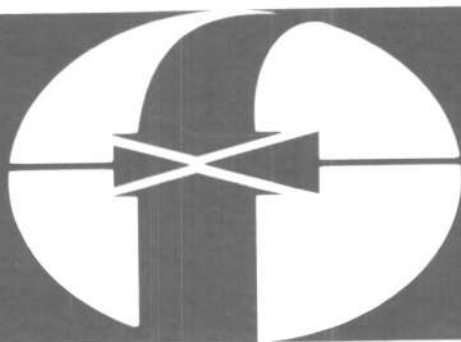


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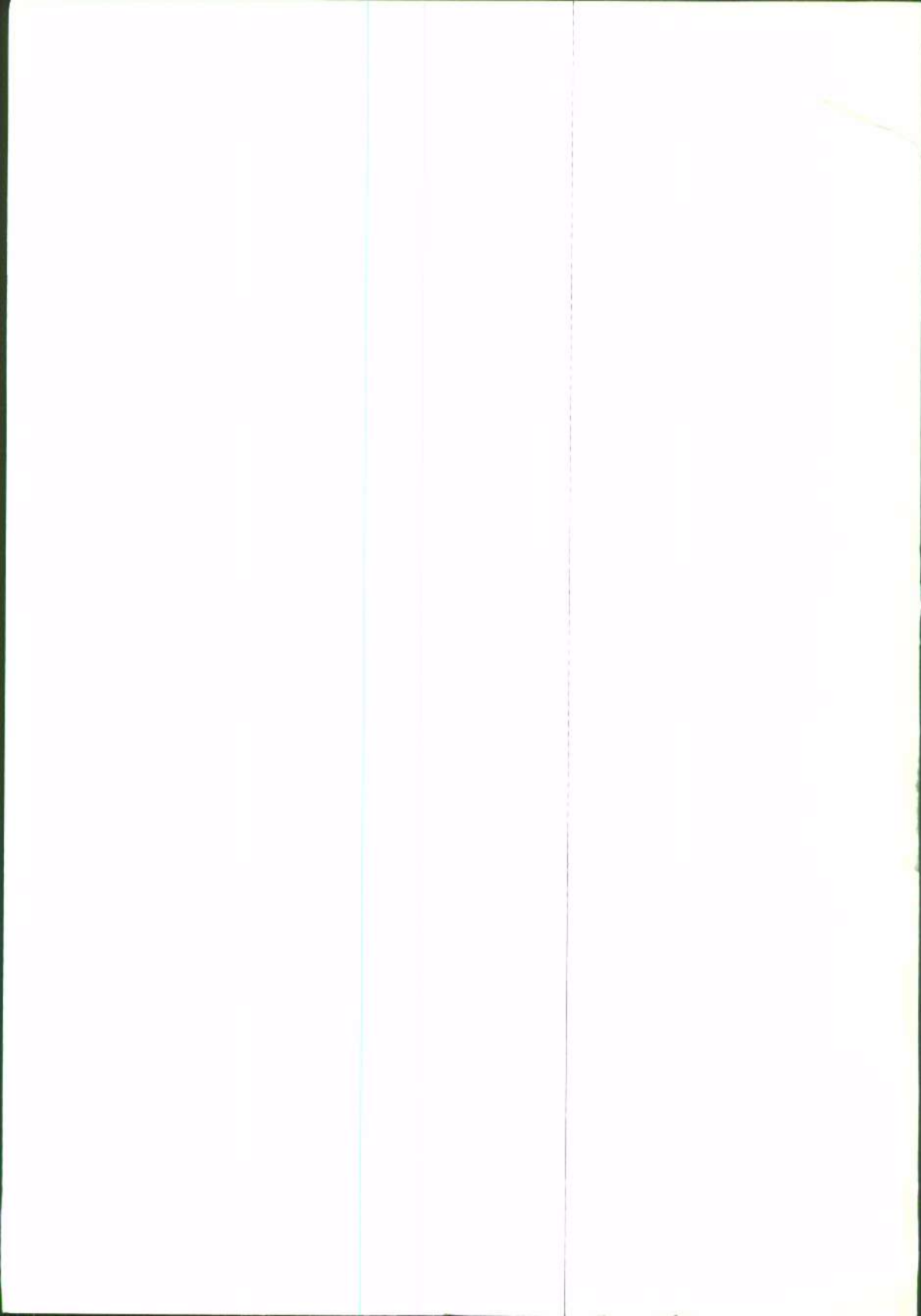


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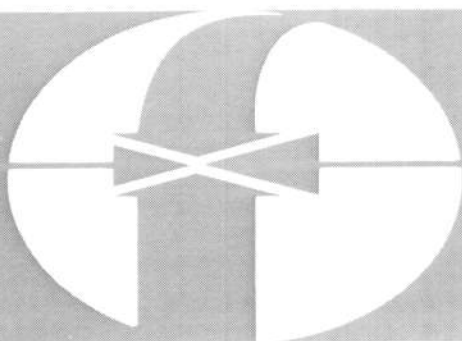
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QUANTIFYING SOVEREIGN CREDIT RATINGS: A REAPPRAISAL OF STATISTICAL SOVEREIGN RISK MODELS*

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1. Introduction

There seems to be no end in sight to the debt problems of many net debtor developing countries. It is therefore hardly surprising that impatience should continue to provoke calls for bold new approaches to the search for a solution, such as the kind of political initiatives that might be released by a North-v-South global dialogue. The politics may be one thing but the technicalities of designing and financing comprehensive schemes of debt relief are another. To all intents and purposes they are likely to continue to be intractable. And that's to say nothing of the question of moral hazard and the implications of the kind of signals that would be sent to those responsible for designing and operating debtor-economy policy adjustments.

