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Determinants of Country Creditworthiness: An Empirical Investigation, 1980–1989

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Abstract

This empirical investigation aims to identify the economic factors that determine a country's creditworthiness. Published country risk ratings are used as direct creditworthy measurement and logit analysis is applied in the present work. The pooled data includes observations of 34 sample countries for the period from 1980 to 1989.

Different from earlier country risk studies which have focused only on developing country's rescheduling cases, this research also pays attention to industrial countries in order to seek the common determinants for both LDCs and DCs. Five macroeconomic ratios have been found significant in affecting country creditworthiness. In addition, this work suggests that these five basic indicators have both progressive and joint effects on creditworthiness. That is, the empirical results show that quadratic model is better than the generally assumed linear model.

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Contents

1 Introduction

There was a rapid growth of commercial lending and sovereign loans to developing countries in the early 1980s. Many less developed countries (LDCs) faced great difficulties in paying back their large debts on time. The debt crisis raised concern and became the focus of attention of the whole world.

Researchers tried to solve the serious debt problem by studying developing countries' debt capacity and LDC country risk. Some of them examined theoretically the ability and willingness of LDCs to pay back their debts while others, faced with many debt rescheduling cases, concentrated on empirical investigations to seek main factors that determine a country's creditworthiness. Earlier country risk studies applied more or less sophisticated statistical techniques and it was expected that these quantitative approaches could provide accurate indication in lending to developing countries and forecasting LDCs' debt rescheduling.

Meanwhile, large increase in commercial lending to LDCs forced banks to establish procedure for monitoring and evaluating risks associated with their lending. Attempts to measure country risk have concentrated on devising systems that would provide an early warning of potential debt servicing difficulties. Commercial banks were the first to utilize economic indicators to assess country risk, and experience showed that creditworthiness considerations significantly affected commercial lending decisions (Feder and Ross, 1982).

Euromoney and *Institutional Investor* are two famous financial journals in the world. They both started to publish country risk ratings and the corresponding rankings for a large number of countries in autumn, 1979, and their ratings and rankings have been continuously available to present. *Euromoney's* annual ratings represent a market view since they are based on the data observed from financial and credit markets, mainly the Eurodollar markets. *Institutional Investor's* semiannual ratings reflect the financial institutions' perception of country creditworthiness as these ratings are based upon questionnaire responses from commercial bankers. International commercial bankers have used these ratings and rankings for years to guide their lending to sovereign governments.

The purpose of this empirical investigation is to look for main factors that determine a country's creditworthiness, using the ratings from the above two journals as direct creditworthy measurement. Based on earlier country risk studies, the present work begins with a set of seven possible determinants of LDC country creditworthiness. This investigation uses the ratings and rankings of the two journals mentioned above as dependent variables, and the database covers observations of 34 different countries for a period of ten years. Sample countries include developing countries and industrial countries. It has been expected that a general model of country creditworthiness for both developing countries and industrial countries could be constructed as the result of this empirical work.

Two points should be mentioned: 1) Nobody has ever tried so far in his country risk study to treat industrial countries' debts in the same way as those of developing countries. This work took sample countries from both LDCs and DCs in order to seek the common factors in determining a certain country's creditworthiness. 2) This paper aims on the non-linearity of the country risk model which has never been examined before. All the earlier country risk studies have

focused on a linear model. However, both the database and the empirical results of the present work suggest that a quadratic model suits better than a linear one.

This investigation has two limits: 1) it focuses on a country's creditworthiness which only involves in lending and borrowing between sovereign countries. Hence, the risk is purely country risk or sovereign risk, and macroeconomic variables are used. 2) Only economic factors of a country's creditworthiness are considered. Non-economic variables such as political factors are not examined.

Section 2 gives simple conceptual or theoretical explanations of sovereign external debt, country risk and its determinants. Section 3 describes in more details the two journals: *Euromoney* and *Institutional Investor*, since their ratings play a very important role in the whole investigation. Section 4 surveys earlier studies of country risk. Statistical approaches will be reviewed carefully. Section 5 presents a full picture of present database. Section 6 is the key part of this investigation. Readers will be shown interesting estimation results. The new discovery of this empirical work, a quadratic model, is presented in this section. Finally, Section 7 concludes the present investigation.

2 Country risk: definition and its determinants

2.1 Interpretations of basic concepts

Rescheduling

In early country risk studies, there are different interpretations of rescheduling. One interpretation is simply that rescheduling is a device to extend the term of the loans in question and rescheduling a short-term loan is in fact another means of issuing a long-term loan. In most cases, rescheduling reflects a failure to contract completely against all possible contingencies.

Loan

Loans are a particular contractual arrangement between suppliers of capital and the users of capital. The borrower promises to pay the lender certain amounts at certain times. A paramount concern in designing the contract is that the borrower may not be able or may not wish to make payments under certain circumstances. The possibility that the lender will not recover his money is reflected not only in the interest rate, but in the covenants of the loan contract. The purpose of these covenants is to protect the lender by precluding the borrower from engaging in certain activities, and ensuring that he engages in others. The loan contract also stipulates conditions under which the lender can intervene, e.g., in the event of a default on another loan.

External Debt

A nation's external debt, as Heffernan describes, consists of loans made by non-residents which are repayable in foreign currency, goods and services. The debt may be short-, medium- or long-term with associated maturities of less than one

year, up to seven years and more than seven years respectively. When a country originally incurs external debt through the disbursement of a foreign loan, this debt appears as an inflow on the capital account of the balance of payments. Repayment of the principal is registered as a capital outflow, whereas payment of interest adds to the deficit or subtracts from the surplus of the current account. And this distinguishes a loan negotiated on international markets from a domestic loan which has no influence on the country's balance of payments.

However, in common with any loan, there is a critical time-element attached to foreign loans. The lender agrees to disburse the loan at one point of time, to be repaid at a later date. The lender can only assess the riskiness of the loan based on the ex ante information about the borrower. The risk assumed by the lender is the ability of the borrower to repay the loan at the specified time.

There are two kinds of external debt: one is called sovereign external debt and consists of all publicly guaranteed loans granted to a foreign firm by a private bank or loans made directly to a foreign government. The other is non-publicly guaranteed private external debt which refers to loans granted to a foreign private individual or firm that the foreign government has no responsibility for.

Country Risk

Country risk (or sovereign risk) analysis deals with risks associated with loans of to a foreign country, involving only public debts or publicly guaranteed debts. These loans are termed sovereign loans to emphasize that the ultimate responsibility for repayment rests with a government. Generally, sovereign risk analysis is concerned with the estimation of probability of default on sovereign external debt.

Interest Rate

Bank loans to sovereign borrowers typically specify an interest rate that is the sum of two components: a reference rate from an OECD financial market, usually the London Interbank Offer Rate (LIBOR) and a spread. The reference rate component is adjusted at fixed intervals to its current market value so that the loans are at floating rates. The spread is set for the duration of the loan, and it's the component specific to the loan. It's the risk premium and in general it's true that the higher the risk bared in lending, the larger the spread charged.

Default

There is a problem to use the term of default. Default in principle means that borrower refuses to pay their debts and associated interests. However, these cases are quite rare in lending to sovereign governments and default actually refers to any case in which public or publicly guaranteed payments to lending institutions are delayed or rescheduled with or without the consent of creditors.

Default in a two-period case means that the borrower gives the lender less resources than the fixed amount that he is committed to pay the lender. However, in a multi-period case, the concept of default is more elusive. A default occurs whenever the lender formally declares that the borrower has violated a certain condition of the loan. A loan may be declared in default when a borrower refuses

or is unable to pay another loan. Thus, a default is mostly a result of decisions, not the mechanical realization of some outcome.

2.2 Statistical models

Many earlier country risk analyses have utilized statistical models to estimate the probability of default by a debtor nation. The probability of default is treated as a dependent variable and statistical methodology is applied to identify significant independent or explanatory variables in affecting the probability. The formula is:

$y = f(x_i) \qquad i = 1, 2, \ldots n$

or

$y = f(x_1, x_2, \ldots x_n)$

where y = probability of default
x_i = economic variables affecting y

Explanatory Variables

According to Bird (1986), the most commonly used economic indicators in country risk studies have been:

1) level of debt in relation to exports or GNP;
2) debt service ratio;
3) current account of the balance of payments;
4) level of reserves in relation to imports;
5) economic growth.

Ratio of External Debt to GNP (D/GNP), for instance, gives an indication of the external claim on a debtor country's current production. The higher the ratio, the greater the likelihood that the country will need to reschedule. Debt-Service Ratio (DSR) is the ratio of external debt-service payments to the value of exports of goods and services. The DSR gives an indication of the size of foreign exchange earnings absorbed by the external debt-service payments of the country. Ratio of International Reserves to the Import of Goods and Services (RES/IMP) is an indicator of short-term liquidity problems.

2.3 Default risk

The measurement of default risk is an obvious problem in the statistical analysis of creditworthiness. One could use observations on actual defaults. Other possibility is to use published risk ratings. This allows an ex ante perspective to the problem. It is to these ratings we turn next.

3 Financial journals and country creditworthiness

Euromoney and *Institutional Investor* are among the most well-known financial journals in the world. *Euromoney* is published in United Kingdom and *Institutional Investor* in United State. In 1979, they both began producing country risk ratings and the corresponding rankings of a large number of borrowing countries. These ratings and rankings are designed to be indicators of country creditworthiness as they show the two journals' evaluation of potential risk associated with loans to sovereign governments, and international commercial bankers have used these rating services for years as part of their international evaluation process for lending to different countries. There are differences in their rating and ranking methods. This section will provide a general picture of the two kinds of rating and ranking methodology.

3.1 *Euromoney*

There is a so called Eurocredit Market where most of the international lending activity takes place. This Euromarket is actually a general term used to describe lending by banks in currencies other than that of the country of domicile. Interest rates in Euromarket are composed of two parts: 1) a fluctuating component which is usually equal to the three-month or six-month LIBOR (see p. 5), the deposit rate, and 2) a fixed component refers to as "spread" (or "margin") which is charged in addition to LIBOR. The LIBOR is allowed to float to protect lenders from interest rate risk and it's usually the same for all borrowers. The spread, on the other hand, differs from transaction to transaction and reflects both the creditworthiness of the borrower and the loan duration. And it has been argued that the spread must reflect the relationship between credit terms and risk assessments.

Euromoney focuses on the lending/borrowing activities within the Eurodollar Market. Its annual "Country Risk League Table" first appeared in the October 1979 publication. Since then, it has ranked and rated sovereign borrowers that are active in the Eurocurrency markets on the basis of average weighted spread that the country is able to obtain in each given year. Each country's loans have been weighted by volume, spread and maturity. Only syndicated loans over LIBOR are included in the analysis. All loans are either of public sector or of private sector with state guarantee. The formula for the determination of a country's weighted average spread is written as:

$$\text{weighted average spread} = \Sigma\,(\text{Volume} * \text{spread} * \text{maturity}) \,/\, \Sigma\,(\text{Volume} * \text{maturity})$$

where Volume = all the loans signed for a given country in a given year on the Eurodollar and DM syndicated loan markets
Spread = the spread or margin over LIBOR
Maturity = the time over which the loan matures

Weighted average spreads are computed for all participating countries. The higher the spread, the greater the indication of riskiness. Countries which have low spreads are ranked highest in the league table. For instance, *Euromoney* showed

in the League Table published in 1979 that France was the most creditworthy country as it had the smallest weighted average spread of 0.480 while Pakistan was the least creditworthy country since it had the largest weighted average spread of 2.151.

The ratings are thus those of the markets' as the League Table is the result of *Euromoney's* "statistical analysis of the terms and conditions for all sovereign borrowers that had tapped the Eurodollar and floating rate Deutschemark syndicated loan market in each given year". (*Euromoney* Oct. 1979)

Euromoney's ranking method changed significantly in its September 1982 issue. It extended the principle of rating a sovereign borrower. Each country was scored on three factors: (1) its access to the Eurocredit and all bond markets; (2) terms it has obtained (spread/maturity) in 1982 or could obtain in the syndicated loan market; and (3) its selldown performance (the success of the transactions). The final score of the country was then weighted by the relative importance of the three factors. Access to the markets was considered the most important factor and was given a weight of 40 %. The other two factors each weighted 30 %. However, only final score and rank of a country were listed in the new kind of Rating Table. The higher the score, the better the rank.

In 1985, *Euromoney* again altered its method of ranking to reflect changes in emphasis within the market as new financial instruments such as NIFs (Note Issuance Facility) and RUFs (Revolving Underwriting Facility) had become more important sources of funding. The new key criteria for ranking were: bond market; loan market; short-term note market and trade finance. There was also a change of weighting assigned to the three key factors: access to markets 50 %, terms obtained (spread/maturity) 25 % and selldown 25 %. This time, economic index instead of final score of a country appeared in the Rating Table.

In 1987, *Euromoney* refined its rating system. It split the weighting categories into three broad groups: (1) market indicators 40 % (including access to bond markets, access to trade finance, and sell-down); (2) credit indicators 20 % (including payment record and rescheduling difficulties); and (3) analytical indicators 40 %. The analytical indicators was made up of political risk 15 %, economic indicators 15 % and economic risk 10 %. (*Euromoney* Sep. 1988)

The number of countries that have been surveyed by *Euromoney* has also changed over time. From 1979 to 1981, less than 70 countries were ranked each year. Since 1982, the number of countries was over 110.

3.2 *Institutional Investor*

Institutional Investor also ranks developed and developing countries in a "country credit ratings" table which first appeared in September 1979. *Institutional Investor's* country risk table has been published twice a year, in March and in September, and there has been more than 100 countries in the tables each time.

These tables are based on ratings provided by a large number of the world's leading international banks. The bankers are asked by *Institutional Investor* to grade a certain country's creditworthiness on a scale from 0 to 100. If a country was given zero score by the bankers, then this country was considered as the least creditworthy and hence has the greatest probability of default. Bankers are not permitted to rate their home countries. Finally, these individual responses of the

leading bankers are weighted, using an *Institutional Investor* formula that properly gives more weight to responses from banks with the largest worldwide lending exposure and the most sophisticated country analysis systems. (*Institutional Investor* Sep. 1981, p. 210) Thus, these ratings reflect the financial institutions' perception of country creditworthiness.

Since readers are not given information on the weighting formulae, we don't know clearly about the development in its evaluation methods as we do about *Euromoney's*. And from the nature of *Institutional Investor's* country risk assessment we could only guess that individual country's annual ratings in its tables would not change so dramatically as in *Euromoney's* tables. The ratings could remain fairly stable.

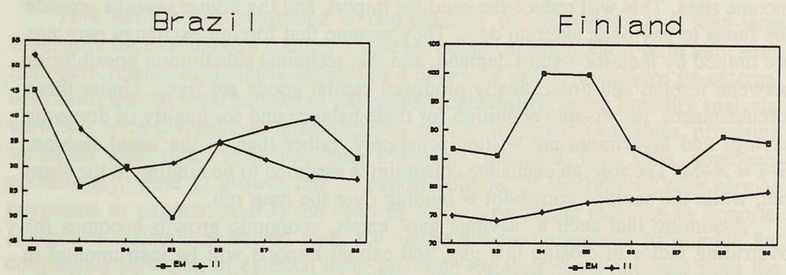
3.3 Comparison between *Euromoney* and *institutional Investor*

Euromoney and *Institutional Investor* employ quite different methodology in their ratings and rankings of country creditworthiness. *Euromoney's* ratings represent a market view since they are based on the data observed from financial and credit markets. *Institutional Investor's* ratings, on the other hand, reflect the financial institutions' perception of country creditworthiness as these ratings are based upon questionnaire responses from commercial bankers.

