Journal of Business Finance & Accounting, 28(3) & (4), April/May 2001, 0306-686X

LDC Credit-risk Forecasting and Banker Judgement

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1. INTRODUCTION

The international banking system has been a major creditor of less-developed countries (LDCs) since the 1970s. Since the Mexican moratorium of 1982, there have been frequent interruptions to flows of debt-service, along with periodic waves of restructurings and reschedulings. These continued through the 1990s, notably in Latin America and the former Soviet bloc. During 1997–99, there were major financial crises in Asian countries such as Thailand and South Korea that were formerly regarded as extremely sound, while Russia in effect defaulted.

Banks are in the business of measuring and managing risk, and the assessment of country credit-risk is a vital activity for banks involved in international lending. Considerable resources are devoted to it, and yet recent events suggest that the results are to a great extent unsatisfactory. Calverley (1990) surveys the methods used, which range from desk research and country visits, through checklist systems, scenario analysis, scoring systems (which generate a numerical rating), and multivariate techniques (essentially logit and discriminant analysis), to formal country-specific econometric models. The central issue that this paper

*The authors are respectively from Trinity College, Dublin, Ireland; and Cranfield University School of Management, UK. They wish to thank each of the following: The Economist Intelligence Unit, and in particular Ms Mina Toksoz, for supplying data; Mr M.J. Harrison of Trinity College Dublin, for extremely helpful advice; and an anonymous referee, whose comments on successive drafts were highly pertinent, and delivered very rapidly. The usual disclaimer applies. (Paper received August 1999, revised and accepted April 2000)

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addresses is the information content of bankers' country credit ratings. The paper is not primarily concerned with the quality or forecasting power of these ratings *per se* – instead, it seeks to establish whether these ratings have much the same information content as a small number of key macroeconomic variables.

This paper uses a parsimonious econometric model to capture the average risk assessments of bankers, as represented by the *Institutional Investor* country credit ratings. Unlike earlier econometric analyses of these ratings, a regression model of banker judgement is validated via an examination of its predictive ability up to nine years out-of-sample.

The present study complements the work of a number of recent authors in exploring the factors that underlie banks' credit ratings, including Feder and Uy (1985), Brewer and Rivoli (1990), Cosset and Roy (1991), Stone (1991), Oral et al. (1992), Cosset et al. (1993), Lee (1993a and 1993b), and Ul Haque et al. (1996). This research is summarized in Table 1, which for comparison also gives corresponding details of the model to be described below.

The thrust of these earlier studies is principally explanatory, in focusing on the specific determinants of banks' country credit-risk assessments. In all cases they stop short of intertemporal out-of-sample testing, whereas our main concern is with the intertemporal robustness and predictive ability of our model of banker judgement.

We estimate a regression model of the *Institutional Investor* rating system, using four macroeconomic variables and a time-dummy, and test its ability to replicate actual rating values out-of-sample. We conclude that the country-risk assessments of international banks may be validly replicated by a parsimonious linear econometric model. This is a conclusion about the activities of banks, and should not be interpreted as a basis for practical risk assessment.

This paper is organized as follows. Section 2 contains a discussion of variables and data. Section 3 contains the regression model of banker judgement, along with a review of related statistical issues. Out-of-sample test results are reported in Section 4, and results are summarized and conclusions drawn in Section 5.

