WHICH FACTORS DETERMINE SOVEREIGN CREDIT RATINGS?

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Abstract

The purpose of this study is to examine the determinants of the sovereign credit ratings provided by the three major rating agencies: Fitch Ratings, Moody's and Standard and Poors. A principal Component Analysis is employed in order to identify the common factors affecting these ratings. The impact of the variables correlated with these factors on ratings is then assessed through linear regression modelling and ordered logistic modelling. Results show that sovereign ratings are mostly influenced by per capita income, government income, real exchange rate changes, inflation rate and default history. Our study also highlights the importance of corruption, as measured by Transparency International's Corruption Perceptions Index, which appears as a proxy for both economic development quality of the governance of a country.

EFM Classification Codes: 620
Keywords: Credit ratings, sovereign debts, sovereign default, Principal Component Analysis, logistic model

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Which Factors Determine Sovereign Credit Ratings?

Sovereign debt (debt incurred by governments) can take the form of commercial loans or of bond issues. In particular, developed countries are the largest issuers of bonds on capital markets. Moreover, in the 1990s the structure of private capital flows to developing countries has dramatically changed, since bond issues exceeded bank lending[1]. As a result the demand for sovereign credit ratings - the risk assessments assigned by credit rating agencies to government bonds - has significantly increased, all the more so as recent years have witnessed an important number of debt crises in developing countries[2]. Sovereign credit ratings significantly influence the terms and the extent to which, in developing countries especially, public and private borrowers have access to international capital markets.

The rating agencies use a combination of several quantitative and qualitative variables (economic, social and political) in order to assign a credit rating to a debtor or to a debt instrument. As a consequence, an important issue is to identify the various factors which are statistically significant in the determination sovereign credit ratings. The present paper attempts to answer this question[3].

The sovereign debt market, unlike the corporate debt market, is characterized by the absence of a bankruptcy code[4]. Thus, in the event of default, the lender does not have access to the obligor's assets. The default on domestic Russian GKO bonds in August 1998 illustrates this problem. Consequently, the creditworthiness of a sovereign borrower depends not only on its ability but also on its willingness to pay its debt (see, for instance, Eaton et al., 1986, Clark, 1997 and Clark and Zenaidi, 1999).

A number of empirical studies examined the impact of economic factors on the sovereign ratings and on the difficulties of a country to service its external debt (e.g., Feder and Uy, 1985, Cantor and Packer, 1996, Haque et al., 1996, Larrain et al., 1997, Jüttner and McCarthy, 2000, Monfort and Mulder, 2000, Mulder and Perrelli, 2001 and Alfonso, 2003). The use of a parsimonious set of economic variables constitutes the common feature of these studies. The selection of the explanatory variables is essentially dictated by various rating agencies' reports and by theoretical studies on sovereign default.

[1] See World Bank (2000), Chapter 6, page 126.
[2] See Dailami et al. (2003), Chapter 3. A list of commercial-debt restructuring activities of developing countries since 1980 is provided in an annex to this paper.
[3] This paper only focuses on foreign currency sovereign ratings.
[4] Bulow (1992) and Duffie et al. (2003), for example, discuss the differences between corporate and sovereign default.

Since the willingness of a government to pay is a crucial factor that distinguishes sovereign debts from corporate debts, political factors should play a key role in determining sovereign ratings. However, few empirical evidence has been devoted to political risk (see, for instance, Brewer and Rivoli, 1990, Cosset and Roy, 1991, Lee, 1993, Haque et al., 1998 and Mckenzie, 2002). According to Haque et al., omitting political variables, when studying the determinants of sovereign credit ratings, can induce bias in the parameter estimates for the economic variables.

All these articles, with the exception of Mckenzie (2002), choose a priori some variables that seem to be relevant to explain the relationship between these variables and a government's ability and willingness to pay its debt. Mckenzie proposed an alternative approach by using a principal components analysis (PCA hereafter) to identify, among the 46 variables of his data set, the common factors that affect the default to the International Bank for Reconstruction and Development (IBRD). His analysis suggested that most of the variation in default to IBRD can be explained in terms of twelve factors.