The methodological difference between the two journals is reflected in their country risk tables. Figure 1 (see page 13) shows the difference graphically in the two example countries, Brazil and Finland. We can see clearly here that *Institutional Investor's* ratings remain more stable in time than *Euromoney's*.

Appendix 1 shows annual rating movements, trends and the differences between the two kinds of ratings for all 34 sample countries. Countries are divided into six groups (G1–G6) according to their geographical situations. RA1 and RA2 refer to EM and II ratings, respectively.

Figure 1 **Country risk ratings of Brazil and Finland, 1982–1989**



*EM = *Euromoney*
**II = *Institutional Investor*

Gordon and Palmer (1989) examined the consistency between these two views on their assessment of developing countries' creditworthiness from 1982 to 1987, and results showed that these two were actually consistent in recognizing country

creditworthiness though they differed in measurement scales and methods. Further more, general trend seemed to indicate that the two services were becoming more consistent over time.

4 A survey on earlier studies of sovereign risk

There were quite a lot of country risk studies in the past, especially at the beginning of the 1980s when developing countries' debt problem raised great concern of the whole world. Those earlier studies focused on the developing countries' debt capacity issues – some approached the debt capacity by examine the optimal level of debt while others focused on the sustainability of debt policies. These studies could be divided into three principal strands: Growth-Cum-Debt Models concentrate mostly on theoretical explanations of LDCs' debt problem; Quantitative approaches focus on the indicators that influence a country's creditworthiness; and the third approach takes consideration of both demand and supply side conditions in the financial markets. This section surveys mainly the quantitative approaches since the present work is an empirical one.

4.1 Growth-Cum-Debt models

The basic models and conceptions that have guided international lending and borrowing since the 1970s are so called "Two-Gap theory" and "Growth-Cum-Debt" models which relate to economic development (e.g. Avramovic (1964)). According to these models, a developing country is faced with two gaps: savings fall short of investment needs (S < I) and import needs exceed exports (X < M). The inflow of foreign capital serves to close two gaps at once: first, as a supplement to domestic savings it allows for the increase of investment and thus is supposed to trigger growth. As foreign exchange it allows for the import of foreign goods that the country needs. Provided that foreign debt is used for investment, the country will grow out of the savings and foreign exchange gap as income rises. This will reduce the need for import, and the higher savings provide the funds to pay back external debt. They assume that foreign exchange earnings are limited by inelastic export demand, and that technical substitution possibilities between foreign and domestically produced capital goods are fixed. Under these circumstances, the *ex-ante* condition for trade balance and for quality of domestic savings and investment are written separately, rather than in the usual fashion: S–I = X–M. The foreign exchange constraint is assumed to be binding in the short run, while the savings constraint is binding over the long run.

Assuming that such a "savings gap" exists, economic growth becomes the overriding factor in closing this gap, and capital imports will be instrumental in achieving this. Thus, capital imports produce economic growth which finally results in higher income, higher savings and an export surplus. The emphasis of this traditional approach has been on the use of external finance for investment purposes, and savings for growth.

When there are not enough data available to allow the construction of a solid econometric prognostic model, researchers are forced to rely on theory, or even on

mere hypotheses. Theory without empirical foundation and control may offer misleading frameworks of analysis and lead to wrong predictions. This was largely the case in the 1970s when Growth-Cum-Debt models guided international lending and enticed bankers and governments alike to overlend and overborrow.

The Two-Gap and Growth-Cum-Debt models expose three major weaknesses: First, they assume that financial and physical capital shortages are the most predominant bottleneck of economic growth; Second, they apply a theory of the balance of payments according to which there is an *ex ante* given need for imports, and that these needs diminish with growth of income; Third, it neglects the role of credit rationing or the existence of credit limits (Müller (1991)).

4.2 Quantitative approaches to sovereign risk analysis

Applying statistical models, quantitative approaches of sovereign risk studies aimed on finding factors which determine or affect a country's ability and willingness to pay on schedule interest and amortization on its external debt. In early 1980s, most of the sovereign risk studies concentrated on developing countries' debt problems, especially developing countries' debt rescheduling cases. And the statistical techniques are often used as an early warning system in conjunction with qualitative country evaluation.

Among these quantitative approaches, there are mainly three types of statistical techniques that have been used in the earlier studies: principal components analysis, discriminant analysis, and logit analysis.

4.2.1 The beginning of quantitative studies

Facing the large long-term loans received by most developing countries in the middle of the 1970s, international institutions began their country risk studies. Avramovic et al. (1964) at the World Bank were the first to undertake a systematic examination of factors that affect a country's balance of payments and, hence, its ability to service external debt.

This early work suggested a combination of short-term and long-term indicators for evaluating a country's debt servicing capacity. Short-term indicators that were related to liquidity aspects of a country's ability to service its external debt dealt with general balance of payments vulnerability. In the liquidity analysis, variables were divided into three different groups: fluctuating variables, offsetting variables and rigid variables, and indicators obtained from this approach, accordingly, were 1) growth rate of export volume, 2) the ratio of debt service payments to exports, and 3) the ratio of foreign exchange reserves to imports. Long-term indicators derived from the analysis were considered to provide for continuous servicing of external debt, and four variables were obtained from the approach: 1) growth rate of GDP, 2) the ratio of investment to GDP, 3) the ratio of exports to GDP, 4) the rate of inflation.

4.2.2 Principal components analysis

This technique is often used when there are too many regressors relative to too little data and when there is multicollinearity between the regressors.

The idea of principal components analysis is that a set of composite variables (or components) is substituted for the original set of variables, and each component is a linear combination of all the original variables. A component's relative importance is measured by the proportion of total sample information it contains (see Anderson (1958)).

Dhonte (1975) is the first, and so far, the only one who has ever used the principal components analysis to examine developing countries' rescheduling experiences. Two principal components were involved in his analysis, and ten indicators were examined. The first principal component explained about 35 percent of the variation in the sample data. He found four indicators the most significant. The second principal component explained an additional 18 percent of the variation. There he found two more indicators – Debt Service Payments/Debt Disbursement and Debt Service Payments/External Debt ratios – most significant. Then, selecting variables from each of these groups, he drew the conclusion that a balance must be maintained between a debtor's "involvement" in debt and the terms on which debt is accumulated.

4.2.3 Discriminant analysis

Discrimination (or classification) is in general defined as measuring the characteristics of an individual or an object and on the basis of the measurements classify the individual or the object into one of the two possible groups (Amemiya (1981)). The assumption underlying discriminant analysis is that distinct subpopulations exist in the total population. The term *population* means all the observations under consideration. The objective of discriminant analysis is to construct from sample information a rule (an estimated function) that will enable one to distinguish between these subpopulations.

When applied to sovereign risk analysis, discriminant analysis deals with LDCs' rescheduling cases in their debt payments. It is assumed that a country can be assigned to either of the two subpopulations: countries which reschedule belong to one subpopulation (P_1) and those which do not reschedule belong to the other subpopulation (P_2). The objective of discriminant analysis is to use data from past economic performance to derive a function that will discriminate between countries by placing them in one of the two subpopulations. This function is called discriminant function and is written as

$$Z = a_1x_1 + a_2x_2 + a_3x_3 + \ldots + a_nx_n$$

or

$$Z = \Sigma\, a_iX_i \qquad i = 1, 2, \ldots, n$$

where x_i represents the independent explanatory variables and a_i is the coefficient associated with the *i*th explanatory variable. If statistically significant, these

coefficients will provide an indication of the relative importance of the economic variables they are attached to.

Researchers should decide first which economic variables to be tested for statistical significance in relation to their ability to assign countries to one of the two populations. Then, a linear discriminant function Z is to be obtained, also are the values of the coefficients of the statistically significant explanatory variables in the function. Once these are done, the annual values of x_i for a given country are fed into the function and a Z score is computed for the country in question. Finally, the Z score and the critical value Z* is compared: if a country has a Z score bigger than Z*, it is predicted not to reschedule and if Z score is smaller than Z*, then to reschedule.

Two kinds of errors – type I and type II errors – occur in the classification of countries. Type I error is the one when a country belonging to P_1 is classified in P_2, that is, the country reschedules when it is predicted not to and type II appears when a country belonging to P_2 is assigned to P_1 by the discriminant function, that is, the country is predicted to reschedule but actually does not. Costs and probabilities are attached to these two types of errors to yield an expected cost function. The rule (the discriminant function) is selected so as to minimize the expected cost of making the two types of errors. The discriminant function and the critical value Z* are jointly determined through an iterative procedure which minimizes the expected cost function.

Frank and Cline (1971) used discriminant analysis to investigate the quantitative importance of indicators in determining default probability. In this analysis, two subpopulations were concerned: rescheduling and non-rescheduling countries. They attempted to identify each observation as belonging to one of the two subpopulations. Based upon the work of Avramovic, eight indicators were selected: 1) debt service ratio, 2) index of export fluctuations, 3) compressibility of imports, 4) imports/GNP ratio, 5) imports/reserves ratio, 6) amortization/debt ratio, 7) per capita GNP, and 8) growth of exports. After testing their data sample which contained 145 observations on 26 countries, only three indicators – debt service ratio, imports/reserves ratio, and amortization/debt ratio – are found statistically significant at the 5 percent level.

Grinols (1976) applied both discriminant and discrete analyses to a larger data sample of 20 variables and 64 countries. Finally, the results suggested that discriminant analysis was more effective than the discrete analysis at explaining the sample period rescheduling. Five variables were found as statistically significant – debt service payments/reserves ratio; disbursed external debt/debt service payments ratio; debt service payments/imports ratio; external debt/GDP ratio and external debt/exports ratio.

Abassi and Taffler (1982) used the discriminant analysis to evaluate country risk. Their sample included 1140 observations on 95 developing countries for the period 1967–1978. There were 55 rescheduling cases of 14 countries in the sample. They used, however, only about 70 countries in the analysis each year. Drawing on earlier studies, the employed 42 indicators in their own analysis, and the indicators chosen were relevant to foreign exchange sectors, country debt, or domestic economic situation.

4.2.4 Logit analysis

Logit analysis is the third approach used to statistically analyze the decision to seek rescheduling. This is a framework for analyzing choice among discontinuous alternatives. The output of this type of analysis is the relation of selection probabilities to the factors that influence choice. This analysis is designed specifically to relate choice probabilities to a model of behaviour and to the underlying attributes of the alternatives and the decision maker. Thus, this approach, due to its nature, seems more appropriate for analyzing debt-servicing problems.

Feder and Just (1977) made the first application of logit analysis as they considered it better than discriminant analysis in dealing with the binary-valued, dependent-variable case. They tried to reinvestigate the significance of the indicators that had been examined by Frank and Cline and others. There were eight indicators under their examination, and finally they found that six of them were statistically significant. Three out of the six indicators were the same as those that Frank and Cline had found, and the other three of them were identified as: per capita income, capital inflows/debt service payments ratio, and real export growth rate. And they got the lowest error rate of any of the statistical studies of country risk assessment.

Feder, Just and Ross (1981) continued the logit technique to rescheduling. Their principal adjustment was in the scope and definition of the dependent variables. The list of the explanatory variables was also altered.

Mayo and Barrett (1977) designed a debt early warning model for the U.S. Export-Import Bank, building upon the earlier studies. This model applied a larger data sample to the logit analysis than Feder and Just. In the new study, a substantially larger number of indicators was examined. Specifically, the Mayo and Barrett model attempted to predict debt servicing difficulties five years into the future, and this attempt made it unnecessary to project or to lag the explanatory variables as done in the earlier studies.

4.2.5 Probit analysis

A probit model transforms a dichotomous dependent variable into a probability. The probit analysis is quite close to the logit analysis (see Amemiya (1981)). Kharas (1984) examined the determinants of developing countries' long-run creditworthiness, using the probit technique. Recently, Rahnama-Moghadam, Samavati and Haber (1991) also employed this technique in their work.

4.2.6 Other quantitative approaches

Sargen (1977) used two conceptual approaches to analyze past debt rescheduling. The first approach – the debt service approach – assumes that rescheduling arise from the fluctuations occurred in the export earnings. In the second approach, rescheduling are treated as monetary phenomena. Meanwhile, inflation and an overvalued exchange rate are assumed to increase the demand for imports and to cause export stagnation, which in turn leads to a rapid build-up of external debt.

Sargen applied discriminant analysis to six indicators to differentiate rescheduling from non-rescheduling cases in order to test the validity of each approach. And, finally, he found two most significant explanatory indicators: inflation rate, which is a monetary approach variable, and the ratio of scheduled debt service payments to exports, which is a debt service approach variable.

4.3 Supply of external finance and debt capacity

Most of the earlier country risk studies view only the borrowers' characteristics and their relationship to debt capacity. However, this new approach also considers lenders. That is, it examines both sides of the markets in analyzing debt problems. Eaton and Gersovitz (1981a) has emphasized the need to consider the total market environment in analyzing debt problem.

4.4 Shortcomings of earlier country risk studies

There are some limits in those earlier country risk studies. McDonald argued that Growth-Cum-Debt models are theoretical statements without empirical support while quantitative approaches don't have enough theoretical background. One of the problems with earlier quantitative models is that statistical specifications (Functional Forms, etc.) have not been well checked. For instance, the previous investigations have assumed a linear relation between the explanatory variables and the dependent one which is not true as we can see from the empirical results of this work.

5 Present data

The data used in this investigation are pooled cross-section, time-series with altogether 518 observations. There are seven indicators selected to the present investigation on the basis of the previous country risk studies. There are 34 sample countries from the two groups of both developed and less developed countries and data base covers a period of ten years, from 1980 through 1989.

5.1 Sample countries

The 34 sample countries were carefully selected in order to be representative enough. Fifteen of them are developing countries and the other nineteen ones are industrial countries. The classification of LDCs and DCs is basically consistent with World Bank's view. The two groups of countries are listed differently below.

Table 1 **Sample countries**

Less Developed Countries

1 Argentina	6 India	11 Philippines
2 Brazil	7 South Korea	12 Peru
3 China	8 Mexico	13 Thailand
4 Egypt	9 Nigeria	14 Turkey
5 Hungary	10 Pakistan	15 Yugoslavia

Developed Countries

1 Australia	8 Iceland	14 Portugal
2 Canada	9 Italy	15 Spain
3 Denmark	10 Japan	16 Sweden
4 Finland	11 Netherlands	17 Switzerland
5 France	12 New Zealand	18 United Kingdom
6 Germany*	13 Norway	19 United States
7 Greece		

* former West Germany

There are several reasons for the selection of the sample countries: First of all, the countries were supposed to be representative. This was considered the most important in choosing these sample countries. A country's relevant economic importance in the world weights a lot while its geographic situation and economic system also count. For example, inside the developing-country group, Mexico is the first country which officially defaulted its sovereign debts and Argentina was one of the countries which several times rescheduled their debts in the past. They were often chosen in the earlier empirical country risk studies. China, Hungary and Yugoslavia represent another group of economic systems. And the industrial-country group includes the world's richest nations as well as poorer EEC countries.