Table 1

Summary of Recent Research on the *Institutional Investor* Ratings

Authors and Methodology	*Sample* *Countries*	*Year of Rating*	*Predictors*[a] *with Coefficients Significant at 5% Level*[b]
The present paper *Linear*	54 LDCs. 414 pooled cases (1980–87) for estimation, 473 (1988–96) held out for prediction.	1980–96	**GDPX**, *Public debt/exports*; **RTD**, *Real total debt*; **INVR**, *Fixed investment/ GDP*; **MCOV**, *Import cover*; **DUM**, *Time dummy.*
Ul Haque et al. *(1996)* *Logit*	60+ LDCs & other. 942 pooled cases for estimation.	1980–93	Export growth; current acct./GDP; US T-bill rate; dummies for: inflation, debt/GDP, Asia, export orientation.
Lee (1993a) *Logit*	40 LDCs. 360 pooled cases for estimation.	1979–87	*Total external debt/exports*; *Time effects.* Growth rate of GDP/ capita; Interest rate; Variability of GDP/capita; Regional and debt-status dummies.
Lee (1993b) *Logit*	29 LDCs. 29 cases for estimation.	1986	Growth rate of GDP/ capita; govt. debt held domestically/GDP; Debt/GNP; indicators of political risk, from Brewer & Rivoli (1990).
Oral et al. (1992), and **Cosset et al. (1993)**[c] *Mathematical programming & generalized logit*	70, LDCs & other. 70 cases used for separate estimation in each year.	1982, 1987	*Gross fixed investment/GDP*; *Import cover*; *Time effects*; *External debt less reserves/ exports*; GNP/Capita; Export variability; Current account balance/GNP; Political instability indicator; Regional dummies.
Cosset & Roy (1991) *Logit*	71, LDCs & other. 71 cases for estimation.	1987	*Gross fixed investment/GDP.* GNP/Capita;
Stone (1991)[d] *Linear*	23 LDCs. 460 pooled cases for estimation.	1980–88	*Import cover*; Debt/GDP; *Real GDP*; Industrial country GDP; Arrears/ total debt.

Table 1 (Continued)

Authors and Methodology	*Sample Countries*	*Year of Rating*	*Predictors*[a] *with Coefficients Significant at 5% Level*[b]
Brewer & Rivoli (1990) *Logit*	30 LDCs. 30 cases for estimation.	1987	Current account balance/GNP; Total external debt/GNP; Indicators of political risk.
Feder & Uy (1985)[d] *Logit*	55 LDCs. 405 pooled cases for estimation.	1979–83	*Import cover*; *time dummies*; Debt/GNP; Export growth; GDP growth; terms of trade; Export vulnerability; GNP/capita; various other dummies.

Notes:
[a] *An italicized variable name* indicates a variable used in this paper, or a close substitute.
[b] Oral et al. and Cosset et al. do not report tests of significance. All variables used by them are shown.
[c] Oral et al. also report results for *logit* and *classification and regression tree*. Their preferred approach is generalized logit, which is the main topic of the related paper by Cosset et al.
[d] Stone and Feder & Uy use biannual data. All other papers use annual data.

2. VARIABLES AND DATA

(i) The Dependent Variable: A Measure of Banker Judgement

While individual banks' assessments are intended primarily for internal use, aggregated information is publicly available in *Institutional Investor*. This major financial journal is read primarily by market professionals, and had a circulation of 136,000 in 1989 (*Benn's Media*, 1993, p. 210). *Institutional Investor* publishes biannual country credit ratings for more than 100 countries, based on a survey of between 75 and 100 leading international banks, whose individual responses:

> are weighted using an *Institutional Investor* formula that properly gives more weight to responses from banks with greater worldwide exposure and more sophisticated country-analysis systems (Shapiro, 1989, p. 135).

The rating for each country-year case is a number between zero (maximum risk) and 100 (least risk). A major advantage of using the ratings to represent banker judgement is that, while individual bankers' underlying judgemental processes may

embody random errors in application, these should be eliminated through pooling.

Taffler and Abassi (1984) question whether this rating system is entirely satisfactory as an objective indicator of country risk. They argue that:

> The high rating given to Latin American countries in many cases, for example, may reflect more familiarity through geographical and ethnocentric association with the United States, and the large sums already lent, rather than their intrinsic creditworthiness *per se* (Taffler and Abassi, 1984, p. 558).