Attention must rather remain focused on the evolving needs, policies and performances of individual countries. Flexibility is therefore required in deciding on the right mix of debt reductions, whether in terms of debt write-offs, buy-backs, conversions, or equity swaps, new "involuntary" loans to support existing exposures, and new "voluntary" loans as profitable opportunities once again become increasingly evident. Whether that, and what has already been achieved, are seen as simply little more than muddling through depends on the quality of the credit ratings used in its application. These have to come from sovereign risk analysis (SRA) and it is here that there really does seem cause to question the way in which decisions are made about foreign debts and foreign lending.

The three major strands to current SRA practices include the country report, the checklist and various statistical models. Each has its attributes and weak points and arguably the best applications use all three in successions that start with a rough guide to credit ratings based on statistical forecasts and which then move on to more detailed inquiries with reference to checklists and country reports. In contrast, the underlying aim of the procedures reviewed here is to combine the essential strengths of these three procedures with a revised appreciation of the scope and methods of SRA to produce a single, integrated and structured account of the ways in which a wide range of events, each of which has to be interpreted within the special contexts of individual economies, could

* The careful organisation of the data compilations and analysis used to investigate the various procedures reviewed in this paper is gratefully acknowledged. Special thanks must go to Simon Blackman, Graham Bond, Kenneth Dyu, Sarah Hambleton, Jung-Kyu Oh, Sang-Yong Park and Craig Staniland. The research has been generously financed over a number of years from various budgets by the University of Liverpool.

contribute to the incidence of foreign debt problems observed in practice. Ideally, the resulting explicit expression of these interrelationships avoids the need (encountered in the great majority of statistical studies of SRA thus far) for trial and error empiricisms in choosing between ad hoc explanatory variable suggestions. The statistical analysis can thereby be left free to concentrate on estimating the relative weights to be given to what we know about the past and to various kinds of latest available information.

Two themes are emphasised in reviewing the relationships between variables thought to be associated with debt problems. They both concern what appear to be widespread misunderstandings over the very meaning of SRA, given the special implications of unforeseeable events and the broader macroeconomic contexts of sovereign debt problems. Although more will have to be said later on, it is perhaps helpful to anticipate this with a few words of explanation at the outset.

2. The Two Major Contexts of SRA

To begin with, if the "risk" in SRA refers to the risk of interruptions to loan amortisations and interest payments, then it should be understood that "uncertainty" is more of a problem than "risk". This is because, technically speaking, risks relate to events that have observable probabilities. They can then 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.

On the second count, the "sovereign" bit of SRA refers to "sovereign" borrowers, either in the form of governments or enterprises whose loan servicing payments are guaranteed by government. It follows that, just as Mr Micawber could well have explained from his knowledge of income and expenditure, there is more to a "debt" problem than the debt (and its servicing) itself. In the case of "sovereign" foreign debts, the guarantees of governments mean that the ability to meet servicing charges depends essentially on the incomes and expenditures represented by a debtor-economy's balance of payments. And if that is so then SRA must relate to much the same issues as those encountered

in evaluating macroeconomic performance in general.

(Sovereign risk thus defined may be contrasted with country risk. Although there have been some confusions in the past, the latter 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).

3. Current SRA Practices

The SRA preferred by practising country assessors has always been the country report¹ This has the advantage of allowing any amount of special knowledge and personal judgement to be brought to bear in weighing up the prospects of individual economies. In the right hands therefore it should produce a lot to say about a country's creditworthiness². The major drawback is that a pile of country reports are not exactly the most convenient guide to the *relative* merits of different countries, which is of course precisely what's wanted when it comes to deciding where to place new loans or how best to rearrange existing commitments in times of trouble.

The country-assessor's response to this has usually been the checklist. The "list" ingredients themselves typically take the form of the kind of economic and social indicators to be found at the back of most country reports³. A country's performance for any one indicator can be turned into a country score, usually simply with reference to performance rankings, which can then be added up across indicators to produce an overall rating for any one country. (The uniform application of these routines has been seen

1. Surveys of SRA procedures used in practice have been published by Goodman (1977), Mathis and Maslin (1981), Burton and Inoue (1983) and Heffernan, Delmain and Hollist (1985).

2. Discussions of the design of country reports can be found in Friedman (1983) and Heffernan (1986).

3. Particular examples of checklists are described in, for example, Thornblade (1978) and Thompson (1981) while a tabular survey of checklist indicators is set out in a Group of Thirty Report (1982).

to have the virtue of objectiveness. And yet the exercise of personal judgement in adjusting ranking scores and the weights used in aggregating indicators could, as emphasised again later, be used to advantage to take account of the different circumstances of individual economies).