Secondly, there were limits in selecting the sample countries due to the existing data. The former USSR could have been chosen as a sample country if only its relevant data were available. It was, however, too difficult to get all the needed information and I had to drop it.

Thirdly, industrial countries were for the first time taken into the empirical model in the study of country creditworthiness. I tried my best to get as many sample countries to the model as possible. The most difficult thing is to obtain their total external debts from relevant publications. The external debt is well reported for LDC's by the World Bank but not for DC's.

5.2 The empirical model

Earlier country risk analyses usually assume a reduced form of equation

$$CW = f(X)$$

where CW is a measure of creditworthiness and X is a set of variables and indicators that related to debt servicing capacity of borrowing countries. Since

there was no direct measurement of creditworthiness available for the dependent variables, proxy ones were used instead. For instance, Sargen (1976) and Feder and Just (1977, 1980) used risk premiums, and Eaton and Gersovitz (1981) used volume of credit.

The present analysis utilizes a direct measure of country creditworthiness as reported by both *Euromoney* and *Institutional Investor* (see details of the two journals in Section 3). The two journals' country creditworthiness ratings are within the interval (0,100) and therefore can be interpreted as a probability (see discussion in Feder and Ross 1982). In order to make the formulation of the model compatible with the underlying assumptions of ordinary least squares, a logistic transformation is employed. Suppose a creditworthiness rating of any list of the two journals (say R) is related to the vector of relevant indicators (X) by the following functional form

$$R = e^{\beta' X + \varepsilon} / |1 + e^{\beta' X + \varepsilon}| \qquad (1)$$

Where ß is a vector of the parameters and ε is a normally distributed random variable with mean zero. X will have a positive ß parameter if it's an indicator positively related to creditworthiness. And from equation (1) one can obtain

$$R^* \equiv \ln[R/(1-R)] = \beta' X + \varepsilon \qquad (2)$$

where R* is the logit of R. Equation (2) is a straightforward linear regression equation that will be estimated once the vector X is defined. The seven variables and indicators reviewed below are derived from earlier studies and from country risk related discussions. They are hypothesized as possible determinants of country creditworthiness in the present model.

5.3 Variables and indicators

Dependent variable

As told already in the introduction section the dependent variables in this present investigation are in fact the direct ratings from the two famous financial journals, *Euromoney* and *Institutional Investor*. These ratings were listed in Table 1 and also presented graphically in Section 3. In the graphics, all 34 sample countries of the presents study are divided into six different groups according to their geographic situation.

Explanatory variables

Seven variables have been chosen for this empirical investigation on the basis of early studies. They are: 1) Debt/GNP 2) Debt Service Ratio which is replaced by Interest Rate/Exports due to the data shortage 3) Reserves/Imports 4) Current Account/GDP 5) Income per Capita 6) Inflation 7) Government Expenditure/GDP.

1) EDT/GNP (X_1): EDT = Total External Debt; GNP = Gross National Product

This is a standard measure of a country's degree of indebtedness. The total stock of debt is compared to the flow of national resources from which the debt is to be serviced. The higher the ratio, the higher the debt burden and the lower creditworthiness. It is expected that this variable will have a negative coefficient in the present regression analysis.

World Bank's *World Debt Tables* provide us with developing countries' debt related information which reports annual levels of nominal external debt owed by countries. Most of the developing countries' EDT/GNP data in this research were obtained from these tables while industrial countries' debts were partly picked up from *OECD Financial Statistics* (Part 2) and the others from annual reports by central banks of individual countries. Debts here refers to public and publicly guaranteed, gross external ones. GNP (Gross National Product) were obtained from International Monetary Fund's (IMF) *International Financial Statistics*.

2) INT/EXP (X_2): INT = Interest Payment of Debt; EXP = Export

It has been argued by some researchers that Debt-Service Ratio (ratio of external debt-service payments to the value of exports of goods and services) is one of the most significant indicator of a developing country's debt capacity study. The external debt service payment is calculated as a sum of the payment of principal plus interest in a given year. And in the previous country risk studies, this consists of the gross interest payments on all external debt, plus the repayment of principal (amortization) on the medium-term and long-term debt. Hence, DSR gives an indication of the size of foreign exchange earnings absorbed by the external debt-service payments of the country. A negative relationship was expected between this explanatory variable and the probability of rescheduling, the dependent variable. That is, if a country experiences a sudden decline in foreign exchange earnings in relation to its debt-service burden or a sudden increase in the latter relative to a given level of foreign exchange earnings, this country would well be forced to reschedule or even outright repudiation of the debt.

In the present investigation, since the industrial countries' related data are not available, I shall use an alternative – INT/EXP. Before I decided to do so, I tried to regress INT/EXP on DSR with the developing – country group data. Results showed that they were positively related and I chose INT/EXP as the proxy of DSR. I believe that the former will serve fairly well instead in my model. The DSR gives an indication of the size of foreign exchange earnings absorbed by the external debt-service payments of the country and so would the INT/EXP.

In order to have a compatible measure of data among all the sample countries, this INT/EXP has been selected carefully from IMF's *Balance of Payments Statistics* and *International Financial Statistics*.

3) RES/IMP (X_3): RES = Non-gold Reserve; IMP = Import

This is an indicator of short-term liquidity problems. The main purpose of holding foreign exchange reserves in developing countries is to safeguard the short-term import capacity of the economy in the face of fluctuations in foreign exchange receipts. Drawing down reserves is a flexible means of finance. The larger reserves relative to imports, the more reserves available to service external debt. Therefore

higher reserve/import ratio is expected to lead to higher creditworthiness ranking. Hence, a positive relationship is expected between the explanatory variable and the dependent variable.

The RES/IMP ratio was obtained directly from IMF's *International Financial Statistics*.

4) CA/GDP (X_4): CA = Current Account; GDP = Gross Domestic Product

Sachs (1981) has argued that this variable will be negatively related to the probability of default. Thus it should have a positive relation with the probability of ranking.

Just like RES/IMP, a direct table of this indicator is provided by the IMF's *International Financial Statistics*.

5) GNP/POP (X_5): = GNP per capita

The level of per capita income is a standard summary of a country's wealth and its level of development. The higher the per capita income, the greater the consumption of non-essential items will be. And hence, the greater flexibility in the adjustment of consumption patterns. Countries with low or subsistence-level per capita income lack this flexibility and, therefore, more likely would reschedule. On the other hand, a wealthy country could always borrow more and would be less likely to reschedule.

As argued by Feder and others (Feder et al., 1981), a relative measure of per capita income is more suitable to the empirical model than absolute value. Therefore, per capita income is measured relative to United States' value in the present analysis. And it was obtained from World Bank's *World Development Report* with one exception – Iceland whose GNP per capita was obtained from *The World Bank Atlas*.

6) INFL (X_6): = Inflation

In McDonald's opinion, a higher rate of inflation possibly indicates a larger probability of balance of payments crisis and consequently a higher probability of default. And as a result, a higher inflation rate will be followed by a lower country creditworthiness.

This indicator was obtained from IMF's *International Financial Statistics*.

7) GE/GDP (X_7): GE = Government Expenditure

It has been suggested that the larger size of the government sector in a developing country, the higher probability of balance payments crisis (see Edwards, 1984). For example, Mexican fiscal deficit was one of the main reasons of its debt crisis in 1982. Some of the previous work provided also evidence that this indicator was quite significant in affecting a country's creditworthiness.

This indicator was obtained mainly from IMF's *International Financial Statistics*. The remaining part was from *Government Finance Statistics* and World Bank's *World Development Report*.

6 Empirical results

The empirical investigation has been carried out parallelly using both *Euromoney*'s and *Institutional Investor*'s ratings as direct measures of creditworthiness. Since the rating scores from *Euromoney* were available from only 1983,[1] investigation results weighted more on the ratings from *Institutional Investor*'s country risk tables whenever I had to make an overall decision. However, the two kinds of rating scores were both equally treated in the research procedure. To avoid confusion, all the numbers and results related to *Euromoney*'s ratings are marked with footnotes 1 (or RA1) and those related to *Institutional Investor*'s ratings are indicated as 2 (or RA2).

This section is divided into four parts. Since earlier studies have all applied linear models in country risk investigations, there might be good reasons to do so. Due to this, I decided to follow their examples by estimating the linear relationship between the hypothized indicators and dependants (the ratings scored by the two journals to the sample countries) in the present database. Meanwhile, as earlier studies focused only on developing countries, it was hoped that I could check how well a linear model would fit with samples of both developing and developed countries. This contains the first part of this empirical investigation. The second part of this section is about the linearity test. It is expected at least from theoretical point of view that quadratic relation could exists in a country risk model and with this in mind, I carried further on to test the linear relationship of the model. The results actually support theoretical view and they will be shown in the second part of this section. Then, a final best model with the present database is abtained for the creditworthiness which is a quadratic model with all together 16 variables in the quation of which five are basic indicators,. five are the squares of the same basic indicators and the other six are cross terms. The new found will be described in the third part of the section. And finally, a stability test will be carried out in the closing part of the section.

6.1 Linear model

The present analysis starts by estimating the linear relationship between the dependent variable and the seven independent variables in the two cases. A logit analysis is applied and there are two good reasons to utilize logit technique in the present work: One reason is that the country risk ratings of *Euromoney* and *Institutional Investor* are within the interval from 0 to 100 and therefore can be considered as a probability. The larger the rating number, the higher the probability and hence the more creditworthy of the country's sovereign debt. (See Section 4 for a further explanation of the logit analysis.) Logit model has a general formulation as

$$y = \ln(p/1-p)$$

[1] Actually, *Euromoney*'s rating scores are available from 1982. But four of the important sample industrial countries: Japan, Germany, Switzerland and United States were not scored in that particular year.

The small p in general stands for the probability and it should also remain within the interval between zero and one, and y is called canonical parameter.

With the present data, the formula is written as

$$R^* = \ln[R/(100-R)] = \beta'X + \varepsilon$$

where R = rating score given by the two magazines to each sample country in a given year. X is the vector of the indicators or variables. R* is the logit of R, and $0 \leq R \leq 100$.

The second reason to utilize the logit is that the present database consists of pooled observations which are discrete ones. Compared with the other alternatives, logit analysis seems to be the best choice.

The classical linear regression was carried out using the Ordinary Least Squares technique and results are composed with two parts: first year by year from 1980 to 1989 and then, an overall regression on all the pooled observations in each case for the whole period from 1980 to 1989. Table 2 shows the overall regression results when the ratings from *Euromoney* and *Institutional Investor* were used as two dependent variables separately in the two different regressions. RA1 represents *Euromoney*'s rating and RA2 *Institutional Investor*'s.

Table 2 **Linear regression results 1980–1989**

RA1

Variable	Coefficient	t-value
Constant	0.262	
x1	−0.0032	−1.8
x2	−0.0170	−3.8
x3	−0.0054	−0.9
x4	0.0069	0.4
x5	0.0261	19.3
x6	−0.0004	−2.6
x7	0.0099	2.5

$R^2 = 0.74$
Observations = 218

RA2

Variable	Coefficient	t-value
Constant	−0.004	
x1	−0.0063	−4.2
x2	−0.0054	−1.5
x3	−0.0053	−1.1
x4	0.0587	4.2
x5	0.0267	24.3
x6	−0.0006	−4.1
x7	0.0039	1.2

$R^2 = 0.76$
Observations = 300

* Critical point is 1.96

As can be seen in Table 2, there are 218 observations in case 1 (RA1) while 300 observations in case 2 (RA2). Five of the seven indicators examined in the model – EDT/GNP, INT/EXP, INFL, CA/GDP and GNP/POP – have the expected signs. The first three relate negatively and the other two positively to the country creditworthiness. RES/IMP and GE/GDP, on the contrary, showed unexpected opposite signs of their effects. RES/IMP was believed to affect positively the country creditworthiness and evidences from the previous country risk studies also support this relationship. Also, GE/GDP in both cases indicates positive relation with the country creditworthiness while it is supposed to have a negative effect.

The critical point of 95 % significance for t-statistics of this linear model is 1.96. According to this, only two indicators – X_5 (GNP per capita) and X_6 (INFL) – are significant in both cases. Particularly, X_5 shows a surprisingly high t-value: in case 1 it is about 19.3 and in case 2 it's approximately 24.3 which indicates that a country's wealth affects strongly its creditworthiness. These large numbers of t_5 in both cases are due to the high income levels of industrial countries and the large number of the industrial countries in the sample. Four other indicators – X_1, X_2, X_4 and X_7 – are significant only in one of the two cases.

The goodness of fit (R^2 = 0.74 in case 1 and R^2 = 0.76 in case 2) is quite satisfactory in either case. The difference in R^2 between the two cases is only 0.002.

Residuals in the linear model are shown in Figure 2. The pictures suggest that the seven basic indicators fit the two kinds of ratings quite well though residuals of some industrial sample countries do not look so well.

In the year by year regressions, the signs of coefficients are a little bit mixed in some cases and they are not the same as in the overall results. The goodness of fit in the yearly regression is generally higher than in the overall regression.

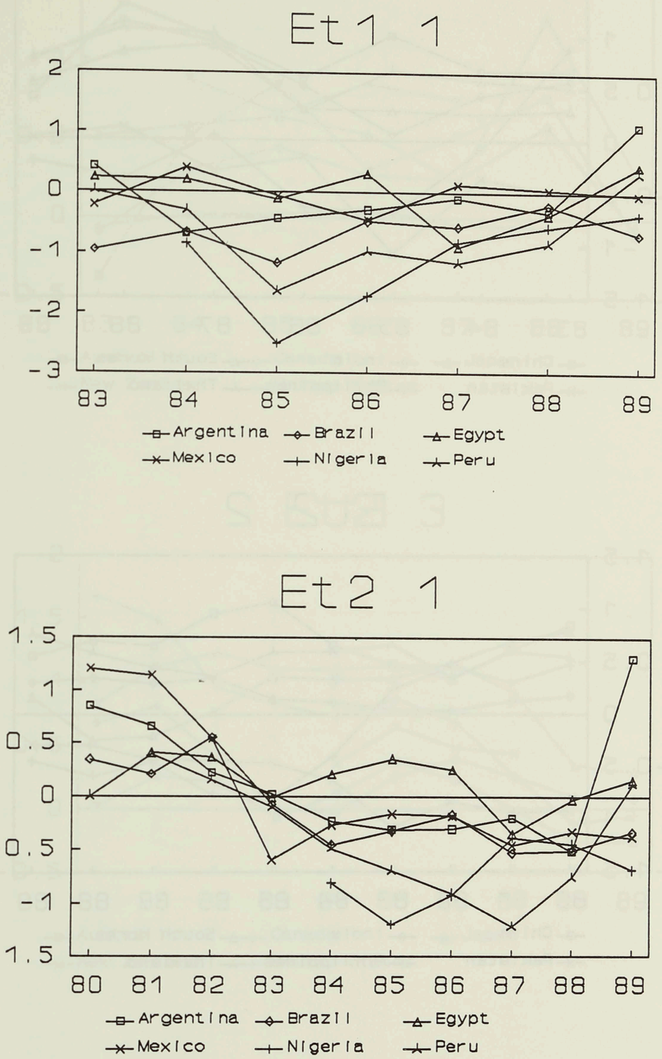
If the example of earlier country risk studies was followed here, this present investigation would finish by declaring that (at least from the regression results) six of the seven hypothesized indicators are significant country creditworthy determinants. Only X_3 (RES/IMP) is rejected. Instead, I decided to test this assumed relationship for the non-linearity of this model, and there is more evidence in the results showing that a non-linearity model is more proper.