This paper aims to examine the determinants of the sovereign ratings of the three most prominent rating agencies, i.e., Fitch Ratings, Moody's and Standard and Poors (S&P). The data is composed of the ratings of 86 countries on December 31st 2003, and 49 economic and political variables observed at December 31st 2002. Following Mckenzie (2002), unlike other studies on sovereign ratings, the PCA method is employed to identify a set of thirteen factors that describe these ratings. While twelve are economic factors, one of them can be clearly assimilated to a political factor. Each factor thus identified is correlated with a certain number of variables. The effect of these variables on ratings is then assessed through a linear regression model and an ordered logistic model. The former enables retains eleven variables, while the latter reduces the set of variables to nine. The evidence, consistent with other similar studies, suggests that per capita income, government income, real exchange rate, inflation rate and default history are the variables which have the most significant impact on sovereign ratings. In contrast to the findings of previous studies, corruption index, which reflects the development level, as well as the quality of governance of a country, has a strong influence on ratings. Finally, although the two models exhibit high predictive power, the logistic model provides better results than the regression model.

The remaining of the paper is organized as follows. Section 1 provides a brief review of the literature on sovereign debt and default. Rather than attempting an exhaustive survey of the literature, this section focuses on the fundamental articles that can explain the use of a set of explanatory variables. The rating systems of sovereign debts and the data are described in

the second section. Section 3 presents and discusses the empirical results obtained by the regression and the logistic models. Finally, section 4 concludes.

1. The sovereign debt literature and the selection of explanatory variables

The potential determinants of sovereign debt-servicing difficulties, default and sovereign ratings selected by different empirical models were derived from theoretical models on sovereign default, previous empirical evidence or rating agency reports. All these sources taken together suggest that sovereign credit risk can be captured by a relatively small number of economic and political variables; these variables do not differ markedly from one study to another. Table 1 displays a list of the most important variables used in the literature affecting the probability of sovereign default and thus sovereign ratings[5].

Most of the existing theoretical models dealing with sovereign debt and sovereign default can be divided in two main approaches[6]. The first one raises the question as why do sovereign debtors repay their debt, since, if they default, the lender may not have recourse to a bankruptcy code or to a legal procedure to enforce payment. Eaton and Gersovitz (1981) suggested that the willingness to maintain a good reputation and to preserve future access to credit markets[7] constitutes an incentive for countries to repay their debt. The rationale behind this result is that a country decides to honour its debt obligation if the future cost of unavailable loans is greater than the short-term benefit of higher consumption. On the other hand, Bulow and Rogoff (1989b) showed that, under general conditions, a small country (price taker) will decide to default if cash-in-advance contracts allow it to hedge future stochastic output and lending. Lending to small countries is made possible if additional economic, political and legal sanctions are imposed. A country rarely makes an outright default but, rather, renegotiates its original debt. Bulow and Rogoff (1989a) developed a model, based on the threat of future sanctions, in which the rescheduling of (or default on) a country's debt results from a bargaining game between creditors and the borrower. The choice made by the latter is based on an assessment of the costs and benefits of rescheduling or defaulting. Since countries have not only domestic debt but also foreign denominated debt, the question raised

[5] Aylward and Thorne (1998) and Peter (2002), for instance, provided tables gathering all the variables tested in the most important studies in the existing literature.

[6] As the main goal of this paper is to provide an empirical study of the determinants of sovereign ratings, the review of the theoretical literature focuses on the fundamental articles. For a systematic overview of the literature on sovereign debt and default, interested readers should refer, for instance, to Eaton and Fernandez (1995) and Obstfeld and Rogoff (1996).