Formal tests of the relationships between indicators and the incidence of debt problems introduces the need for statistical analysis. Although there is no reason in principle why checklist results should not be the subject of such inquiries⁴, in practice the academics largely responsible for this work have preferred to rely on their own models, the most appropriate kinds of which have a far more useful output format in forecasts of the probabilities of debt problems⁵. The selections of indicators thought to be associated with the incidence of these difficulties are almost exclusively ad hoc. The relevances of most suggestions are individually argued although some are chosen to fill gaps seen to be left by others. The empirical results themselves are left as the final arbiter of what "works" although one guide as to what might be worth looking at has been the concept of "debt capacity".

This seems to relate mainly to vulnerabilities to debt problems and to the ability to cope once they occur. (Even though the distinction is presumably blurred if some limitations on an ability to cope, eg, low foreign exchange reserves or low per capita income, can be regarded as a vulnerabilities). Problems in finding indicators that adequately portray these properties then arise. Two of the most popular indicators, the ratio of debt service payments to exports (the debt service ratio, DSR) and the ratio of reserves to imports (RIR), illustrate well enough the difficulties of avoiding ambiguities and omissions while having to restrict a final selection to manageable proportions. In the case of the DSR, the changing market prospects of different lines of exports, the structures of debt maturities and the proportions of loans subject to variable interest charges variously qualify the ratio's two components. Additionally, it is the long-term dynamics of a continuously rising DSR that indicates an unsustainable debt position, as a result, essentially, of an imbalance between interest rates and returns to investments. Any otherwise "high" DSR might simply reflect the effects of increased foreign lending attracted by new investment opportunities.

Much the same kind of problems of interpretation apply to the RIR. Thus whether high imports mean that debt problems are more likely depends on how far various imports can

4. One evaluation of the forecast performance of checklists can, however, be seen in Blask (1978).

5. Reviews of statistical SRA models have been published by McDonald (1982), Saini and Bates (1982) and Heffernan (1986) while the author has elsewhere, Wynn (1989), assessed both checklists and statistical models as representations of quantitative methods of SRA.

The implications for information analysis are therefore much the same as in judging business opportunities in domestic loan markets. There, interest centres on evaluating entrepreneurial skills and judgement in terms of formal qualifications and track records

raised from a variety of sources and the perceptions of other agents, with better information, in terms of vital reactions like capital flight. This is because of the practical difficulties of monitoring the day to day evolution of balance of payments situations, and especially the amounts and terms of loans being something that clearly cannot be measured directly. It has the further advantage of that can be done despite whatever happens. Such a focus helps to make tangible of the managerial qualities available to LDCs and especially the ability to do the best a particular situation at a point in time. Interest should rather rest on appreciations that is built on forecasts of a handful of indicators that are supposed to characterise economy policy-makers mean that statistical SRA models cannot rely on a structure the scope and style of SRA. Unforeseeable events and the freedoms enjoyed by debtor-This second aspect of these preliminary forecasting has far reaching implications for managers to react to events as a situation evolves.

is further compounded by the amount of scope that there is for debtor-economy shocks, these are, as emphasised already, often quite unforeseeable. The problem principle to trace many debt problems to some initial exogenous shock, or series of forecasts cannot come from this kind of source. Second, while it may be possible in ed macroeconomic model building is therefore simply not practical so the required range of disaggregated variables for the great majority of LDC debtor economies. Detailed lack of long runs of continuous and up-to-date quarterly observations on a wide The first of these indicator-predicting problems follows, on a purely technical level, from blms.

tasks for forecasting the indicators themselves before it's possible to forecast debt problems. This is because of the time that debt problems occur lays up some formidable analysis. Third, the facility now generally seen in this work of concentrating on descriptions of an economy at the time that debt problems occur lays up some formidable statistical estimation to be tackled by empiricisms such as principal components this needs to be taken into account as something more than an inconvenience for circumstances of individual economies. Second, many of the variables are related and object of the analysis, the design of creditor and debtor policies tailored to the cir a particular economy. This seriously limits the response that can be made to the very so substantial that the analysis could well fail to pick up issues that are important for

be postponed or dispensed with in an emergency while the adequacy of reserves depends not only on imports but also on the variability of exports, flexibilities in adapting policies in the face of change, structural diversities, and access to markets for more loans. The upshot has been that more and more indicators have been tried to cover different gaps so that no less than 28 variables have been shortlisted by ten major studies⁶ in this area while the number of variables found somewhere or other to be significantly associated with debt problems amounts to no fewer than 19.

The only major exceptions to these marginalisms in the choice of trial indicators have been the search for, variously, "monetary" variables in the belief that debt problems are rooted in the inadequacies of domestic economic policies, debt proxies to avoid the publication delays and coverage inadequacies of data on debt variables, and an attempt to define sustainable debt situations with reference to a growth-cum-debt model. Some alternative extremes have aimed at trying virtually everything and have therefore had to concentrate on tackling all the consequential burdens for statistical analysis⁷.