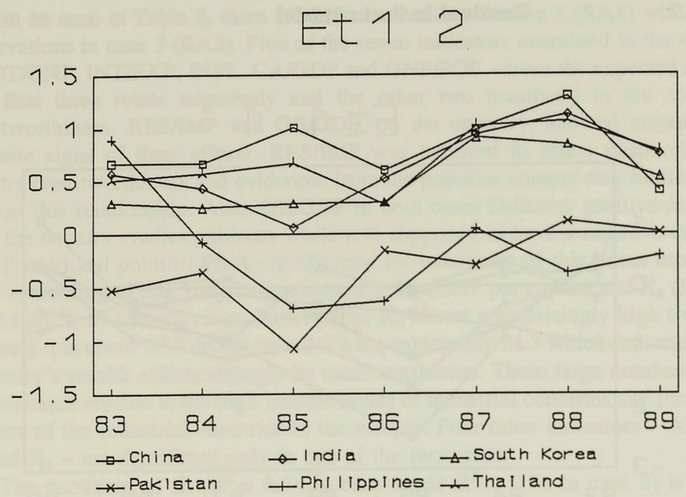
6.2 The modified LM test

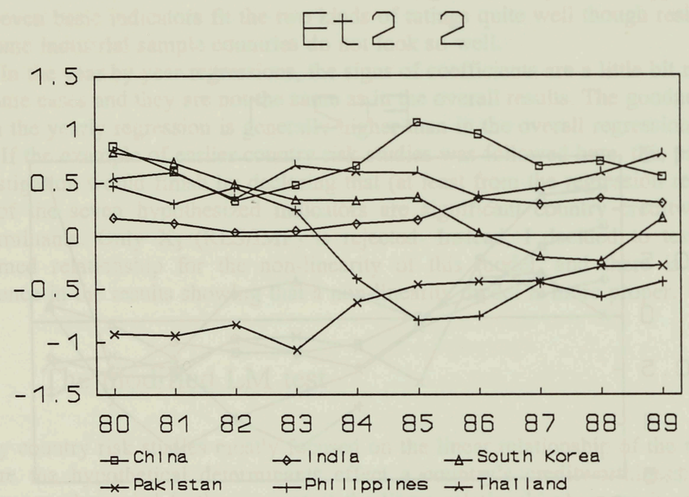
Early country risk studies mostly focused on the linear relationship of the model where the hypothetical determinants effect a country's creditworthiness. This present work carried further on to test the linear relationship because it seemed theoretically true that these indicators proved to be statistically significant in earlier studies could also be quadratically related to country creditworthiness.

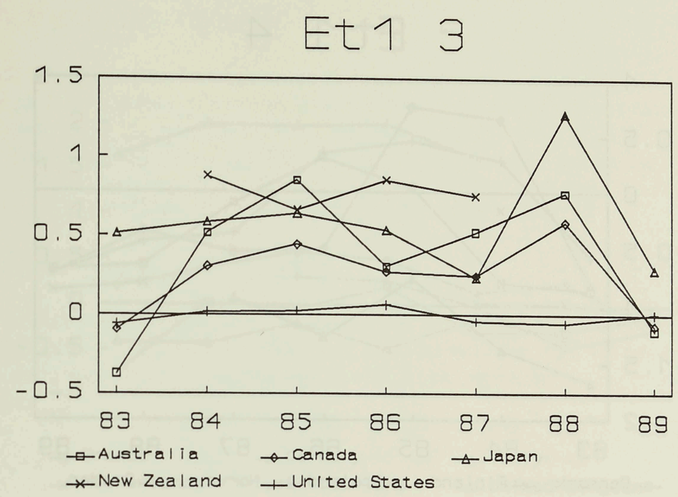
Lagrange Multiplier (LM) Test is applicable to testing nested hypotheses. The distinguishing feature of the LM test is that it only entails the estimation of the restricted model. Suppose we wish to test the hypothesis that a subset of m parameters in a classical linear regression model are zero, the LM statistic is based on the fit obtained by taking the residuals from the Ordinary Least Squares (OLS) regression on the restricted model and regressing them on the complete set of independent variables. The LM test statistic is given by

Figure 2 **Residual in linear model**




Et1 2
1.5
1
0.5
0
-0.5
-1
-1.5
83 84 85 86 87 88 89
China
India
South Korea
Pakistan
Philippines
Thailand


Et2 2
1.5
1
0.5
0
-0.5
-1
-1.5
80 81 82 83 84 85 86 87 88 89
China
India
South Korea
Pakistan
Philippines
Thailand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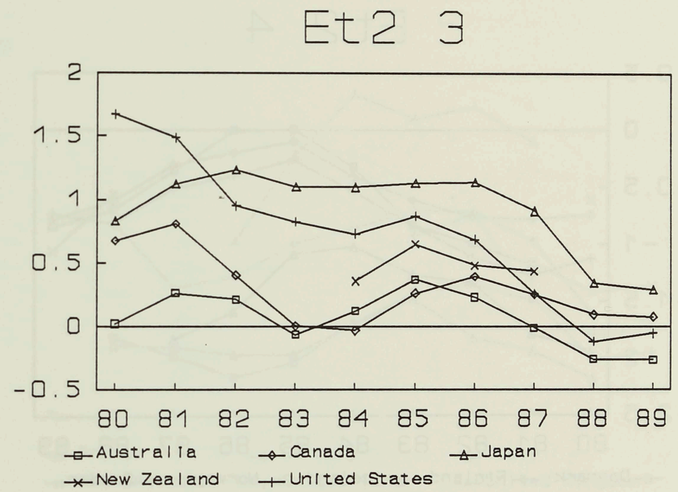
1.5
1
0.5
0
-0.5
83 84 85 86 87 88 89
Australia
Canada
Japan
New Zealand
United States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Australia
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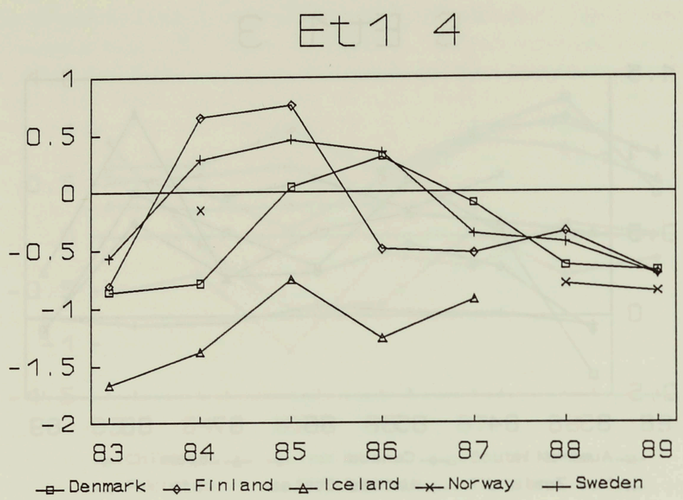
Japan
New Zealand
United States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-1
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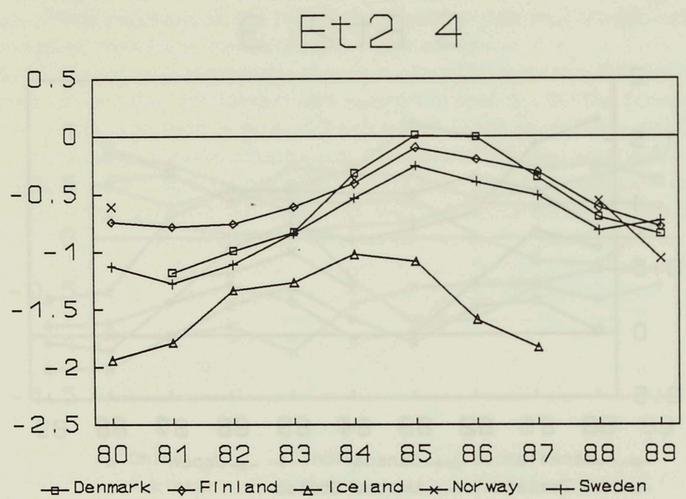
-2
83 84 85 86 87 88 89
Denmark Finland Iceland Norway Sweden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-2
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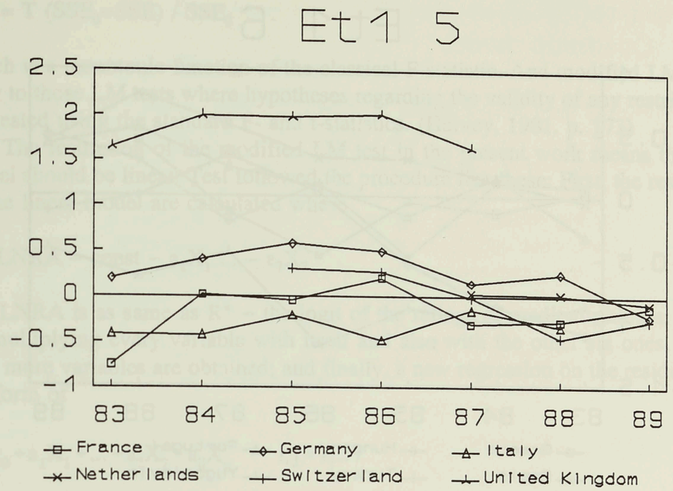
Denmark Finland Iceland Norway Sweden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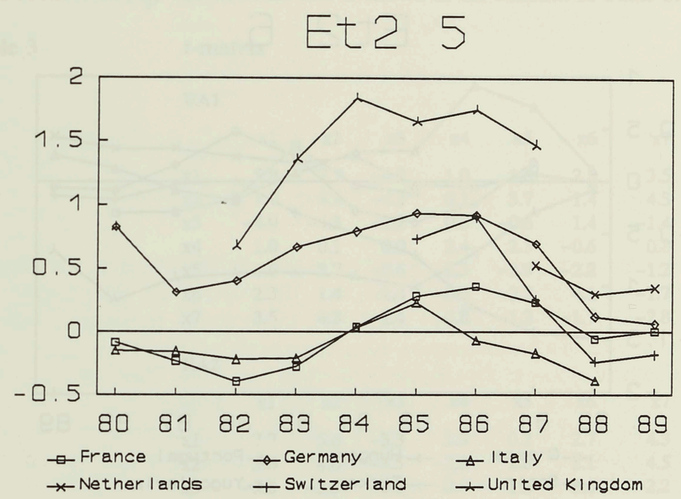
1.5
1
0.5
0
-0.5
-1
83 84 85 86 87 88 89
France Germany Italy
Netherlands Switzerland United Kingdom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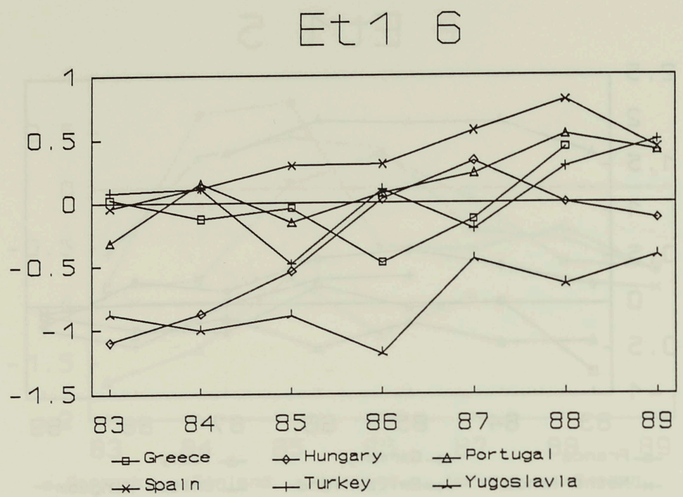
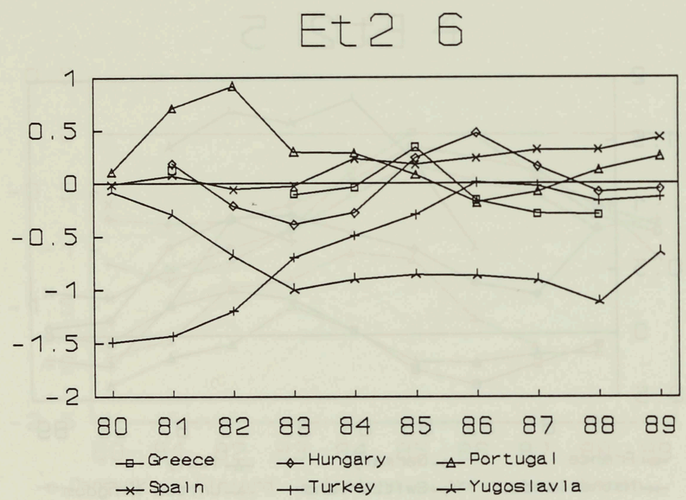
80 81 82 83 84 85 86 87 88 89
France Germany Italy
Netherlands Switzerland United Kingdom





$$LM = T\,(SSE_0 - SSE) / SSE_0$$

which is a monotonic function of the classical F-statistic. And modified LM tests refer to those LM tests where hypotheses regarding the validity of any restrictions are tested using the standard F- and t-statistics. (Harvey, 1981. p. 173)

The restriction of the modified LM test in the present work means that the model should be linear. Test followed the procedure like these: First, the residuals of the linear model are calculated where

$$\varepsilon = LNRA - const - a_1X_1 \ldots - a_7X_7$$

and LNRA is as same as R* – the logit of the ratings of creditworthiness; Then, by multiplying every variable with itself and also with the other six ones, forty-nine more variables are obtained; and finally, a new regression on the residuals in the form of

$$\varepsilon = a_0 + a_1X_1 + \ldots + a_7X_7 + a_{ij}X_{ij} \qquad i,j = 1,..7 \tag{3}$$

Altogether 49 new regressions have been done and a list of t-statistic of each cross term coefficient (a_{ij}) was obtained and is shown in the t-matrix in Table 3.