[7] See, also, Eaton, Gersovitz and Stiglitz (1986) and Grossman and Van Huyck (1988).

above can be specified in the following manner: Why do countries pay their foreign currency debt? Kremer and Mehta (2000) argued that the more a government is indebted to foreigners the more it is incited to default. Indeed, foreign currency sovereign ratings are generally lower than domestic ratings (see, for instance, Trevino and Thomas, 2001). However, countries may be inclined to pay their external debt for three main reasons. First, foreign creditors may seize the foreign assets (if any) if a country reneges on its debt. Second, a country may not have access to future foreign loans. Finally, default on external debt may have a negative impact on international trade (see, for example, Gibson and Sundaresan, 2001 and Rose, 2002).

Under this approach, a country trades off the costs and benefits of making debt payments or of defaulting on debt (Haque et al., 1996). The probability of default is thus an increasing function of variables inciting a country to default and it is a decreasing function of variables raising the cost of default. Sovereign credit ratings are inversely proportional to the default probability. The main economic variables considered in the literature are: per capita income, gross domestic product (GDP) growth, inflation rate, economic development, ratio of foreign debt to GDP, real exchange rate, and default history.

Table 1. Description of the potential explanatory variables

Variable	Economic Rationale	Theoretical predictions
Per capita income	An increase of the per capita income implies a larger potential tax base and a greater ability for a country to repay debt.	-
Gross Domestic product (GDP) growth	An increasing rate of economic growth tends to decrease the relative debt burden. Moreover, it may help in avoiding insolvency problems.	-
Inflation rate	A low inflation rate reveals sustainable monetary and exchange rate policies. It can also be seen as a proxy of the quality of economic management.	-
Economic development	Developed countries are integrated within the world economy and are less inclined to default on their foreign debt in order to avoid sanctions from the lenders.	-
Current account	A large current account deficit implies the dependence of a country on foreign creditors. A persistent deficit affects the country's sustainability.	+
Foreign debt/GDP	This ratio is negatively related to default risk.	+
Real exchange rate	The real exchange rate assesses the trade competitiveness of the economy.	+

Default history	A country's default history affects its reputation.	+
Ratio debt/GDP	The higher this ratio is, the greater the occurrence of a liquidity crisis.	+
Ratio reserves/imports	The higher this ratio is, the more reserves are available to service foreign debt.	-
Ratio investment/GDP	This ratio captures the future growth ability of a country and it is a decreasing function of default.	-
Corruption Index	This index is a measure of political risk and can reduce a country's willingness to pay.	+
Regulatory quality, accountability, rule of law and political stability	These indicators provide a means of evaluating the governance of a country and affect a country's willingness to pay.	-

Table 1 displays a list of the most important variables, used in the literature, affecting the probability of sovereign default and thus the sovereign ratings. It briefly explains the relationship between each variable and the ability and the willingness of country to pay its debt. For theoretical predictions, a sign + (-) means that the theory predicts a positive (negative) relation between the explanatory variable and the risk of default.

The second theoretical approach to sovereign default risk is described by Haque et al. (1996) as the debt-servicing capacity approach. In this approach, it is the unintended deterioration of the country's capacity to service its debt that could cause its default. Countries may be unable to repay their (internal/external) debt because they are either insolvent or illiquid. The sustainability of a debt, as a result of short-term liquidity or of long-term solvency, is likely to determine the probability of default. Sustainability may be affected, for example, by macroeconomic variables, economic policy, currency crises, short-term budget mismanagement or by internal/external shocks. The sovereign crises which occurred in recent years (South Korea, Brazil, Turkey, Russia, Ecuador, and Argentina) illustrate debt-servicing difficulties, ranging from debt rescheduling to outright defaults, that a country may face. A country may be illiquid, while being solvent if creditors decide not to reschedule/restructure short-term debts. On the other hand, excessive long-term debt may be associated with an insolvency situation. In some cases, outright default has been avoided by the intervention of the international financial institutions. However, as discussed by Roubini (2000), though it is not easy, in practice, to differentiate solvency from liquidity, several indicators allow to asses a country's sustainability.