Writing in *Institutional Investor*, Shapiro (1993, p. 124) reports a tendency for countries to receive more favourable ratings where there is geographical proximity, or a former colonial relationship, with the country of the banker. However, while all these matters may limit the rating system's accuracy as an objective indicator of risk, they are irrelevant to its use as an indicator of banker judgement. We take the *Institutional Investor* ratings to be reliable indicators of bankers' country-risk *assessments*, a view that is supported by Feder and Ross (1982), Burton and Inoue (1985) and Stone (1991).[1]

(ii) Independent Variables

Suttle (1989, p. 22) argues that the factors influencing a country's ability to meet external debt-servicing commitments include 'domestic financial policies, debt management policies, structural (or supply-side) policies, the external economic environment and the behaviour of creditors'. There is no unique way to represent any of these factors: each may be represented by a number of specific variables or ratios, having similar informational content. For example, debt management policies are reflected by the ratios debt/GDP and debt/exports, among others, and debt may be defined in several ways. Rather than make a choice of variable *a priori* to represent each dimension, we begin with a comparatively large set of variables from which a parsimonious selection is finally made as described below.

Appendix A lists 70 ratio-scaled financial and economic indicators that cover the major dimensions of economic information proposed by Suttle, and that are likely to be used by bankers in their judgement of country risk, and it includes all

the ratio-scaled economic variables investigated in the papers cited in Table 1. Additional support for this initial set of variables comes from the literature on multivariate modelling of country risk, where the objective is to predict rescheduling using a multivariate statistical model: the variables generally used in that research are included here (see for example Somerville and Taffler, 1994). Moreover, Appendix A includes the variables identified as determining the supply of credit to LDCs by Eaton and Gersowitz (1981). Finally, categorical variables are included, to partition the sample: by geographical region, by category of principal export, and intertemporally.

(iii) Data

The data set includes a seventeen-year annual series of *Institutional Investor* ratings, drawn from the September issues of the journal from 1980 until 1996.[2]

The data for the independent variables are drawn from The Economist Intelligence Unit's *Country Risk Service* (most being IMF or World Bank series), and they have been Winsorized (Barnett and Lewis, 1994, pp. 78-81), to avoid the problems caused by outlying observations.

The sample covers 54 countries (see Appendix B). Around 100 countries are rated each year. However, this paper is concerned only with LDCs. To be included in the sample, a country must be in that category and have existed within the same borders throughout all or most of 1979–1996; moreover, data for it must be complete or nearly so. Thus many countries are excluded, including the industrial countries, the former CMEA area, and a few LDCs that are highly unrepresentative of the generality of LDC debtors, including Hong Kong, Singapore, South Africa, and six monarchical states in the Arabian peninsular. The EIU database contains many missing observations for Iraq and Libya, which are therefore excluded. A further 13 of the *Institutional Investor*'s LDCs are absent both from the database and from the sample; all are small countries (ranging from Barbados and Grenada to Ethiopia and Tanzania) that in 1986 accounted for under two percent of aggregate LDC external debt. In all, the sample countries account for 83 percent of outstanding external debt among the countries covered by the *World Debt Tables* in 1986.

The estimating sample runs from 1980 to 1987, and the nine years 1988–1996 are used for out-of-sample prediction. The estimating sample is a pooled cross section-time series, and consists of 414 country-year-cases: of the original 432 (i.e. 8 × 54), 18 are unrated.

3. MODELLING BANKER JUDGEMENT

(i) The Linear Regression Model of Banker Judgement

We use a straightforward linear specification to model the *Institutional Investor* rating, given the prevalence of linearity in the policy-capturing literature, its simplicity and comprehensibility, and its direct relation to the weighted-checklist and scoring systems that are commonly used by banks (Calverly, 1990). All ratio-scaled independent variables are specified to enter the regression with a lag, to reflect the unavailability of data for the current year when bankers make their assessments. For example, the World Bank publishes data up to year $t - 2$ in March or April of year t in *Global Development Finance* (formerly *World Debt Tables*). However, a two-year lag on independent variables within the model would be excessive, given the availability of high-quality estimates and forecasts,[3] and a one-year lag is chosen as a conservative and realistic assessment.