Table 3 **t-matrix**

RA1

	x1	x2	x3	x4	x5	x6	x7
x1	5.8	7.7	−4.9	1.0	1.6	2.3	3.5
x2	7.7	4.3	−4.3	0.1	3.7	1.4	4.3
x3	−4.9	−4.3	−2.2	0.0	−0.6	1.4	−1.4
x4	1.0	0.1	0.0	2.4	2.3	−0.6	0.8
x5	1.6	3.7	−0.6	2.3	−2.9	−2.2	−1.2
x6	2.3	1.4	1.4	−0.6	−2.2	4.1	−1.7
x7	3.5	4.3	−1.4	0.8	−1.2	−1.7	−2.8

RA2

	x1	x2	x3	x4	x5	x6	x7
x1	7.7	5.6	−3.3	1.3	0.2	2.7	4.3
x2	5.6	4.6	−3.5	−2.2	2.8	2.1	4.5
x3	−3.3	−3.5	−0.5	0.8	−1.2	2.6	−2.2
x4	1.3	−2.2	0.8	2.9	6.6	−1.5	0.7
x5	0.2	2.8	−1.2	6.6	−3.4	−3.6	−5.2
x6	2.7	2.1	2.6	−1.5	−3.6	3.9	−0.9
x7	4.3	4.5	−2.2	0.7	−5.2	−0.9	−1.5

The numbers speak for themselves again. These high t-values in both cases tell that the hypothetical linear relationship in the earlier studies did not hold, no at least for the present data. In another word, the seven suggested indicators are in non-linear relationship with the two kinds of direct measurements from *Institutional Investor* and *Euromoney*.

6.3 Quadratic model

On the basis of the t matrix which is shown in Table 3, the seven cross terms (x_1x_4, x_1x_5, x_3x_4, x_3x_5, x_4x_6, x_4x_7, x_6x_7) which are not statistically significant were dropped from the total 28 ones and 21 cross terms are left in the new model. But it is not convenient to have so many variables in the model since the present database is not big enough. So, regression is done again with the remaining 28 variables (7 basic ones and 21 cross terms). The same process is repeated again and again, applying a step-wise procedure[2] to select suitable numbers of variables and finally a model with altogether 16 variables were obtained which was considered as the best model for the present work.

The new equation of quadratic model is obtained and the final quadratic equation for the country risk study in this present work can be written as

$$LNRA = a_0 + \Sigma a_i x_i + \Sigma a_i^2 x_i^2 + \Sigma a_{ij} x_{ij}$$

where $x_i = x_1, x_2, x_4, x_5, x_7$

$x_i^2 = x_1^2, x_2^2, x_4^2, x_5^2, x_7^2$

$x_{ij} = x_1x_7, x_2x_5, x_2x_6, x_4x_5, x_5x_6, x_5x_7$

That is, in the present study the model should be written like

$$LNRA = a0 + a1x_1 + a2x_2 + a4x_4 + a5x_5 + a7x_7 + a12x_1^2 + a22x_2^2 + a42x_4^2 + a52x_5^2 + a72x_7^2 + x_1x_7 + a25x_2x_5 + a26x_2x_6 + a45x_4x_5 + a56x_5x_6 + a57x_5x_7$$

It's to say that five out of the original indicators are significant in affecting a country's creditworthiness. They are: x1 (EDT/GNP), x2 (INT/EXP), x4 (CA/GDP), x5 (GNP/POP) and x7 (GE/GDP). In the model, they appear both in original state and in a form of square. Also, these basic indicators have joint effcts on the creditworthiness as they appear in the cross term form. There are altogether six such terms. It is interesting to notice that in addition to the other five indicators, indicator X6 (Inflation) appears only in the cross term, showing that inflation has actually joint effects on the creditworthiness. And only this effect it has as far as this model is concerned.

Regression results of the new model are shown in Table 4. In this new quadratic model regression, there were altogether 16 variables left and the results seem very satisfactory. And if compared with the linear model results, quadratic model fits even better.

[2] Wonnacott p. 187

Table 4 **Regression Results of quadratic model 1980–1989**

RA1

Variable	Coefficient	t-value
Constant	0.557	
x_1	−0.0197	−3.8
x_2	−0.0569	−4.4
x_4	−0.0572	−2.6
x_5	0.0441	6.8
x_7	0.0396	2.2
x_1^2	0.0001	2.3
x_2^2	0.0004	2.1
x_4^2	0.0079	2.7
x_5^2	−0.0002	−5.0
x_7^2	−0.0007	−2.6
x_1x_7	0.0002	2.0
x_2x_5	0.0006	4.7
x_2x_6	0.0000	3.4
x_4x_5	0.0018	4.3
x_5x_6	−0.0001	−4.4
x_5x_7	−0.0002	−1.7

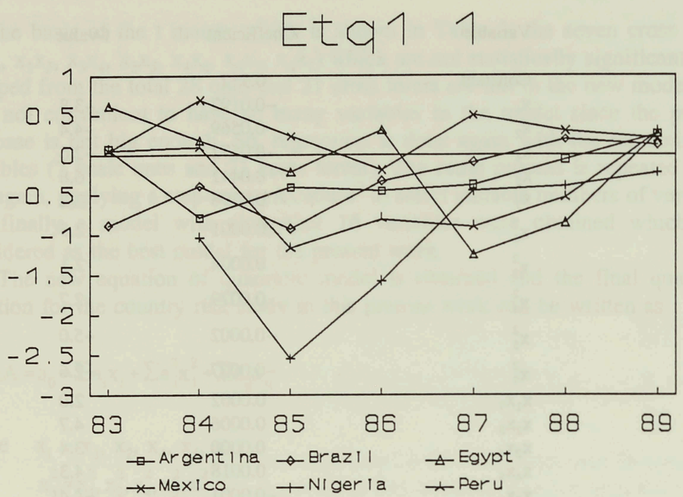
$R^2 = 0.85$
Observations = 218

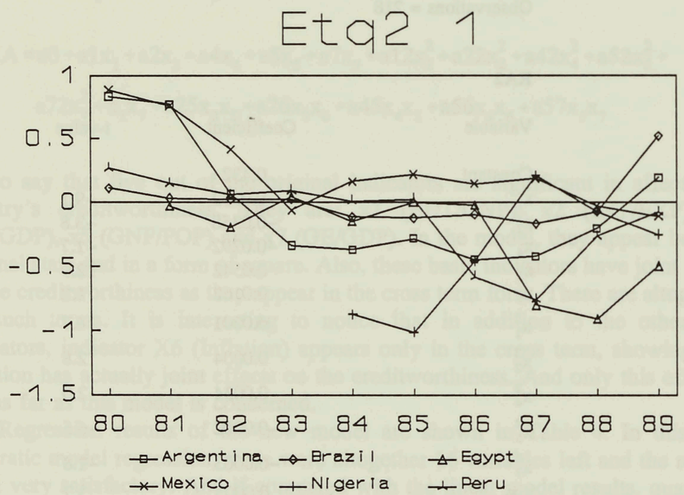
RA2

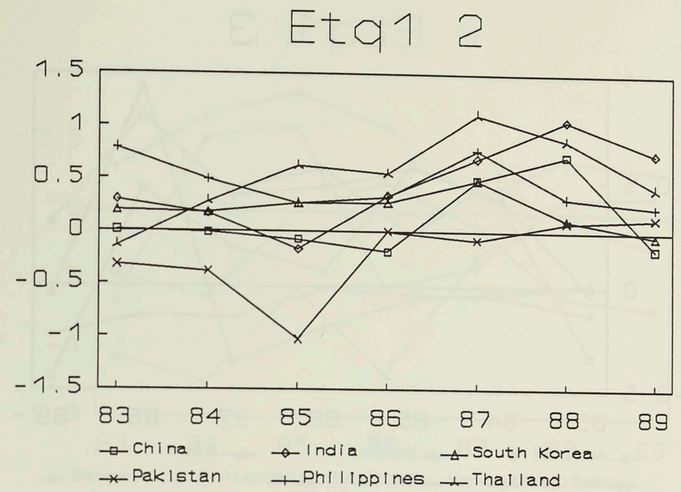
Variable	Coefficient	t-value
Constant	0.432	
x_1	−0.0332	−9.1
x_2	−0.0358	−3.8
x_4	−0.0292	−1.7
x_5	0.0542	12.9
x_7	0.0162	1.2
x_1^2	0.0001	4.7
x_2^2	0.0004	2.8
x_4^2	0.0034	2.0
x_5^2	−0.0002	−6.5
x_7^2	−0.0003	−1.8
x_1x_7	0.0003	3.7
x_2x_5	0.0003	3.4
x_2x_6	0.0000	4.3
x_4x_5	0.0021	7.3
x_5x_6	−0.0001	−6.5
x_5x_7	−0.0003	−4.2

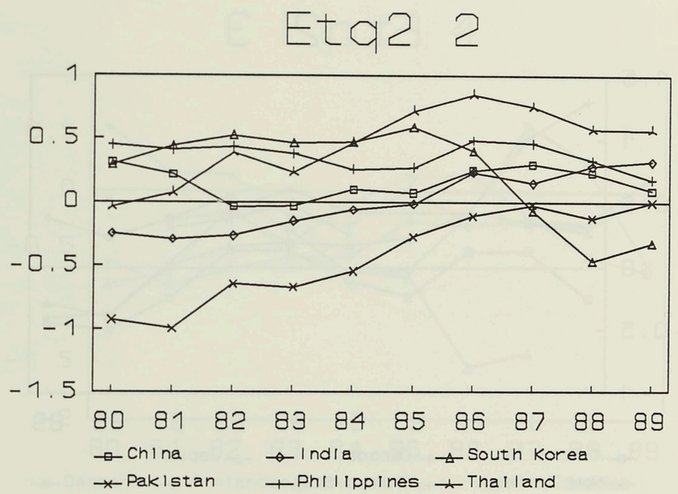
$R^2 = 0.89$
Observations = 300

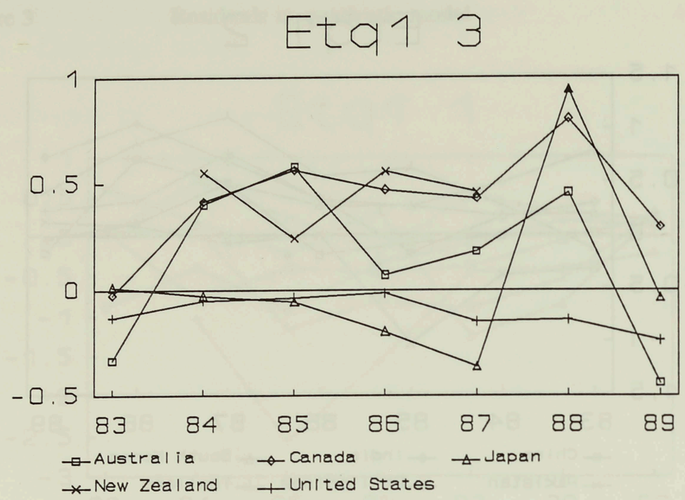
Figure 3 **Residuals in quadratic model**

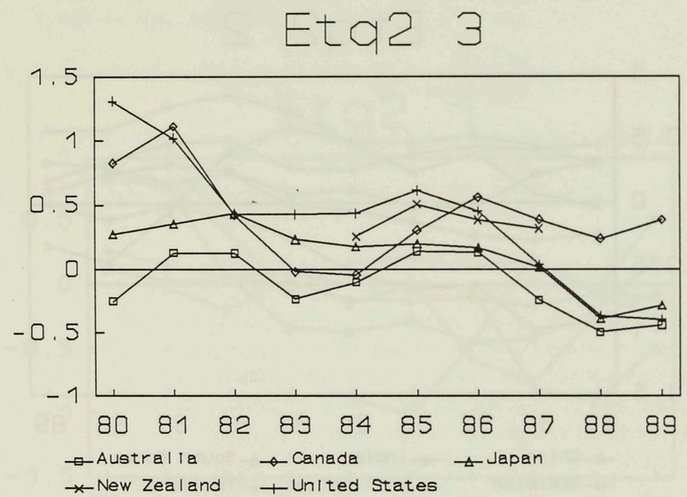









Etq1 3
1
0.5
0
-0.5
83 84 85 86 87 88 89
Australia
Canada
Japan
New Zealand
United States