According to this strand of theoretical literature the following indicators are suggested: current account, inflation rate, real exchange rate, fiscal balance, foreign debt, public debt, ratio debt to GDP, short-term external debt, and ratio of international reserves to imports. A number of the economic variables are common to the two approaches, since they affect the opportunity cost of a country to make debt payments as well as its capacity to service its debt.

However, the impact of the political risk on the probability of default is different in the two approaches. In the first one, political risk has an impact not only on the ability but also on the willingness of a country to pay its debt. In the second one, political risk relies on the quality of economic management and influences the debt-servicing ability of a country.

Since agencies have recently begun to rate a large number of countries, few empirical studies examine the determinants of the sovereign credit ratings. Early examples of this literature are Feder and Uy (1985), Cosset and Roy (1991) and Lee (1993) who analysed ordinal rankings of sovereign risk based on data provided by two international publications: *Euromoney* and/or *Institutional Investor*. The empirical evidence provided by Haque et al. (1996) indicated that the economic variables could explain a large part of the variations of the country creditworthiness ratings produced by these two magazines and the *Economic Intelligence Unit*. In a subsequent paper, Haque et al. (1998) found that, in accordance with Lee (1993), that economic variables have more influence than political variables on sovereign ratings.

The reference paper of Cantor and Packer (1996), based on a sample including industrialized and developing countries in September 1995, suggested that among the plethora of the criteria used by Moody's and S&P, six variables (per capita income, GDP growth, inflation, external debt, level of economic development and default history), are likely to explain the ratings. Alfonso (2003) using the same methodology as Cantor and Packer, and data available in June 2001, concluded that while GDP per capita is the sole relevant variable in explaining the determinants of ratings of developed countries, external debt plays a key role for developing countries. The study realised by Cantor and Packer was replicated by Jüttner and McCarthy (2000) for the period 1996 to 1998. The explanatory power of the Cantor and Parker model deteriorates in 1997 due to the financial crisis of the emerging markets (Thailand, Russia and Brazil, for example). Their results reveal that this relation is not stable over time. Monfort and Mulder (2000), with a sample of twenty emerging market economies for the period 1994-1999 - which includes the Asian economic crisis of 1997 - confirmed these results and found that estimations display autocorrelation. Moreover, by testing a dynamic error correction specification of the model, they suggested that the ratings exhibit a high degree of inertia and seem to follow a random walk (i.e., they react only to unexpected innovations in variables). However, some lagged variables (debt over exports and export growth) appear to contribute to current ratings. Mulder and Perrelli (2001) used a panel of twenty five countries, including the emerging market economies, for the period 1992-1999. Empirical evidence shows that a static equation of six economic variables, in accordance with

other studies, appears to explain a large part of the variations in ratings. Nonetheless, since their sample did not include industrialized countries, a major difference relative to other studies is that the key variable explaining ratings is the ratio of investment to GDP and not variables such as per capita income, GDP growth and inflation. Moreover, the Asian crisis led some rating agencies to amend their methodologies in order to attach a greater importance to liquidity risk, which can be measured by the ratio of short term external debt to reserves.

2. Sovereign credit ratings and data

Sovereign credit ratings are an assessment of the creditworthiness of a government's ability and willingness to make timely payment of the principal and the interests (the service) of its debt[8]. Ratings are estimates of a potential occurrence of default. They allow estimating future probabilities of default of a government but they do not address the default risk of other issuers of the same country[9]. There are differences between local and foreign currency sovereign ratings. Typically, ratings of foreign currency-denominated debt are lower than those of domestic currency debt as the former take into account sovereign transfer risk. Indeed, a government may service its local currency-denominated debt by having recourse to taxes or money creation. In contrast, sovereigns must secure their foreign exchange reserves to service the foreign currency-denominated debt. Moreover, a government may put obstacles to the payment of foreign currency debt of private entities to non-resident creditors. The ratings assigned are based on those quantitative and qualitative variables that rating agencies consider reliable. The quantitative variables include a number of economic and financial measures, while the political and policy aspects constitute for the most part a qualitative appraisal of default.