Table 2 displays the linear regression model of banker judgement, estimated using OLS. The independent variables are drawn from the set of variables listed in Appendix A, using a stepwise procedure based on the *F*-test as criterion. Before the final selection was reached, the stepwise procedure was applied to many different subsets drawn from Appendix A, using the results of principal components and correlation analyses of the data to avoid multicollinearity.

Ideally, specification of an econometric model starts with economic theory. This would be appropriate if we were modelling country risk *per se*, but here we are concerned with the judgemental basis of bankers' country-risk assessments. Economic theory is at one remove, where it influences bankers' judgemental procedures, and the stepwise search is used to select from the wide range of variables that are reported in the work of country analysts.[4]

Table 2

Institutional Investor Rating: Regression Analysis, t = 1980–1987

Estimated Coefficients	*(t-values, d.f. = 408)*	
$II_t =$ 17.216	(6.0)	
$+ 0.839\ INVR_{t-1}$	(9.8)	Gross fixed investment/GDP, %.
$- 0.063\ GDPX_{t-1}$	(−11.0)	Public sector external debt/exports, %.
$+ 0.606\ RTD_{t-1}$	(11.6)	Real total debt, US$bn, at 1979 prices.
$+ 2.108\ MCOV_{t-1}$	(8.2)	Import cover, number of months.
$- 5.245\ DUM_t$	(−4.3)	Dummy = 0, t = 1980–81, then = 1, t = 1982–87.

Notes:
$F(5, 408) = 171.0$; $R^2 = 0.68$; $\bar{R}^2 = 0.67$; $N = 414$.
Heteroscedasticity is discussed in note 6 to the text.

II: *Institutional Investor* rating value.
Estimated using Microfit 4.

GDPX: debt excludes short-term. RTD: total (i.e. public + private short-, medium- and long-term) debt in US$bn, deflated by US index of wholesale prices. MCOV is 12 × (foreign exchange reserves/annual imports of goods and services).

Four of the independent variables shown in Table 2 are ratio-scaled economic indicators. The fifth is a binary shift variable, relating to an intertemporal partition of the sample, 1980–1981 and 1982–1987, and reflecting the breaking of the 1982 debt crisis and its impact on bankers' risk assessments. For a four-variable model excluding the dummy, the Chow test (Johnston and DiNardo, 1997, pp. 113–16) establishes the existence and date of a statistically significant parameter shift, and the Gujarati test (Gujarati, 1970a and 1970b) indicates that the difference lies in the intercept rather than the slopes. With sub-periods chosen as 1980–1981 and 1982–1987, the Chow F-statistic is significant at the five percent level, and larger than for any of the other six possible partitions.

The model has a high $\bar{R}^2$, at 0.67, and the coefficients are individually and jointly significant at the five percent level. The results indicate that high ratings are associated with:

High *fixed investment/GDP*	**INVR**	(elasticity = 0.56)
Low *public external debt/exports*[5]	**GDPX**	(elasticity = −0.31)
High *real total debt*	**RTD**	(elasticity = 0.18)
High *import cover*	**MCOV**	(elasticity = 0.17).

(Elasticities are calculated at the sample means.)

The function shifts down after 1981: for a given vector of variable values, the perception of creditworthiness by bankers is lower in the later period.

Four of these findings are uncontroversial: we expect bankers to associate creditworthiness positively with fixed investment/GDP and import cover, and negatively with the debt/export ratio, and to become more sceptical after 1981.