4. Problems with Existing Statistical Models

Prima facie evidence as to the achievements of much of this work is clear enough even within its own major terms of reference, ie, relying more on what works empirically than on what is theoretically justified. In particular, no general consensus as to the variables that are associated with debt problems has been achieved. Thus in the case of the ten variables that appear three or more times in the ten major inquiries referred to earlier, 64 per cent are found, overall, to be data consistent. The rate for the remaining variables cited is 66 per cent. Things are not that much more encouraging in terms of collections of variables that are found to be statistically significant in the context of any one study. Judging from the evidence of structural breaks in moving beyond observation periods, this is always likely to be all the more serious a difficulty in trying to apply the lessons of one period, such as the first oil price rise, to another, such as the second. Three other major problem areas remain. First, the differences between countries are

6. These include studies by Frank and Cline (1971), Feder and Just (1977), Mayo and Barrett (1978), Sargan (1977), Saini and Bates (1978), Feder, Just and Ross (1981), Cline (1984), Kharas (1984), Taffier and Abbasi (1984) and McFadden, Eckhaus et al (1985).

7. Reference is made here in particular to the studies by, respectively, Sargan (1977), Saini and Bates (1978), Kharas (1984) and Taffier and Abbasi (1984).

rather than on detailed knowledge of the purposes to be served by a loan and special insight into their future prospects. (It is perhaps obvious enough, but of course judgements of the "quality of management" are assumed to extend beyond the purely technical achievements of management processes to include views on the effects of the policy goals and constraints decided by political processes. There is clearly little that the most skilled of management teams can do to avoid the consequences of inept policy directives).

As indicated earlier, when it comes to cross-border loans guaranteed by governments these managerial qualities have to be assessed with reference to whether balance of payments difficulties could frustrate the honouring of such contractual obligations. It is this that also provides the context for as many other aspects of a debtor-country's economy as relate to its balance of payments. Hence changes in world markets for goods, services and finance, the policies chosen to promote economic development and to adjust to external change, and the priorities given to goals other than external equilibrium, so that avoiding having to reschedule external debts becomes one goal amongst others, notably employment, the growth of productivity, and the control of inflation, all emphasise the wider macroeconomic contexts of a debtor-country's "debt" problems.

These broader issues also follow directly from the fungability of the uses of foreign savings in the public domain. Thus while creditors may hope to tie their loans to financing productive enterprises, the domestic funds that might otherwise have had to be relied on can now be used with less restriction. Hence quite apart from the *carte blanche* offered by balance of payments support loans and the subterfuges of enterprises that channel foreign finance on to others that foreign creditors might be less enthusiastic about, loans can be used marginally to support a variety of purposes, including consumption.

5. Implications for Analytical Integrations

These perspectives to SRA mean that it is necessary to refer both to much more information and to different ways of analysing more information than is possible in the single-equation, summary-indicator, rescheduling prediction (SESIRP) statistical SRA models referred to above. Such needs have always been at the heart of SRA procedures followed in practice where, although more and more use has been made of other analytical devices over time, the emphasis remains on the detail that can be accommodated in the country report. However, the different shortcomings of country reports, checklists and

statistically validated models mean that individually they are insufficient. As against this, their equally different attributes suggest that they are much more effective when used in conjunction. The question is then, how should they be combined?

From what can be gathered from what little has been published, current best practice seems to be to use a sequence of methods beginning with a statistical model followed by a checklist and country reports⁸. Each stage can then be used to identify problem situations that can be looked at in more detail with the advantage of the greater amounts of information consulted in succeeding stages. The problem with this is that the shortcomings of the stage-methodologies could well mean both that problem-cases can slip through one stage and that such mistakes cannot be discovered and put right in succeeding stages. In contrast, the combination of methodologies that is reviewed here takes the form of an integration so that they are in effect applied simultaneously.

6. Information Requirements

Given the special advantages of the kinds of validation and forecast quantifications offered by statistical methods, it is only sensible to make a start in examining the informational needs of SESIRP models. While the number of variables that can be realistically referred to in these is clearly limited, the amount of information on any one set of variables may at first sight appear impressive given the universal use of pooled time series, cross-section data to estimate these models. And yet the equal weights given to these two dimensions may not be as appropriate as is evidently generally assumed without argument. In particular, the time series dimension may have far less relevance than is casually supposed. There are two reasons for doubts, one that concerns the long term and the other the short term. On the first count, the evidence of structural changes alluded to earlier means that past experience becomes increasingly irrelevant as both domestic and external situations change. Second, the information content may be much less than is generally supposed because of the slow moving nature of many explanatory variables. Thus information on many characteristics of an economy may change little from one year to another, if not for longer periods of time. Obvious examples include per capita income, especially in relative terms as between economies. However, indicators in the form of averages over time, such as, say, a five-year estimated rate of growth of income, as well as derivative indicators such as an incremental capital-output ratio, will

8. See, for example, Merritt (1982). Note also, incidentally, the title of the Thornblade (1978) paper.

carry four observations over from one year to the next.

By the same token, the special relevance of the latest available information highlights the need to make the best possible use of the current cross-section data. This is further emphasised by the far more valuable perspectives offered by cross country comparisons. Thus whether "high" rates of income or export growth are associated with a reduced incidence of debt problems depends on what is "high" and that depends largely on the opportunities presented by any given current environment or the state of a particular economy. Both are subject to change. Comparisons with past achievements are therefore far less relevant than comparisons with the achievements of other economies. (And additionally the lessons offered by the experience of other countries is all the more relevant in this context when the number of rescheduling countries has always been, even at the height of the current debt crisis, far outweighed by the number of countries managing to avoid having to reschedule).