Etq2 3
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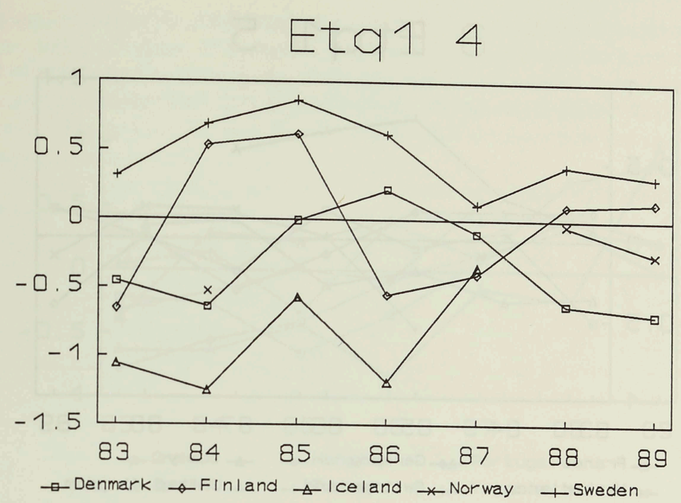
1
0.5
0
-0.5
-1
80 81 82 83 84 85 86 87 88 89
Australia
Canada
Japan
New Zealand
United States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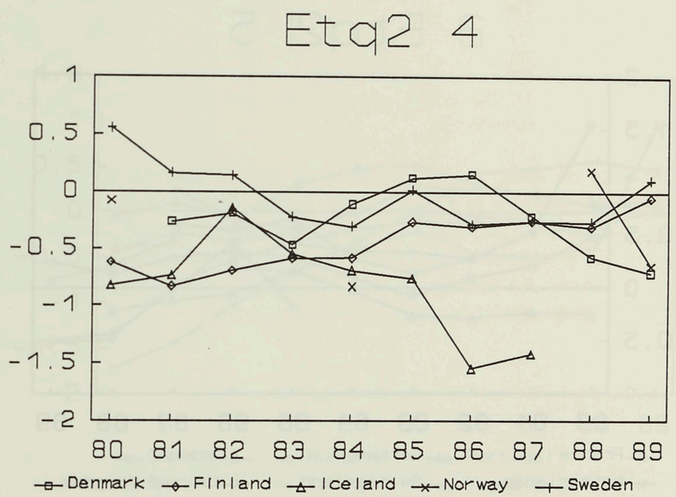
0
-0.5
-1
-1.5
83 84 85 86 87 88 89
Denmark
Finland
Iceland
Norway
Sweden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-1
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-2
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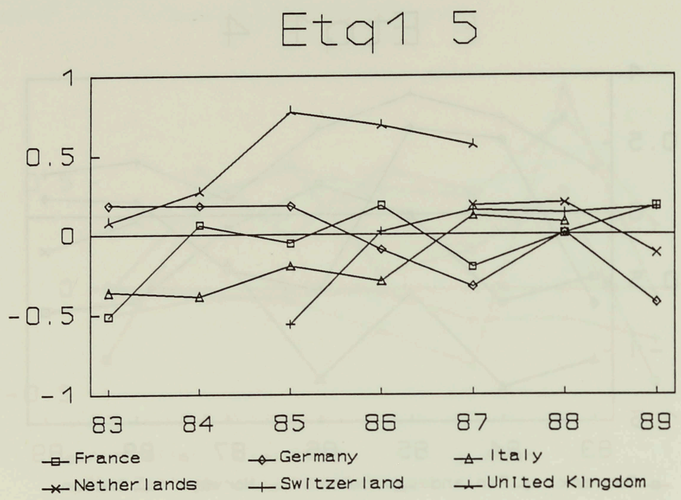
Denmark
Finland
Iceland
Norway
Sweden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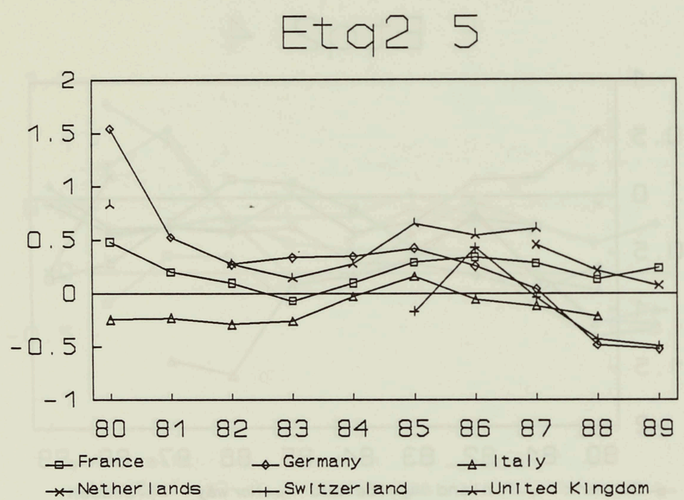
0.5
0
-0.5
-1
83 84 85 86 87 88 89
France
Germany
Italy
Netherlands
Switzerland
United Kingdom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2
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1
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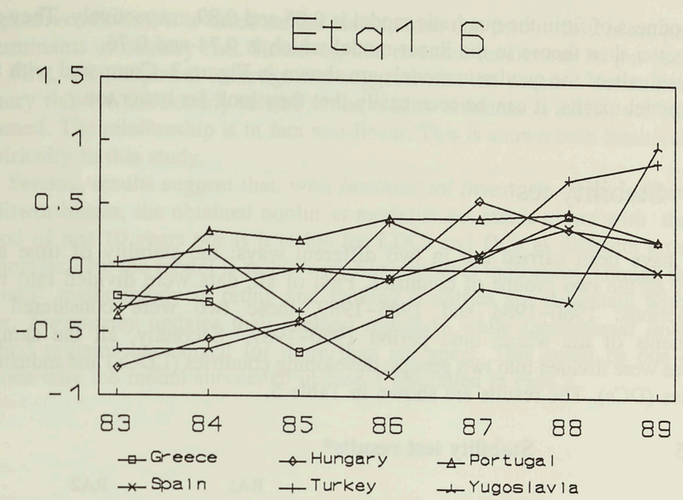
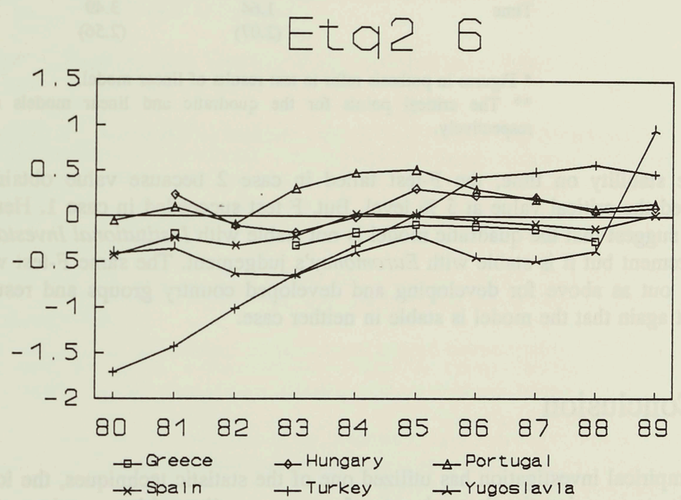
0
-0.5
-1
80 81 82 83 84 85 86 87 88 89
France
Germany
Italy
Netherlands
Switzerland
United Kingdom


Etq1 6
1.5
1
0.5
0
-0.5
-1
83 84 85 86 87 88 89
Greece
Hungary
Portugal
Spain
Turkey
Yugoslavia


Etq2 6
1.5
1
0.5
0
-0.5
-1
-1.5
-2
80 81 82 83 84 85 86 87 88 89
Greece
Hungary
Portugal
Spain
Turkey
Yugoslavia

The goodness of fit in the quadratic model is 0.85 and 0.89, respectively. They are much better than theose in the linear model which is 0.74 and 0.76.

Residuals of the quodratic models are shown in Figure 3. Compared with the linear model results, it can be seen easily that they look far better,too.

6.4 Stability test

F-tests have been carried out in two different ways: the stability of time and stability of the two groups of countries. First of all, data were divided into two time periods: 1980–1984 and 1985–1989, these two were considered as components of the whole time period 1980–1989.[3] Secondly, all the sample countries were divided into two groups: developing countries (LDCs) and industrial countries (DCs). The results are shown in Table 5.

Table 5 **Stability test results***

	RA1	RA2
Country groups	3.57 (17.20)	4.17 (27.97)
Time	1.64 (2.07)	3.49 (2.56)

* Figures in pothesis refer to test results of linear model.
** The critical points for the quodratic and linear models are, respectively.

On the stability on time, the F-test failed in case 2 because value obtained exceeded the critical value at 5 % level. But, F test succeeded in case 1. Hence results suggest that the quadratic model is not stable with *Institutional Investor*'s measurement but it is stable with *Euromoney*'s judgement. The same F-test was carried out as above for developing and developed country groups and results suggest again that the model is stable in neither case.

7 Conclusion

This empirical investigation has utilized one of the statistic techniques, the logit analysis, to examine the determinants of country creditworthiness, using cross section time series database of 34 developing and industrial countries for the period from 1980 to 1989. As a result, five economic indicators out of the seven hypothesized ones have been found significant in determining a country's creditworthiness. In addition, the empirical result suggests that these indicators are not only linearly related (progressive effects) to the country creditworthiness, in fact, it is better to think that these indicators are in a quadratic model (joint and

[3] For case 1, it should be 1983–1984 and 1983–1989.

progressive effects). It is based on the assumptions that certain factors are possible determinants of country risk. However, this research results can be put into two:

First, this empirical investigation suggests that the possible determinants of country risk are not linearly related to the creditworthiness as earlier studies have assumed. The relationship is in fact non-linear. This is shown both intuitively and empirically in this study.

Second, results suggest that, with *Institutional Investor*'s direct indicators of creditworthiness, the obtained nonlinear model is not stable either with the time period of last 10 years nor is it stable for LDCs and DCs as different groups of economies. But the model is stable with *Euromoney*'s indication. Though the two journals' methodology in rating and ranking countries are consistent with each other, *Euromoney* updates their method regularly while *Institutional Investor*'s method remains unchanged for more than ten years. This could be one of the reasons why the model succeeded in case 1 but failed in case 2.

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Appendix 1

Seven basic indicators 1980–1989

	Country	EDT/GNP X1	INT/EXP X2	RES/IMP X3	CA/GDP X4	GNP/POP X5	INFL X6	GE/GDP X7
1980	Angentina	48.4	27.1	42.3	-3.1	21.0	100.8	24.7
	Australia	10.4	5.4	4	-2.8	86.4	10.1	26.6
	Brazil	30.6	37.1	12.9	-5.1	18.0	82.8	23.5
	Canada	70.7	11.7	2.5	-0.4	89.1	10.2	21.2
	China	1.5	1.8	8.7	0.2	2.5	7.4	27.1
	Finland	35.5	8.7	6.2	-2.7	85.5	11.6	29.6
	France	40.1	13.8	9.8	-0.6	103.2	13.3	39.9
	Germany	29.7	4.4	13.6	-1.7	119.6	5.4	30.6
	Iceland	45.7	10.8	7.8	-2.4	102.8	58.5	27.6
	India	11.9	5.8	25.4	-1	2.1	11.4	18.7
	Italy	24.4	7.7	11.1	-2.2	57.0	21	42.6
	Japan	14.9	7.5	8	-1	87.0	7.7	19
	South Korea	48.7	14.8	6.9	-8.5	13.3	28.7	20.2
	Mexico	30.3	35.2	6.8	-5.8	18.4	26.4	18.9
	Norway	63.6	13.1	15.5	1.9	111.3	10.9	43.2
	Pakistan	42.5	13.4	5.6	-3.9	2.6	11.9	22.7
	Peru	51	19.1	36.2	-0.5	8.1	59.1	19.3
	Philippines	49.5	17.0	15.6	-5.4	6.0	18.2	14.2
	Portugal	40.4	15.8	4.2	-4.2	20.8	16.6	39.9
	Spain	27.9	14.5	18.8	-2.4	47.5	15.6	28.3
	Sweden	28.4	8.1	5.4	-3.5	119.0	13.7	46.3
	Thailand	25.9	12.2	10.8	-6.4	5.9	19.7	20.3
	Turkey	34.3	39.1	6.5	-6	12.9	110.2	23.9
	United Kingdom	90.1	13.9	9.6	1.4	69.7	18	40.6
	United States	12.5	14.9	2.3	0.1	100.0	13.5	23.7
	Yugoslavia	25.6	14.4	3.3	-3.7	23.0	30.9	10.1
1981	Angentina	63.8	42.3	22.3	-3.8	19.9	104.5	25.5
	Australia	10.4	7.1	4.2	-5	86.4	9.7	26.6
	Brazil	31.4	44.5	12	-4.3	17.3	105.6	26.1
	Canada	74.7	14.7	1.8	-1.7	88.9	12.5	22.2
	China	3.5	3.5	8.9	1	2.3	2.5	24.0
	Denmark	58.8	19.7	8.1	-3.3	102.3	11.7	42.4
	Egypt	82.3	27.5	4.8	-8.7	5.0	10.3	53.5
	Finland	36.5	11.1	5.8	-0.8	83.3	12	29.5
	France	43	21.2	11.1	-0.8	95.0	13.4	42.7
	Germany	32.4	6.3	15	-0.5	104.9	6.3	31.6
	Greece	28.2	18.9	8.1	-6.5	34.4	24.5	40.3
	Hungary	45.8	15.7	8.8	-3.9	16.3	4.5	56.4
	Iceland	41.7	14.8	10.9	-4.4	100.3	50.8	27.9
	India	12.6	6.0	19.6	-1.5	2.0	13.1	18
	Italy	30	11.7	10.3	-2.4	54.2	17.9	42.0
	Japan	16.2	10.5	9.9	0.4	78.6	4.9	18.9
	South Korea	50.3	16.9	5.3	-6.7	13.2	21.3	21.4
	Mexico	34	42.9	6.8	-6.7	17.5	27.9	21.9
	Pakistan	35	12.8	7.6	-3.3	2.7	11.9	23.2
	Peru	42.5	29.9	19.7	-6.9	9.1	75.4	18.4
	Philippines	54	24.4	14.2	-5.4	6.1	13.1	15.6
	Portugal	50.4	26.8	3.2	-10.9	19.6	20	45.1
	Spain	34.5	20.4	17.6	-2.7	43.9	14.5	29.4
	Sweden	35.5	13.0	6.8	-2.5	115.9	12.1	47.6
	Thailand	30.9	16.7	7.5	-7.4	6.0	12.7	19.4
	Turkey	34	30.7	6.9	-3.4	12.0	36.6	23.0
	United States	11.5	19.1	3.5	0.2	100.0	10.3	24.4
	Yugoslavia	29.3	18.4	4.8	-1.5	21.7	39.8	9.0

	Country	EDT/GNP X1	INT/EXP X2	RES/IMP X3	CA/GDP X4	GNP/POP X5	INFL X6	GE/GDP X7
1982	Angentina	83.8	64.7	29.4	-4.1	19.1	164.8	23.0
	Australia	15.1	10.0	7.2	-5.1	84.6	11.1	27.0
	Brazil	36.1	62.3	13.3	-5.7	17.0	97.8	27.6
	Canada	74.2	17.7	2.4	0.7	86.0	10.8	24.8
	China	3	2.9	21.7	2.6	2.3	2	22.8
	Denmark	62.4	21.4	6.4	-4.1	94.7	10.1	43.9
	Egypt	120.9	34.7	4.1	-6.2	5.2	14.8	63.5
	Finland	44	12.7	4.9	-1.5	82.6	9.6	30.6
	France	45.4	23.9	7.3	-2.2	88.7	11.8	45.0
	Germany	33.6	7.0	14	0.8	94.6	5.3	32.0
	Hungary	45.4	12.8	4.2	-2.3	17.2	7	53.6
	Iceland	62.4	21.3	10.4	-8.5	92.0	51	30.7
	India	14.9	7.2	15.6	-1.3	1.9	7.9	18.9
	Italy	27.9	13.0	9	-1.6	51.9	16.5	44.0
	Japan	17.5	11.6	10.1	0.6	76.6	2.7	18.6
	South Korea	52.3	17.2	5.8	-3.6	14.5	7.2	21.3
	Mexico	52.5	58.3	5.9	-3.8	17.2	58.9	31.5
	Pakistan	38.3	21.8	8.6	-2.9	2.8	5.9	21.0
	Peru	49.7	31.4	17.6	-6.5	9.9	64.4	17.5
	Philippines	62.5	40.1	8.5	-8.1	6.2	10.2	15.3
	Portugal	61.4	32.2	2.5	-14	18.6	22.7	43.2
	Spain	35.5	19.7	14.6	-2.4	41.2	14.4	31.1
	Sweden	46.1	14.6	6.5	-3.4	106.6	8.6	48.4
	Thailand	34.8	18.8	8.8	-2.8	6.0	5.3	21.6
	Turkey	38.2	27.2	7	-1.8	10.4	30.8	24.3
	United Kingdom	129.5	13.1	7.1	1.7	73.4	8.6	42.7
	United States	11.3	24.1	4.1	-0.2	100.0	6.2	25.4
	Yugoslavia	31.5	20.3	3.6	-0.8	21.2	31.5	8.0
1983	Angentina	77.3	69.2	32.6	-3.8	14.6	343.8	28.2
	Australia	20.5	15.3	16.1	-3.6	81.4	10.1	29.4
	Brazil	50.4	46.9	11.3	-3.3	13.3	142.1	30.3
	Canada	73.2	15.8	2.9	0.8	87.2	5.8	24.6
	China	3.3	1.3	33	1.9	2.1	1.9	22.9
	Denmark	71.6	18.8	10.6	-2.1	82.0	6.9	44.4
	Egypt	120.3	33.4	3.7	-0.9	4.9	16.1	54.1
	Finland	45.4	12.2	4.3	-1.9	76.1	8.4	31.5
	France	54.3	20.7	9.4	-1	74.4	9.6	45.0
	Germany	34.3	5.9	15.3	0.8	81.0	3.3	31.4
	Greece	30	19.0	4.4	-5.4	27.7	20.2	43.9
	Hungary	52.3	11.6	5.1	-0.9	15.2	6.4	54.8
	Iceland	65.8	18.5	8.9	-2.1	72.7	84.2	29.6
	India	16	10.3	19	-1	1.8	11.9	18.9
	Italy	30.4	11.1	11.6	0.3	45.3	14.7	47.7
	Japan	19.8	8.0	10.1	1.8	71.7	1.9	18.8
	South Korea	50.8	13.6	4.4	-2	14.2	3.4	19.1
	Mexico	66.4	46.7	17	3.8	15.8	101.8	26.7
	Pakistan	42.2	18.6	16.5	0.1	2.7	6.4	23.2
	Peru	63.9	36.8	26.6	-4.5	7.3	111.2	19.3
	Philippines	71.5	40.6	3.5	-8	5.3	10	13.8
	Portugal	74	25.7	2.9	-4.9	15.8	25.1	45.2
	Spain	37.9	17.5	11.9	-1.8	33.8	12.2	32.7
	Sweden	51.3	13.2	7.1	-1.1	88.3	8.9	49.9
	Thailand	35.3	19.3	8.3	-7.3	5.8	3.7	20.5
	Turkey	40.9	26.4	6.2	-3.8	8.7	31.4	24.2
	United Kingdom	139	56.9	6.1	1.3	65.2	4.6	42.5
	United States	11.9	23.8	4.3	-1.3	100.0	3.2	26.1
	Yugoslavia	43.8	17.2	3.2	0.6	18.2	40.2	8.1