In terms of Suttle's categories (*op. cit.*), INVR is a supply-side indicator reflecting economic structure. It indicates the proportion of resources going to fixed investment, which will increase the future resources out of which debt will be serviced. Of all the variables in the regression, it has the highest elasticity: a rise of one percent in INVR at the joint mean is associated with a rise of 0.56 percent in the rating value. GDPX reflects debt-management policy, and has the second-highest elasticity in absolute value. MCOV reflects the outcome of domestic financial policies, and is an indicator of short-run liquidity and long-run solvency. The time-dummy partitions the sample into two periods between which the international environment differs greatly.

Explanation is required for the positive coefficient on *real total debt*. RTD indicates the size of the economy: for example, it correlates at 0.63 and 0.73 respectively with population and real national income, both of which appear as determinants of the supply of loans to LDCs in Eaton and Gersowitz (1981). More speculatively, the positive sign on RTD may reflect bankers' familiarity with large debtors, or it may even reflect hope, rather than rational calculation.

(ii) The Panel Data Problem

The use of panel data yields a large sample, but OLS estimates from pooled data are likely to be inefficient (Johnston and DiNardo, 1997, ch.12). The *Institutional Investor* ratings, and thus also the regression residuals, are likely to be timewise autocorrelated for any given country. However, the panel nature of the data precludes testing for common factors in order to justify using generalized least squares, and the Durbin-Watson test is ruled out by lack of degrees of freedom. The data are possibly also cross-sectionally heteroscedastic, although this is less clear *a priori*, because the underlying behaviour that we are

modelling is not that of the heterogeneous countries themselves, but the assessments made of them by individual banks.[6]

For example, if we assume cross-sectional independence, heteroscedasticity between cross sections, and first-order autocorrelation within cross sections, and apply GLS, then we obtain results that are virtually identical with those of OLS on the pooled data in terms of the statistical properties of the estimated models and of their out-of-sample predictive performances. However, in fact the nature of the heteroscedasticity and autocorrelation of the residuals is uncertain, and therefore the OLS model is retained.

(iii) Logit Regression

Other authors use logit regression to model the *Institutional Investor* rating, reasoning that rating values may be interpreted as perceived default probabilities (Cosset and Roy, 1991, p. 138). We prefer a straightforward linear specification, for reasons given above.[7]

4. PARAMETER STABILITY

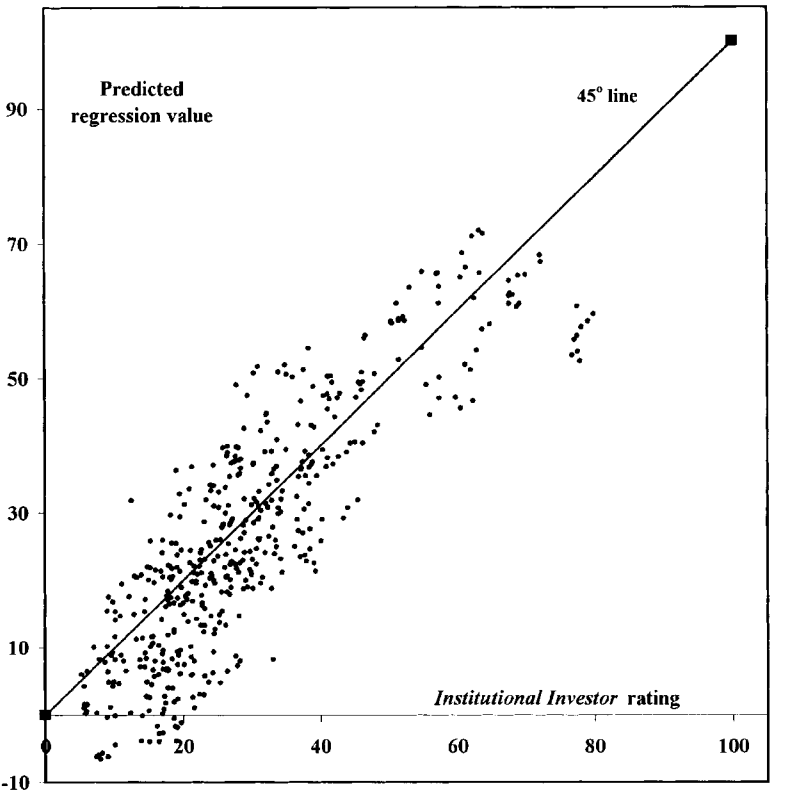
Does the linear regression model show parameter-constancy out-of-sample, or is it sample-specific? (Gilbert, 1986, p. 291). To answer this, we compare regression predictions of the *Institutional Investor* rating for 1988–1996, based on 1987–1995 data for the independent variables, with actual rating values.