7. The Impact of Past Experience

Reappraisals of the information contents of time series and cross-section evidence in the contexts of SRA and the clearly distinguishable information demands of judging how well debtor economies are managed and the implications of the latest available situation, suggest two separate focuses to the analysis. The purpose is to leave the time series record, in the sense of past information, to address the first task and a comparative analysis of the latest available information to answer the second.

While there is every incentive to take account of special events in the past in the first exercise (so that one could say that by the way debtor-economy management teams have handled shocks, both adverse and favourable, so may they be judged⁹), the resulting evaluation can generally be adequately summarised by just one variable in the form of the previous period's rescheduling probability prediction, \hat{P}_{-1} . Such a device may be compared to a lagged dependent variable term in conventional models. In this case, however, it should be noted that a lagged term in a binary dependent variable merely registers one aspect of yesterday's debt status, ie, whether a country encountered debt problems or not. In contrast, a lagged forecast probability has a completely dif-

9. It will be appreciated later on that such flexibilities can be useful wherever it is felt important to allow other (outside) information to have an influence on the proxy discussed below.

ferent interpretation as a representation of all past information in the spirit, for example, of the implications of the lagged dependent variable in the aggregate consumption function in terms of a rational expectations hypothesis. There the previous period's (actual) consumption is seen as a direct response to consumer perceptions of their underlying "permanent" income at that time. The effect is to produce a convenient proxy for this variable which is impossible to measure directly given the central part played by households' expectations of future income streams.

In the case of a \hat{P}_{-1} variable, the lessons of all past experience are effectively swept into a single term. The implication is that past ratings are fixed unless new information should be uncovered or new means are used to appraise the significance of already known information. The remaining explanatory variables can therefore be devoted to the latest available information on any given current situation. The role assumed by the \hat{P}_{-1} representation of all past information is especially important if it is felt that too little attention has been given in many previous statistical studies to the need to forecast debt problems over more distant horizons than one year, given that the maturities of most loans are in excess of one year. Any change means looking at wider contexts than situations immediately preceding debt problems.

Getting the right balance between the two kinds of information is the task of statistical estimation. The \hat{P}_{-1} series presents special demands in this. For some initialising sample, an a priori source of information on \hat{P}_{-1} is required, say in the form of a credit rating from elsewhere. Thereafter new estimates can be prepared as succeeding \hat{P}_{-1} values become available. This may appear strange compared with what happens conventionally and yet the focus of the analysis is thereby in accord with both what is possible and what is required in practice. Past experience is built up over time so this dimension to the available data can only be gradually extended in the same way. Or, expressed otherwise, the events associated with any given debt situation can only be consistently accounted for in terms of the information actually available at that same time. The prime aim of the statistical analysis is to quantify the relative contributions of previous information, in the form of previous ratings, and the latest available new information to our understanding of current debt problems. Continuous re-estimation is not necessarily a specific consequence of the presence of the \hat{P}_{-1} term. Rather, it affirms that "change" more broadly means that both new information and changes in the weights given to previous and new information contribute to revised credit ratings.

8. The Impact of New Information

The second part of the specification calls for a structured analysis of all relevant new information. This presents challenges on two broad fronts. First, a wide variety of events over time could contribute to what might eventually become a debt problem. Second, these events have to be interpreted with special reference to changes in the environment in which debtor economies operate or to changes in the way in which any one debtor economy is run or both, but with the emphasis on the latter since the former is likely to affect many economies in much the same way, or at least in sufficiently the same way that relative ratings remain much the same.

It is important to recognise that they are the same challenges faced in preparing a country report or in conventional macroeconomic modelling. Each of these approaches therefore provides its own special insights that help to clarify what is wanted here. The first has the advantages of making use of *all* relevant information so special attention can be given to the peculiar circumstances of individual economies. (This may be contrasted to the way in which SESIRP models rely on a limited selection of indicators to the exclusion of *all* other evidence, which may be fine in terms of expressing broad generalities but which may be seriously inadequate in the context of any particular economy). The second represents what would be ideal, especially in tracing cause and effect sequences that lead to debt problems.

These sequences suggest both conventional variables that are associated with debt problems and a scheme by which they can be classified. The latter in turn can be used to reduce the amount of information presented for statistical analysis by means of aggregations of these variables. The results emphasise that variables cannot be considered in isolation. In particular, it often seems to be the case that it is performance with reference to, say, a pair or more variables together that is associated with the incidence of debt problems. This could help to explain many of the surprises in variables that turn out to be statistically non-significant in SESIRP models. Information has to be seen in its proper context for its relevance to be appreciated.

Starting at the beginning, debt problems can often perhaps be traced to changes in world trade or financial markets so one category of variables includes terms of trade, export volumes, and the costs of finance. In terms of event sequences the next category needs to cover policy reactions. These will depend in part on the constraints set by resources and the current structure of production and absorption and in part on flexibilities in deciding policy, which depends on political considerations and the sensitivities

of market and pricing systems. First-round reactions can be monitored with reference to budget deficits, credit expansions, money growth, exchange rate appreciation, and new foreign debt. (These are of course far from independent which makes the aggregation processes reviewed below all the more necessary). Second-round effects will be felt later in terms of domestic saving, the level and efficiency of investment, and trade performance. Lastly, all three kinds of variable eventually combine to show how an economy is doing in terms of the ultimate goals of policy such as the growth of productivity, employment, and external and internal equilibrium, assuming income distribution effects are ignored in this context.