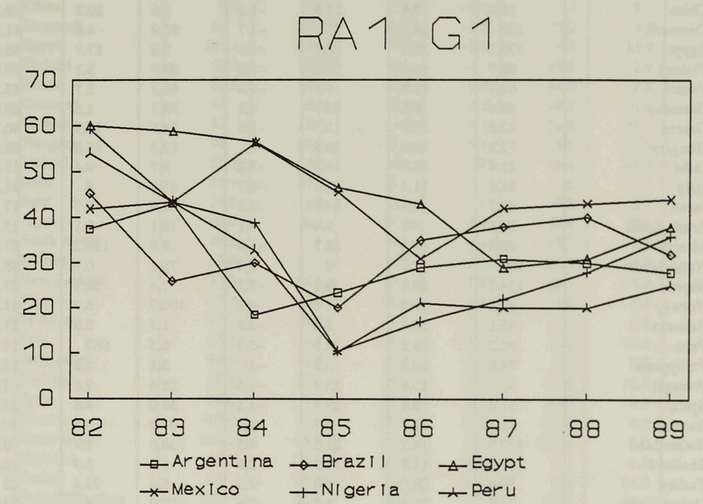
	Country	EDT/GNP X1	INT/EXP X2	RES/IMP X3	CA/GDP X4	GNP/POP X5	INFL X6	GE/GDP X7
1984	Angentina	67.5	68.3	16.9	-3.2	14.4	626.7	19.8
	Australia	22.1	16.7	16	-4.8	76.2	4	30.1
	Brazil	52.6	42.4	26.6	0	11.1	197	28.0
	Canada	72.6	14.0	1.9	0.6	86.2	4.3	25.2
	China	4	1.6	33.4	1	2.0	2.7	22.8
	Denmark	79.4	21.3	11.4	-3	72.5	6.3	43.5
	Egypt	122	34.3	3.7	-4.9	4.6	17	54.5
	Finland	50.1	13.3	10	0	69.9	7.1	29.7
	France	59.3	21.1	10.5	-0.2	63.4	7.4	45.2
	Germany	36	5.5	14.7	1.6	72.3	2.4	31.7
	Greece	37	22.2	5.4	-6.3	24.5	18.4	50.0
	Hungary	55.6	13.4	9.8	0.2	13.6	8.7	53.0
	Iceland	72.9	21.2	8.5	-4.8	71.7	29.2	28.8
	India	17.6	11.5	21	-1.2	1.6	8.3	20.6
	Italy	32.6	11.7	12.2	-0.6	41.7	10.8	47.9
	Japan	20.7	8.1	9.7	2.8	69.0	2.3	18.2
	South Korea	48.4	13.2	3.9	-1.5	13.7	2.3	18.5
	Mexico	57.1	48.2	26.3	2.4	13.2	65.5	23.8
	New Zealand	51.3	17.5	9.4	-7.9	50.2	6.2	43.6
	Nigeria	20.2	7.9	6.4	0.1	4.7	39.6	14.6
	Norway	61.3	13.6	30.4	5.3	90.5	6.3	41.1
	Pakistan	39.5	24.7	13.2	-4	2.4	6.1	23.5
	Peru	66.3	40.3	34.8	-1.1	6.5	110.2	18.3
	Philippines	77.2	44.2	4	-4	4.2	50.3	12.3
	Portugal	82.1	25.7	3.2	-2.7	12.8	28.9	43.7
	Spain	39.5	15.2	18.6	-2	28.8	11.3	35.2
	Sweden	52.3	13.3	8.1	0.3	77.0	8	47.3
	Thailand	36.8	19.7	9.3	-5.1	5.5	0.9	19.9
	Turkey	44.8	22.2	5.4	-2.8	7.5	48.4	24.9
	United Kingdom	165.4	57.9	5	0.6	55.6	5	41.4
	United States	13.1	26.9	3.5	-2.8	100.0	4.3	24.5
	Yugoslavia	44.4	17.9	4.2	1.1	13.7	54.7	7.4
1985	Angentina	84.2	61.1	26.4	-1.4	12.7	672.1	28.3
	Australia	30.5	18.1	13.1	-5.6	64.8	6.7	30.6
	Brazil	48.7	43.3	38.7	-0.1	9.8	226.9	36.9
	Canada	75.7	14.2	1.6	-0.4	81.9	4	24.6
	China	5.7	1.9	16.9	-4.8	1.8	11.9	22.1
	Denmark	86.3	22.7	12.7	-4.7	67.1	4.7	41.5
	Egypt	128.1	32.2	4.4	-4.4	3.6	12.1	50.6
	Finland	48.3	13.7	13.5	-1.4	65.2	5.9	30.6
	France	55.3	21.1	11	0	57.1	5.8	45.1
	Germany	39	5.3	13.3	2.7	65.5	2.2	31.2
	Greece	47	26.9	5.1	-9.8	21.2	19.3	50.5
	Hungary	70.2	13.8	15.1	-2.2	11.6	7	53.1
	Iceland	70.9	18.4	9.3	-4	70.4	31.7	30.2
	India	19.2	14.3	19.9	-2	1.6	5.6	22.4
	Italy	32.1	11.8	11.5	-0.8	39.0	9.2	47.5
	Japan	24.6	8.2	10.8	3.7	67.7	2	17.8
	South Korea	52.5	12.7	4.1	-1	12.8	2.5	18.3
	Mexico	55.2	46.1	21.2	0.6	12.4	57.7	25.8
	New Zealand	74.1	21.8	11.7	-7.4	42.0	15.4	42.4
	Nigeria	22.2	8.7	7.1	2.9	4.7	5.5	13.9
	Pakistan	43.6	23.0	6.9	-3.6	2.2	5.6	23.9
	Peru	89.4	35.5	43.7	0.8	6.0	163.4	17.3
	Philippines	83.5	47.9	6.3	-0.1	3.4	23.1	13.0
	Portugal	84.9	23.7	7.4	2	11.8	19.3	48.3
	Spain	32.9	12.5	20.3	1.7	25.7	8.8	34.8
	Sweden	50.5	14.0	9.3	-1.6	71.2	7.4	47.9
	Switzerland	123.5	14.8	23.6	6.5	98.0	3.4	19.9
	Thailand	47.8	22.7	10.8	-4.1	4.7	2.4	22.1
	Turkey	50.5	22.0	5.1	-1.9	6.4	45	24.9
	United Kingdom	144.1	53.4	5.1	1	50.6	6.1	41.2
	United States	15	27.4	3.9	-2.8	100.0	3.6	25.6
	Yugoslavia	48.2	17.6	4.1	1.9	12.4	72.3	7.0

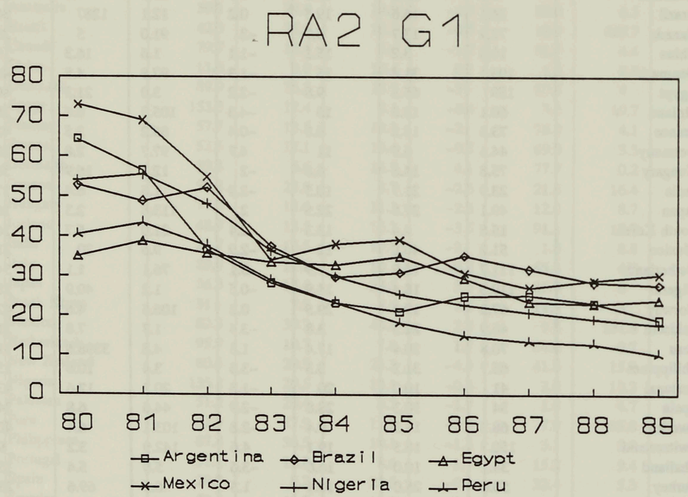
	Country	EDT/GNP X1	INT/EXP X2	RES/IMP X3	CA/GDP X4	GNP/POP X5	INFL X6	GE/GDP X7
1986	Angentina	70.5	62.6	37.3	-3.6	13.4	90.6	23.0
	Australia	38.2	22.8	11.8	-5.8	68.1	9.1	30.0
	Brazil	42.1	45.8	26.9	-2	10.3	145.2	35.5
	Canada	81.2	15.0	1.7	-2.1	80.7	4.2	23.2
	China	8.4	2.9	13.9	-3.1	1.7	7	24.6
	Denmark	84	25.7	10.8	-5.5	72.0	3.7	38.3
	Egypt	134.1	59.2	5.1	-3.3	4.3	23.9	40.6
	Finland	53.3	13.3	8.1	-1	69.5	2.9	31.3
	France	58.4	18.1	12.5	0.3	61.3	2.5	44.6
	Germany	41	5.9	12.9	4.5	69.1	-0.1	30.5
	Greece	43	23.5	5.9	-4.3	21.0	23	50.9
	Hungary	74	13.2	15.9	-5.7	11.5	5.3	58.5
	Iceland	57.9	15.5	10.4	0.4	76.4	21.9	31.2
	India	21.1	16.2	21	-2	1.6	8.7	23.7
	Italy	29.8	12.0	9.6	0.5	48.9	5.9	51.6
	Japan	30.5	8.7	14.6	4.4	73.4	0.6	17.4
	South Korea	45.5	11.1	5.1	4.4	13.5	2.8	17.0
	Mexico	82.6	51.2	18.8	-1.3	10.6	86.2	29.0
	New Zealand	70.5	25.4	17.1	-5.8	42.6	13.2	43.0
	Nigeria	52.7	12.9	20	0.8	3.6	5.4	19.2
	Pakistan	47.7	20.9	8.1	-2.1	2.0	3.5	27.4
	Peru	68.3	34.7	29.8	-4.1	6.2	77.9	16.1
	Philippines	94.1	43.8	9.8	3.1	3.2	0.8	17.5
	Portugal	58.4	16.8	8	3.9	12.8	11.7	48.9
	Spain	28.6	9.8	19.9	1.7	27.8	8.8	34.1
	Sweden	49.6	12.4	10.6	0	75.2	4.2	44.6
	Switzerland	133.2	14.0	22	3.4	101.1	0.8	18.6
	Thailand	45.5	20.1	14.1	0.6	4.6	1.8	20.9
	Turkey	58	28.6	6.4	-2.5	6.3	34.6	21.1
	United Kingdom	160	50.9	6.5	0	50.7	3.4	40.0
	United States	18.1	28.5	4.8	-3.2	100.0	1.9	24.9
	Yugoslavia	33.3	18.7	5.8	1.7	13.1	89.8	6.4
1987	Angentina	76.6	65.2	15.9	-5.6	12.9	131.7	22.2
	Australia	39.1	24.0	14.9	-4.3	59.9	8.5	29.5
	Brazil	42.3	35.5	16.3	-0.5	10.9	229.7	45.3
	Canada	79.7	15.4	3.4	-1.7	81.8	4.4	22.2
	China	11.6	3.0	16.4	0.1	1.5	8.8	21.9
	Denmark	89.9	26.3	16.9	-3	80.5	4	39.8
	Egypt	153.3	17.4	3.1	-0.4	3.6	19.7	45.5
	Finland	57.7	13.5	12.3	-2	78.0	4.1	31.4
	France	53.5	17.1	10.4	-0.5	69.0	3.3	43.6
	Germany	39.3	6.6	14.8	4.1	77.7	0.2	30.5
	Greece	52.3	22.9	8.7	-2.6	21.6	16.4	50.9
	Hungary	77.9	14.6	11.3	-2.6	12.0	8.7	57.1
	Iceland	48.9	13.5	10.2	-3.5	91.1	17.7	27.8
	India	21.7	13.5	19.4	-2	1.6	8.8	23.4
	Italy	29.4	11.2	10	-0.2	55.8	4.7	51.8
	Japan	36.3	13.4	23.3	3.6	85.0	0	17.4
	South Korea	31	7.2	4.6	7.5	14.5	3	16.8
	Mexico	82.3	39.2	45.8	2.8	9.8	131.8	22.6
	Netherlands	95.9	10.7	7.8	1.7	64.0	-0.7	55.5
	New Zealand	80.6	29.9	26.3	-4.4	41.8	15.7	43.1
	Nigeria	135.2	29.5	13.1	-0.3	2.0	10.2	24.4
	Pakistan	51.2	20.4	6.2	-1.7	1.8	4.7	26.4
	Peru	67.9	27.9	15.9	-3.3	7.9	85.8	14.5
	Philippines	87.8	38.5	10.1	-1.3	3.1	3.8	16.9
	Portugal	51.1	12.8	8.6	1.7	15.2	9.4	47.3
	Spain	28.9	8.2	23.5	-0.1	32.4	5.3	34.8
	Sweden	50.8	11.7	10.2	-0.8	83.9	4.2	43
	Switzerland	123.5	15.4	21.3	3.7	115.1	1.4	8.7
	Thailand	44	15.8	14.4	-0.8	4.5	2.5	19.3
	Turkey	61.6	23.4	5.3	-1.2	6.5	38.8	21.9
	United Kingdom	145.2	46.4	9.7	-1.1	56.2	4.1	38.3
	United States	20.5	29.8	4.4	-3.2	100.0	3.7	23.9
	Yugoslavia	34.6	16.3	4.3	1.9	13.3	120.8	8