Figure 1 suggests that there is no systematic deviation between predicted and actual rating values,[8] and this is confirmed by several formal statistical tests.

(a) Actual and predicted values are highly correlated. The squared correlation coefficient ranges from 0.74 in 1990 to 0.77 as far out-of-sample as 1996, with a value of 0.74 for nine years pooled, compared with $R^2 = 0.68$, within-sample.
(b) A high correlation coefficient is consistent with systematic linear bias. For most of the period this is rejected by a runs test, after ordering out-of-sample cases on predicted regression values. The null, that actual values are randomly distributed about the regression plane, is rejected at the five percent level only in 1993, 1995 and 1996.

Figure 1

Scatterplot, 1988–1996



(c) Using the Chow *F*-test, it is impossible to reject, at five percent, the null hypothesis of no significant difference between observed and predicted values out-of-sample, for the entire period 1988–1996, or for any individual year.[9]

(d) Only 20 (4.2 percent) of 473 out-of-sample cases lie beyond a 95 percent confidence interval around the predicted value (Greene, 1997, p. 369).

(e) The scatter is summarized by the root mean-square (absolute) error. This is 9.6 rating points for 1988–1996 pooled, with approximate annual values of eight points during 1988–1990, nine during 1991–1992, ten in 1993, and eleven during 1994–1996.

5. DISCUSSION OF RESULTS, AND CONCLUSIONS

We find that bankers' country credit ratings can be replicated by a parsimonious linear regression model, using four macroeconomic variables and a time dummy. Our results show that the model of banker judgement has stable parameters and is not a mere artefact of the data: its predictions of rating values correspond very closely with the actual rating values, at least up to nine years out-of-sample. Over this extended test period, the root mean-square error rises over time, but it takes a full six out-of-sample years before it exceeds its average value for the period as a whole.

The macroeconomic variables used in the regression model are INVR (*fixed investment/GDP*), GDPX (*public external debt/exports*), RTD (*real total debt*), and MCOV (*import cover*), and they provide some confirmation of the findings of earlier research regarding the economic data that may be used by bankers to predict creditworthiness (see Table 1). Focusing on variables used here whose regression coefficients are found by other authors to be statistically significant,[10] Feder and Uy (1985) and Stone (1991) use MCOV; Oral et al. (1992) and Cosset et al. (1993) use MCOV and INVR, and a variant of GDPX; Cosset and Roy (1991) use INVR; Lee (1993a) uses another variant of GDPX; finally, Stone uses real GDP, which is an indicator of country size, like RTD.

The model developed here uses a small number of variables, and has been shown to be robust, out-of-sample. It does not rely for its performance on numerous partitions of the data set.

According to Fischoff:

> Two decades of ... policy capturing studies persistently [concluded that] (a) simple linear models, using a weighted sum of the cues, did an excellent job of predicting judges' decisions; (b) the judges claimed that they were using much more complicated strategies (Fischoff, 1982, p. 337).

The periodic occurrence of international debt crises suggests that the risk-assessment procedures of the international banking system are not entirely reliable. The findings of this paper indicate that, consistent with Fischoff's conclusions, average banker judgement has little incremental value for LDC country-risk assessment, over and above a simple linear policy-capturing econometric model: i.e. on average, the risk-assessment procedures of banks reflect a simple combination of a small amount of macroeconomic data.