These enlarged information sets can be represented by a composite variable for each category of variables. Considerable flexibilities are therefore available in formalising the kind of "expert" evaluations that can be expressed in country reports. These include the choice of component variables covered by any one composite variable, the ways in which they are scaled, and the weights used in their aggregation.

Given appropriate categorisations of variables and efficient aggregation procedures, the results are effectively little more than an extension of other aggregations of variables. Thus aggregate imports is an unweighted sum of a number of components that are in many other respects dissimilar, eg, imports of consumer and capital goods, raw materials and intermediate goods, necessities and "postponables", etc. From another perspective, the analysis provides a route to tests of checklist procedures within a framework that is both apposite, with its reference to specially tailored lists and aggregations, and (statistically) conventional. And a third view of these structures follows from comparisons with the composites found in ratios such as the DSR, the RIR, etc.

Following a first-step selection of the variables to be included in each composite, the weights used in the aggregations can come from separate logit regressions as explained below. An important second step needs to be explained first, however. This concerns the improved efficiencies of these regressions the more similar the component variables are. One aspect of this can be intuitively sensed from the need that there would be to have the variables in the same unit of measurement if the intention were simply to add them up, in the fashion of checklist procedures. One way of doing this would be to use rank orderings. There is more to the point than this, however. This is because distributions of the ratio indicators used in statistical sovereign-risk models are often greatly skewed, with perhaps extreme outliers, or "peaked" around the mean (the property of kurtosis). One way of tackling such problems is to use an appropriate transform. An example follows from the kind of distribution that can be expected for a variable

such as the ratio of imports to reserves when the denominator could be very small, or even zero. Thus although two early studies used this ratio others can be seen to have switched subsequently to the more sensible reciprocal. There are other transforms and other objectives in transforming variables. So, for example, Taffler and Abassi (1984) seek to achieve at least marginal (ie, individual variable) normality prior to multivariate discriminate analysis by the use of logarithmic, square root and reciprocal transforms.

The trouble with these ad hoc arrangements is that the results can be somewhat "remote" from the original indicator. (For example, Taffler and Abassi use $(1 + X)^{-1}$ for the debt to exports ratio and the domestic credit to GDP ratio). In contrast the emphasis preferred here in scaling variables is to make the best use of comparative evidence, the attributes of which were reviewed earlier. Thus a simple rank ordering will pull in outliers and otherwise place different kinds of variables on much the same footing. There are other, more sophisticated, formal scaling processes that can be used but it has to be said too that informal, subjective, judgements as to what is "high" or "low" can sometimes offer the best results although their application can be extremely time consuming.

The last-stage aggregations give direct expression to the interrelationships between variables. The problems posed by reinforcing or offsetting exogenous shocks and policies and by the tradeoffs between the goals of policy are directly confronted. They are of course the same problems faced by SESIRP modellers in tackling multicollinearity and by anyone trying to build an overall picture of a particular economy's situation out of the lists of economic indicators to be found in reviews such as the World Bank's *World Development Report* and the IMF's *World Economic Outlook*. The weights used to amalgamate component variables can come from logit fits of each group of variables. The emphasis in this needs to be on the overall fits to the data. Correctly signed variables can therefore be retained as long as they contribute to improvements in this respect, and otherwise regardless of the effects of multicollinearities, in order to make use of the widest possible range of information. The composites themselves are the fitted values of the dependent variable from these regressions.

The results could be viewed as an extension of the use made of principal component analysis in earlier studies from Dhonte (1975) and Taffler and Abassi (1984). However, rather than allow the contributions of component variables to be determined simply by what works best empirically, to leave results which are often difficult to interpret or to describe in theoretical terms, the composites referred to here have clearly defined ra-

tionalisations. They could therefore be regarded as structured, or constrained, alternatives to principle components.

The reliance placed on the latest available information in all this, so removing the need for forecasts of explanatory variables in forecasting debt-problem probabilities, is not as restrictive as may seem at first sight for a number of reasons. First, there is the general point stressed earlier that the most interesting events are in any case unforeseeable. Without such knowledge and in the absence of dynamics other than the \hat{P}_{-1} term, forecasts made in any period t are unlikely to change dramatically from $t+1$ to $t+2$, etc, especially in terms of cross-country comparatives. Second, the focus here remains firmly fixed on the contribution of new information to an ongoing analysis of abilities to cope with the unexpected; forecasts would require guessing its implications for policy-makers as they decide what to do next. Third, the different aspects of current information provide a wide-ranging view of an economy's immediate past and future prospects in their own right. Thus performance variables such as the growth of productivity, inflation and external balances reflect the effects of various aspects of the past, while policy variables and intermediate performance variables, such as savings, investment, incremental capital-output ratios, exports, etc, together with opportunities represented by the world economy, all contribute to what may be expected in the future.

9. Other Opportunities for New Analysis

So far, attention has been concentrated on reappraising the relative contributions of time series and cross-section evidence to estimates of statistical models and on the formulation of explanatory variables in these models. There are, however, three other opportunities for further important supporting developments. These are reviewed briefly here. They relate to the quantification of the dependent variable, the evidence that should be used to estimate parameters, and the analysis of forecast errors.