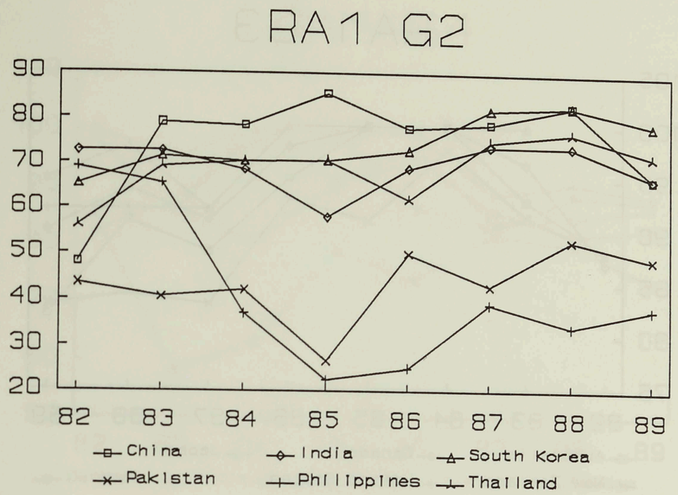
	Country	EDT/GNP X1	INT/EXP X2	RES/IMP X3	CA/GDP X4	GNP/POP X5	INFL X6	GE/GDP X7
1988	Angentina	66.2	51.2	21.1	-1.8	12.7	342.8	21.6
	Australia	39.5	22.0	16.9	-4.1	62.2	7.2	28.7
	Brazil	33.8	31.4	21.3	1.3	10.8	682.3	25.1
	Canada	75.7	15.8	6.1	-1.7	85.4	4	23.4
	China	11.4	3.4	17.5	-1.2	1.6	20.7	19.3
	Denmark	102	28.5	22	-1.7	92.9	4.6	41.2
	Egypt	175.2	35.5	8.7	-1.6	3.3	17.7	45.6
	Finland	58.7	16.3	16.2	-2.8	93.7	5.1	30.2
	France	64.5	16.2	8.6	-0.4	81.1	2.7	43.1
	Germany	40.4	6.8	13.7	4.2	93.1	1.3	29.9
	Greece	42.8	30.0	13.5	-1.8	24.1	13.5	40.7
	Hungary	72.9	13.8	10.5	-2	12.4	15.8	58.3
	India	21.4	22.8	14.2	-3.2	1.7	9.4	17.8
	Italy	31.8	11.4	11.3	-0.7	67.1	5	51.3
	Japan	40.7	19.6	24.6	2.8	105.9	0.7	17
	South Korea	21.1	4.7	9.4	8.1	18.1	7.1	15.7
	Mexico	60.9	41.8	28.7	-1.5	8.8	114.2	27.9
	Netherlands	100	11.5	8	2.4	73.1	0.7	55.7
	Nigeria	114.7	29.6	9.2	-3.2	1.4	38.3	27.8
	Norway	67.3	20.9	31.4	-4.2	100.7	6.7	41.5
	Pakistan	45.1	18.8	3.8	-3.8	1.7	8.8	21.7
	Peru	96.2	29.2	8.6	-3.3	6.5	667	14.6
	Philippines	74.8	30.7	3.8	-1	3.1	8.8	15.6
	Portugal	42	10.6	13.7	-1.5	18.4	9.6	45.3
	Spain	31.4	9.4	29.1	-1.1	39.0	4.8	34.1
	Sweden	58.3	11.7	9.7	-1.4	97.2	5.8	40.8
	Switzerland	132.9	14.7	21.8	4.5	138.6	1.9	9.7
	Thailand	37.2	11.9	12.9	-2.9	5.0	3.9	16.4
	Turkey	59.4	24.0	6.8	2.3	6.4	75.4	22
	United States	22.5	28.5	3.9	-2.6	100.0	4	22.9
	Yugoslavia	42.2	15.7	5.2	5	12.7	194.1	7.5
1989	Angentina	119.7	63.0	23	-2.4	10.3	3079.3	15.5
	Australia	40.6	26.2	15.2	-5.5	68.6	7.6	27
	Brazil	24.1	16.6	19.5	0.2	12.1	1287	30.6
	Canada	72.9	17.7	6.7	-3	91.0	5	23.1
	China	10.8	3.2	15.1	-1.1	1.6	16.3	19.1
	Denmark	103.1	31.8	15	-1.3	97.8	4.8	41.8
	Egypt	159	65.3	9.8	-2.2	3.0	21.3	40.2
	Finland	60.1	18.8	13	-4.3	105.7	6.6	29.3
	France	73.3	18.2	6.8	-0.4	85.2	3.5	42.6
	Germany	44.6	6.9	11	4.7	97.7	2.8	29
	Hungary	75.8	14.8	6.8	-2	12.3	16.9	58.6
	India	23.9	21.7	10.5	-2.9	1.6	6.4	17.7
	Japan	49.1	27.8	22.5	2	113.8	2.3	16.5
	South Korea	15.8	4.4	13.3	2.4	21.0	5.7	16.9
	Mexico	51.2	40.8	12	-2.9	9.6	20	21.2
	Netherlands	111.7	13.9	7.9	3.1	76.1	1.1	54.5
	Nigeria	119.3	18.4	14.9	-0.5	1.2	40.9	28.1
	Norway	67.3	19.3	29.5	0.2	106.6	4.6	42.7
	Pakistan	46.9	22.3	3.8	-3.4	1.7	7.8	21.5
	Peru	70.8	20.4	17.4	1.8	4.8	3398.6	11.6
	Philippines	65.7	31.2	3.3	-3.3	3.4	10.6	15.7
	Portugal	41	10.0	20	-1.3	20.3	12.6	43.3
	Spain	34	10.3	28.8	-2.9	44.6	6.8	34.3
	Sweden	68.2	15.3	9.4	-2.8	103.1	6.4	40.6
	Switzerland	150.7	18.5	19.1	4.6	142.9	3.2	9.4
	Thailand	34.1	10.0	16.6	-3.6	5.8	5.4	15.1
	Turkey	53.8	25.0	10.4	1.3	6.5	69.6	23.7
	United States	24.2	31.4	5.2	-2	100.0	4.8	23
	Yugoslavia	33.5	13.9	9.6	4.1	13.9	1239.9	5.3

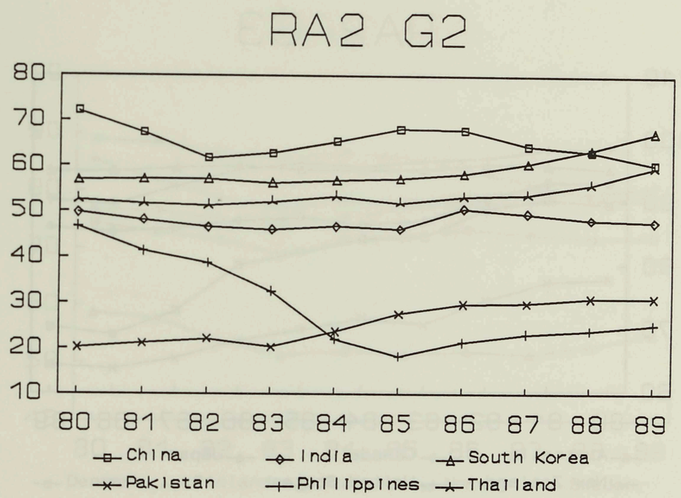
Appendix 2

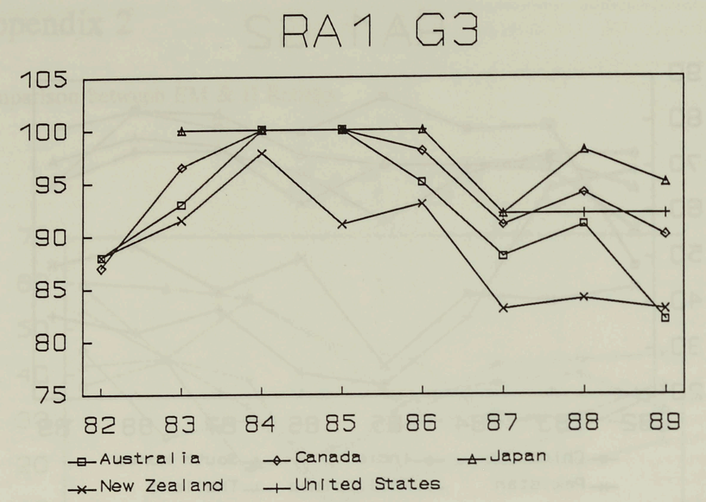
Comparison between EM & II Ratings







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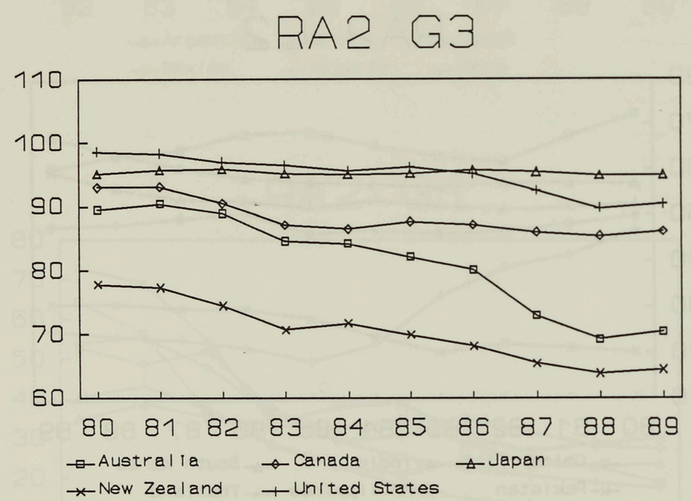
100
95
90
85
80
75
82 83 84 85 86 87 88 89
Australia
Canada
Japan
New Zealand
United States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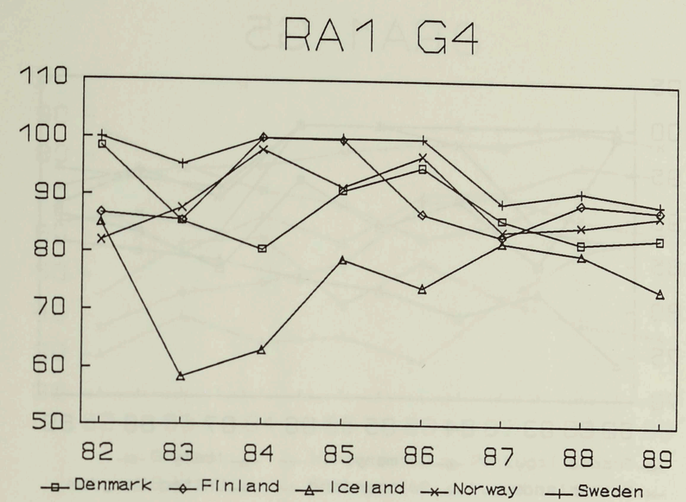
110
100
90
80
70
60
80 81 82 83 84 85 86 87 88 89
Australia
Canada
Japan
New Zealand
United States


RA1 G4
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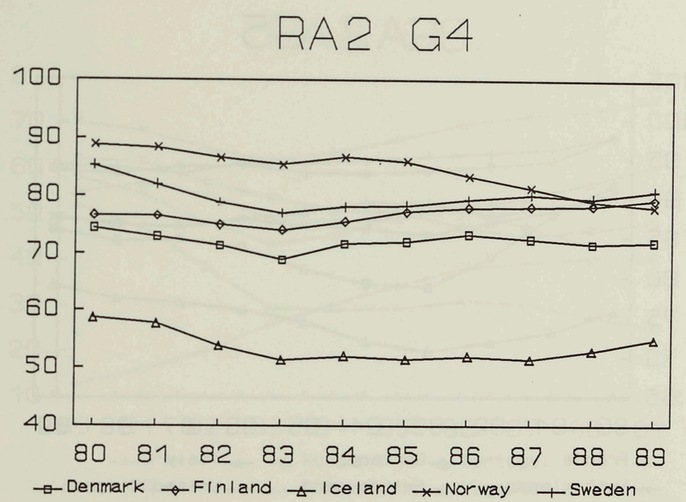
100
90
80
70
60
50
82 83 84 85 86 87 88 89
Denmark
Finland
Iceland
Norway
Sweden


RA2 G4
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90
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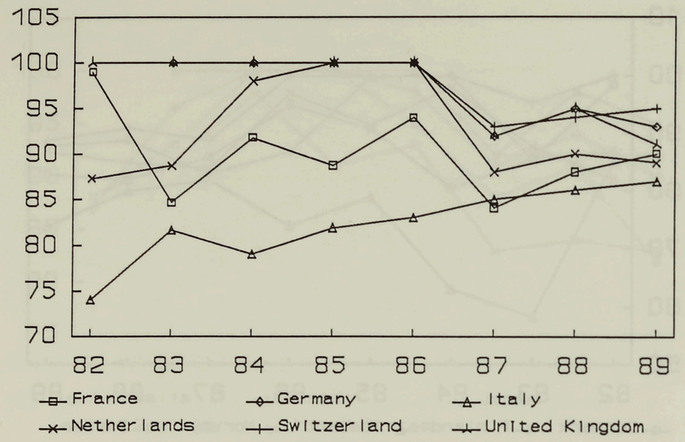
70
60
50
40
80 81 82 83 84 85 86 87 88 89
Denmark
Finland
Iceland
Norway
Sweden

RA1 G5



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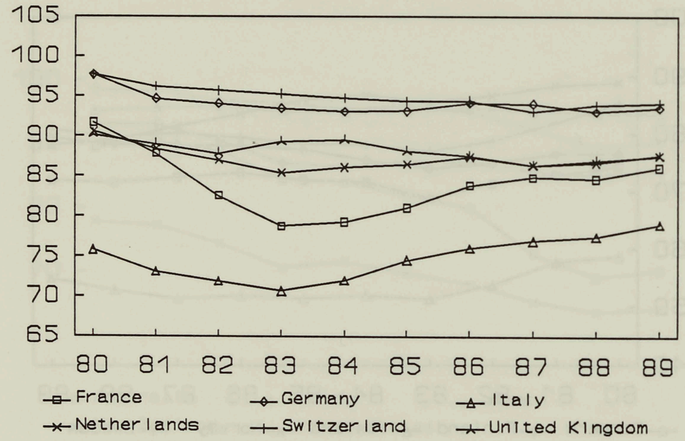

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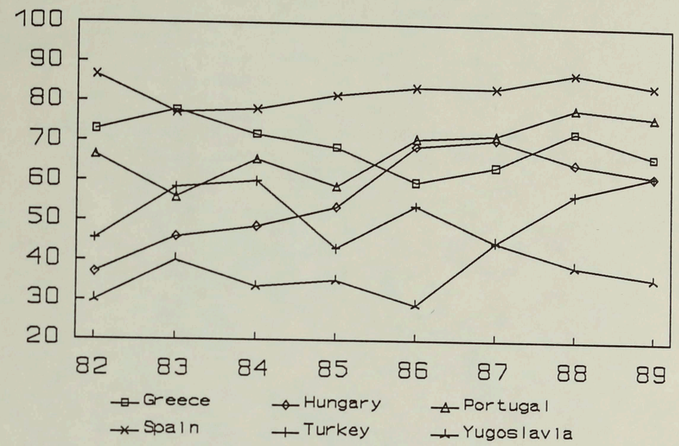
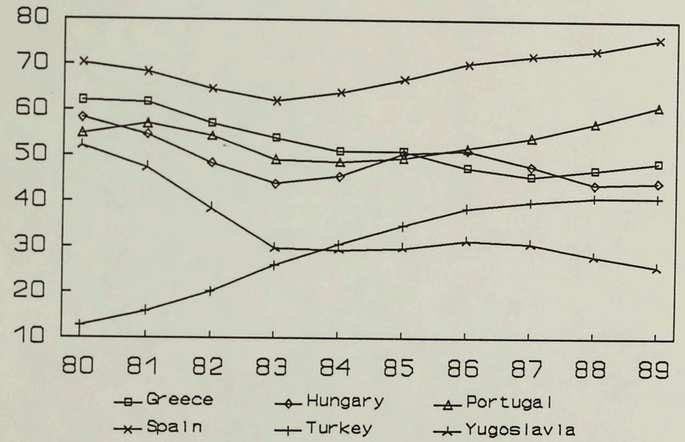


RA2 G6



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