APPENDIX A

Original Set of Variables: 70 Ratio-scaled and 3 Categorical

Policy indicators	
DCPI	Consumer price inflation
DCPIG	Growth of DCPI
DDCR	Growth of domestic credit
DMN2	Growth of money supply
DMN22	DMN2, lagged two years
PSBR	Public sector deficit/GDP
PSBRG	Growth of PSBR
Debt	
COPC	New loan commitments/popn.
GDPX	Public ext. med. and long debt/exports
NARY	(Int'nat. reserves-tot. ext. debt)/GDP
RDPC	Real total external debt/population
RTDG	Growth of real total external debt
TDPX	Total external debt/exports
TDPXG	Growth of TDPX
TDPY	Total external debt/GDP
TDPYG	Growth of TDPY
Short-term debt	
STPD	Total ext. short-term/total external debt
STPDG	Growth of STPD
STPY	Total external short-term debt/GDP
Debt-service	
INPX	Interest on total external debt/expts
INPY	Interest on total external debt/GDP
PDSPX	1-yr. projected debt-serv./current expts
TDSR	(Total external debt-serv. + total external short term debt)/exports
TSPX	Total external debt-service/exports
TSPXG	Growth of TSPX
TSPY	Total external debt-service/GDP
TSPYG	Growth of TSPY
Characteristics of debt and debt-service	
EFIR	Effective interest rate
EFMT	Effective maturity
INPS	Interest/debt-service

MLDPD	Debt outstanding to multilateral instits./total med. & long ext. debt
OCTD	Official creditors/tot. external debt
TSPD	Tot. ext. debt-service/tot. ext. debt
TSPDG	Growth of TSPD
International reserves	
MCOV	Import cover
MCOVG	Growth of MCOV
ILMAG	Growth of international reserves
Balance of payments	
BHPCA	Balance item on cap. acc. /curr. balance
CARA	Current account balance/GDP
CARAG	Growth of CARA
EXIM	Exports/imports
FRQPY	(Current acc. balance less principal re-payments on total external debt)/GDP
Openness of economy	
MYRA	Imports/GDP
XYRA	Exports/GDP
Strength of trading sector	
MGRO	Growth of real imports
NBTT	Terms of trade
NBTTG	Growth of NBTT
TDRA	External trade balance/GDP
XDPD	Index of price competitiveness
XGRO	Growth of real exports
XPM12	Exports to two largest markets/exports
XPP12	Expts of 1st + 2nd expt products/expts
Structural indicators	
AGRP	Agricultural output/GDP
DCPY	Domestic credit/GDP
DPOP	Growth of population
INDP	Industrial output/GDP
INVR	Real fixed investment/GDP
LABFG	Growth of labour force
RYPC	Real GDP/population
SERP	Output of services sector/GDP
SIRA	Savings/investment
Size of economy	
LABF	Labour force

POPN	Population
RTD	Real total external debt
RY	Real GDP
Economic growth	
DFIN	Growth of real fixed investment
DGDP	Growth of real GDP
DIND	Growth of real indust. production
DCPR	Growth of real private consumpt.
RYPCG	Growth of (real GDP/pop.)

Categorical Variables	
Intertemporal:	See text for details
Region:	Asia, Europe, Mid. East, W. Hemisphere, Africa.
Main export:	Fuel, mineral, agriculture, manufacturing, service & remittance.