On the first count, reschedulings of foreign debts and arrears in service payments have invariably been seen as the sole evidence of "debt problems". And although payments arrears might well be quantified in conventional terms, the "yes-or-no" incidence of reschedulings has led to a universal use of a binary dependent variable. However, the balance of payments contexts of foreign debt problems reviewed above enable the underlying evolution of these problems to be monitored in terms that admit more conventional measurement. The current information used in predicting probabilities of debt problems can then be confined to a balance of payments variable.

Breaking the restrictions imposed by a single-equation structure presents a number of opportunities. To begin with, the first-stage analysis can proceed without having to decide just when reschedulings occur which is debatable given that a rescheduling is more of a process than an event, stretching from the first identification of a problem through to the actual implementation of a rescheduling agreement. (And even if an unambiguous answer can be found there remains the problem that a year is a long time so the events associated with a rescheduling at the start of a year may be different than those associated with one at the end). Second, this analysis avoids having to define just what a rescheduling is, which helps in cases of informal, and even in some instances secret, departures from contractual servicing arrangements. Much the same applies to multiple reschedulings, which might be regarded either as manifestations of the same problem if successive, or as separate events if it can be decided how many trouble-free years should intervene. A third benefit includes a means of monitoring the approach to debt problems in a way that is not possible using a discrete dependent variable. This clearly allows for a greater sensitivity in preparing early warning forecasts. (These flexibilities can also be augmented, however, by extending the descriptions possible with 0,1 allocations in the dependent variable to 0,1,2 etc. allocations by, for example, assigning a "2" to one or more years immediately preceding the formal manifestation of a debt problem).

The second topic discussed in this section has to do with the selection of problem-free countries to provide problem-free country-year observations. The issue has attracted little or no attention thus far and most studies assume the virtues of expanding sample coverages in respect of problem-free countries without restriction. For data prior to 1982, the year which marks the nearside extreme limit of the samples used by most studies published thus far, such a one-sided open-endedness has produced greatly unbalanced samples. This is because prior to 1982 the number of reschedulings was quite small so, as the writer has pointed out elsewhere, Wynn (1989), "...although the pooled time series, cross-section observation sets for... nine (major) studies... range from 145 to 715, the number of reschedulings similarly extends only on a very much reduced scale, from thirteen to fifty-five..." There is, however, a need for care in selecting observations from countries that have been free of debt problems. The most obvious aspect of this is the importance of eliminating countries that are unlikely to have any foreign debt problems simply because they have little or no foreign debt. However, the broader macroeconomic contexts of sovereign-debt problems highlighted here suggest that the need to compare like with like has to be extended beyond that of debt-status alone.

So, for example, size and trade structure no doubt have a bearing on the incidence of debt problems and on the policy alternatives available by way of response to debt problems.

Once the debt-problem countries of a sample have been identified, matching selections of problem-free countries can follow. The object is to focus on the circumstances relating to debt problems in a way that is as free as possible from other influences. Country classifications can provide a useful first-stage guide to selections. "Off-the-peg" examples include the various classifications to be found in the statistical appendix of the IMF's *World Economic Outlook*. The major schemes there currently relate to "predominant export category" and "financial criteria". The first distinguishes between five kinds of exports: fuel, manufactures, primary products (subdivided in turn depending on whether they consist primarily of minerals or agricultural commodities), services and private transfer, and, lastly, diversified export bases. The second grouping consists of eight net external creditor (developing) countries while the remaining net debtor countries are subdivided with reference to two other financial considerations, in the form of the distinctions between: (i) market, official and diversified borrowers, and (ii) borrowers that have experienced debt-servicing difficulties in the recent past and those that have not. Other separate miscellaneous groupings include net debtor fuel exporters, 15 heavily indebted countries, small low-income countries, sub-Saharan African countries, major oil-exporting countries, and four newly industrialising Asian economies.

Second-stage, fine-tuned, selections could be based on economy characteristics that include (together with suggestions of appropriate indicators) size (eg, population), size of market (eg, GDP), level of development (eg, per capita GDP), and trade dependence (eg, imports plus exports as a proportion of GNP), in addition to total foreign debt, debt burden (eg, debt relative to exports) and the debt-servicing burden (eg, the debt service ratio).

The third point of this section follows from the way in which the "yes-no" way of registering debt problems has also influenced the analysis of forecast errors. Thus even though logit models produce forecasts in the form of predictions of the probabilities of debt problems, "yes-no" realisations have usually led to this information being put in the same form by the choice of a critical probability above which \hat{P} s are reckoned as forecasts of debt problems and vice versa. This amounts to throwing away information. Thus for a \hat{P} cut-off point of 0.5, forecast probabilities such as 0.6 and 0.9 are scarcely equivalent even though they may both be registered as forecast reschedulings. In practice, of

course, \hat{P} s can be used to more effect than simply to decide, for example, to confine loans to countries that are forecast to have "no-debt-problems". Ideally, they should be used to decide both the interest charges and maturities of individual loans and the compositions of loan portfolios. And in that case forecast errors can be analysed with reference to these decisions and what would have been decided had the debt problems that actually occurred been known in advance. Clearly, forecast errors are more serious when the forecasts have encouraged, or discouraged, large amounts of business that would have been (respectively) avoided, or welcomed, with the benefit of hindsight.

