0.519	0.722	0.119
Kenya	0.571	0.935	0.072	0.669	0.758	0.554
Argentina	0.999	0.999	0.997	0.995	0.054	0.293
Jamaica	0.774	0.121	0.149	0.565	0.879	0.520
Guyana	0.948	0.998	0.913	0.827	0.945	0.791
Bolivia	0.996	0.999	0.973	0.470	0.015	0.372
Zaire*	0.989	0.999	0.938	0.834	0.725	0.617
Sierra Leone*	0.949	0.998	0.876	0.598	0.946	0.629
Togo*	0.992	0.973	0.892	0.941	0.032	0.753
Liberia*	0.704	0.786	0.079	0.553	0.834	0.562
Senegal	0.770	0.935	0.275	0.621	0.891	0.516
Malawi*	0.916	0.990	0.784	0.888	0.925	0.698
Brazil*	0.999	0.999	0.999	0.917	0.972	0.484
Honduras	0.617	0.711	0.067	0.702	0.731	0.548
Paraguay	0.002	0.004	0.940	0.518	0.000	0.288
Venezuela*	0.008	0.041	0.074	0.502	0.003	0.100
Zambia	0.907	0.959	0.285	0.798	0.922	0.614
Niger	0.832	0.827	0.379	0.709	0.875	0.550
El Salvador	0.505	0.491	0.036	0.559	0.519	0.410
Nigeria	0.175	0.046	0.050	0.562	0.617	0.270
Guatemala*	0.307	0.029	0.112	0.518	0.677	0.269
Tunisia	0.309	0.121	0.145	0.521	0.401	0.428

(A) The conventional variables model with a one-year lag (version *(A)-(3)-(I)*).
(B) The conventional variables model with a no lag (version *(B)-(3)-(I)*).
(C) The composite variables model with a two-year lag (version *(C)-(3)-(I)*).
(D) The composite variables model with a no-lag (version *(D)-(3)-(I)*).
(E) Cline's (1984) model.
(F) McFadden *et.al.*'s (1985) model.
* Rescheduling country in 1983.