APPENDIX B

Member Countries of the Data Set

Algeria	El Salvador	Malawi	Sudan
Argentina	Gabon	Mexico	Syria
Bangladesh	Guatemala	Morocco	Taiwan
Bolivia	Honduras	Nicaragua	Thailand
Brazil	India	Nigeria	Trinidad
Cameroon	Indonesia	Pakistan	Tunisia
Chile	Iran	Panama	Turkey
China	Ivory Coast	Papua N.G.	Uruguay
Congo, Rep. of	Jamaica	Paraguay	Venezuela
Colombia	Jordan	Peru	Yugoslavia
Costa Rica	Kenya	Philippines	Zambia
Dom. Rep.	Liberia	Senegal	Congo, Dem.
Ecuador	Malaysia	S. Korea	Rep. of (Zaire)
Egypt		Sri Lanka	Zimbabwe

NOTES

1 Other country-risk ratings include those published by *Euromoney* and *The International Country Risk Guide*. During the early 1980s the *Euromoney* rating was essentially a measure of spread above LIBOR on syndicated loans, which is not a *direct* measure of average banker judgement. Since 1987, it resembles the *ICRG* rating. In each case, the published ratings are derived by combining specific objective indicators with a judgemental element involving panels of experts or consultants. The EIU ratings produced by The Economist Intelligence Unit are constructed in a similar fashion, except that the judgemental element is obtained 'in-house'. See Ul Haque et al. (1996) for further details of the *Euromoney* and EIU ratings.

2 Most of the independent variables are available only as annual data, so it is impossible to exploit the biannual availability of the *Institutional Investor* ratings.

3 For example, in 1999 the EIU database of country data includes forecasts up to 2003.

4 see for example the EIU *Risk Ratings Review*; the articles on country-risk ratings in the September issues of *Euromoney*, in particular September 1987 p. 357; *The International Country Risk Guide*; the *Political Risk Letter* of Political Risk Services.

5 Throughout, 'debt' means external debt. **GDPX** excludes short-term debt.

6 For the regression with $N = 414$, the null hypothesis of homoscedastic residuals is rejected at five percent by a Lagrange multiplier test: the test statistic of 26.8 exceeds the critical value $\chi^2_{1,0.05} = 3.8$. For annual cross-sectional regressions, the same test rejects the null in 1983–1985 but not in 1980–1982 and 1986–1987. A consistent estimator of the variance matrix of the OLS coefficients may be obtained using the White procedure (Johnston and DiNardo, 1997, p. 164). Compared with this, OLS underestimates $\mathrm{SE}(\hat{\beta})$ by 15, 11 and 1 percent for MCOV, DUM and INVR respectively, and overerestimates it by 1, 5 and 13 percent respectively for RTD, the intercept and GDPX. The adjusted *t*-statistics remain significant, although only valid asymptotically. OLS coefficients are inefficient, but to apply GLS, more information would be required on the structure of the heteroscedasticity.

7 Repeating the procedure of Section 3 (i) with a logit specification, we obtain (*t*-values in parentheses):

$$\ln\frac{II_t}{100 - II_t} = \underset{(-11.0)}{-1.611} + \underset{(9.6)}{0.042}\mathrm{INVR}_{t-1} \underset{(-12.0)}{-0.004}\mathrm{GDPX}_{t-1} + \underset{(12.1)}{0.033}\mathrm{RTD}_{t-1} + \underset{(7.8)}{0.103}\mathrm{MCOV}_{t-1} \underset{(-3.8)}{-0.235}\mathrm{DUM}_t$$

$F(5, 408) = 178.8$; $R^2 = 0.69$; $\bar{R}^2 = 0.68$; $N = 414$. Thus the stepwise logit regression selects the same variables as in Table 2; their coefficients, which are individually and jointly significant at five percent, have the same signs as in Table 2; and $\bar{R}^2$ has the same value.

8 Figure 1 displays the scatter for 1988–1996, but the annual scatters are similar.

9 Computed *F*-ratios are: 0.72 for 1988–1996 pooled, compared with $F_{0.05;473,408} = 1.17$; annual values in the range [0.58, 1.14] with (n,408)

d.f., where $n \epsilon [51, 54]$, compared with a critical value of $F_{0.05;n,408}$ of about 1.37.

10 Except in Oral et al. (1992) and Cosset et al. (1993), who do not report tests of significance.

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