10. Conclusions

The reformulations of SRA reviewed above can be compared with what others have seen as the way ahead. These include the search for new summary indicators, or new expressions of those that have been tried already, and for rules of thumb for monitoring the evolution of country debt situations¹⁰. Additionally, different analytical frameworks have been proposed, such as structural models of the interaction of supply and demand in international capital markets and of sustainable debt accumulations within the process of growth¹¹. (On another tack, there is also a considerable literature exploring solutions to debt problems. This includes game theory investigations of the decision to reschedule debts¹²)

However, the first two rely on inadequate perspectives; one persists in too marginal an approach to indicator selections and the other is too narrow in continuing to see debt problems in debt terms alone. And so far as world capital markets are concerned, these are just another source of exogenous shocks that are common to all debtor-economies. What remains important for credit ratings is how shocks impact on an individual economy in terms of the sustainability of its balance of payments position, not the shocks themselves. So although debt reschedulings have been interpreted as the

10. Examples of the first can be seen in the proposals presented in Lomax (1983) and Bird (1986) while an example of the second is discussed in Johnson (1985).

11. See for example Cline (1984) and McFadden, Eckhaus et al (1985) on the first count and Kharas (1984) on the second.

12. A review of the latter, *inter alia*, can be seen in Eaton and Taylor (1986).

result of a disequilibrium in the international credit market, when at some interest rate ceiling the supply of capital is totally inelastic, there are other explanations of such price (P) and quantity (Q) phenomena and their effects. One is that a "shortage" of loans is an exogenous event caused by changing supply and demand conditions in world markets for foreign savings. The markets clear but some (price-taking) debtor-economies may find the price (P) of loans is too high for them to be able to afford the costs (PQ) of all their borrowing requirements (Q). Or if the ceiling applies to a particular country, even if it is prepared to pay a higher interest rate, then that is because such rates would only make worse what is already seen by lenders to be an unsustainable external payments situation. Lastly, while growth-cum-debt models help to clarify the major theoretical issues surrounding SRA, their abstractions must mean that they are too inflexible to be able to cope with the many subtleties in the ways in which debt problems evolve in practice.

In contrast, the emphasis here is that the impact of unforeseeable events and the broader macroeconomic contexts of debt problems suggest a reorientation of statistical SRA away from the goal of forecasting a narrow range of variables that are supposed to characterise the underlying circumstances of such problems at a point in time. What is wanted instead are evaluations that are more broadly concerned with the effects of political constraints and technical competences on the macroeconomic histories of debtor economies and of the sustainability of current policies and performance. The upshot is to emphasise a SRA sharing the same objectives and procedures as country-economy evaluation in general.

Responses to these requirements are described in terms of both debt-management track records and the latest available information. The previous period's credit rating acts as a summary proxy for the former. The reference to all relevant information in the latter, as well as the means of allowing for interrelationships between variables, is achieved by composite variables based on classifications of component variables suggested by conventional macroeconomics and scaled with special reference to comparative evidence. These last procedures provide a means of formalising the scope for personal judgement and special knowledge enjoyed by practising country assessors in preparing country reports sensitive to individual country situations and to the considerable diversities in events that could eventually contribute to debt problems. Reviews of other opportunities for new analysis refer to more flexible dependent variable formulations, the virtues of samples that have a better balance between debt-problem and problem-free countries, and more appropriate methods of analysing forecast errors.

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Abstract

Diversities in current practices and research relating to sovereign risk analysis (SRA) are contrasted with the need to concentrate on the implications of unforeseeable events and the broader macroeconomic contexts of sovereign borrowing. Extensions and integrations of otherwise conventional concepts and methods of analysis plus an emphasis on comparative evidence are discussed as means of quantifying credit ratings in terms of a proxy for debt management histories and summaries of all relevant latest available information. The latter effectively formalise the sensitivities of country reports and the various interrelationships between explanatory variables. More flexible dependent variable formulations, the need for care in sample selections, and more pertinent forecast error analysis procedures for SRA are also reviewed.

LA QUANTIFICATION DU DEGRE DE SOLVABILITE D'UN ETAT: UNE REEVALUATION DES MODELES STATISTIQUES CONCERNANT LES RISQUES ETATIQUES

RESUME

Les diverses façons de noter les dettes souveraines (en s'appuyant sur des rapports par pays, des listes de points principaux ou des modèles statistiques) sont passées en revue, avec leurs avantages et inconvénients. Les modèles statistiques ont pour inconvénient majeur de ne pas dégager un consensus quant aux meilleurs indicateurs pouvant annoncer un problème de dette, sans compter les difficultés liées aux indicateurs interconnectés, aux différences entre pays et aux indicateurs prévisionnels ex ante. Deux guides sont proposés en vue de faciliter la sélection des indicateurs en palliant ces inconvénients: il s'agit des incidences sur l'endettement de changements imprévisibles d'une part et des politiques et performances macro-économiques du pays endetté d'autre part. Divers décalages dans le temps, catégorisations, échelles et amalgames de variables sont utilisés pour optimiser les mandats de gestion de la dette à partir des résultats passés et des toutes dernières informations disponibles. La possibilité d'utiliser d'autres variables dépendantes, le très grand soin à apporter à la sélection des échantillons et les procédures d'évaluation à appliquer aux erreurs de prévision sont également passés en revue.