Sovereign credit ratings are relative measures of creditworthiness since countries are rated against other countries. Rating agencies assign a grade to a borrower according to its degree of relative creditworthiness. The grades range from AAA, the highest rate, (Fitch and S&P) or Aaa (Moody's) to respectively D and Caa, the lowest rate. For example, a credit rating between AAA and BBB- is used to denote an "investment grade" debt, while a debt rated BB+ to D is considered as speculative or "high yield". Although the three agencies use

[8] Peter (2002) provided a discussion on the definition of the sovereign default.
[9] Notice that sovereign ratings affect corporate ratings and debt markets. When investors have little information about a country and its firms, they tend to associate sovereign ratings to "country risk".

different symbols for their ratings, there is a correspondence between the different rating systems. This correspondence allows transforming the rating notches[10] into numbers.

The data used in this paper include the foreign currency ratings of 86 countries at December 31st 2003, and, for each country, the 2002 values of a series of 49 economic and political indicators. Ratings from the three major rating agencies, Fitch, Moody's and S&P, were used when available. All countries were rated by Fitch, 75 by Moody's and 74 by S&P. Thus, ten countries were rated by Fitch only, one by Fitch and S&P, and two by Fitch and Moody's. The rating assigned by agencies being a discrete variable, ratings were transformed into a continuous variable trough a linear scoring system: a value of 21 is associated to the highest rating grade, AAA, while 0 corresponds to the lowest grade, D. The scores obtained for each country were subsequently averaged. As shown in annex 1, the ratings do not differ significantly across the three rating agencies[11]. The difference between the average rating score of Fitch and Moody's is 0.34 notch; between Fitch and S&P 0.04 notch; and between S&P and Moody's 0.36 notch. In only two cases, Argentina and Turkmenistan, a difference higher than three notches is observed. In each case, Moody's rating is higher than that assigned by Fitch and S&P. In addition, these countries are rated in the lower end of the scale; hence, the rating differential may be more attributable to differences in the scaling system than in credit quality assessment, as Moody's uses a 21 notches scale as opposed to a 24 notches scale for Fitch and S&P.

A total of 49 economic, political and social indicators were collected on these countries (see, Annex 2), covering the period 1998 to 2002; they were obtained from Fitch Ratings' *Sovereign Comparator*, which gathers data from various official sources, mostly the International Monetary Fund (IMF). This data is split into eight different categories, corresponding to the criteria classification used in Fitch's sovereign rating methodology: economy, money and banking, government finance, exchange rate and competitiveness, trade openness, external assets and liabilities, income, demographics and society. We also included in our empirical analysis the sovereign default history, which is quoted as a key factor by all rating agencies and by previous empirical studies. Data concerning sovereign defaults on official debt (i.e. Paris club and multilateral creditors[12]) were collected from the World Bank's *Global Development Finance* (2003) and transformed into a dummy variable using the

[10] A notch is a one-level difference on a rating scale.
[11] Larrain et al. (1997) studied the Moody's and S & P sovereign ratings and found that they are not statistically different.
[12] The Paris Club gathers official bilateral creditors. Multilateral creditors are principally multilateral development banks, such as the World Bank or the African Development Bank.

following scoring system: countries which defaulted or rescheduled their debt to official creditors at least once in recent history were assigned a score of one, while countries with no default history were assigned a score of zero.

3. Empirical study

This section aims to identify the possible factors that explain the sovereign ratings and to examine their impact on these ratings. The empirical work follows three steps: firstly, data reduction and identification of variables with the highest explanatory power through PCA; specification and testing of a rating determination model, secondly, through a regression analysis; and, finally, through an ordered logit analysis. For each step, the method used is briefly described and the results obtained are presented.

3.1 Principal components analysis

In order to attain a parsimonious set of determinants of sovereign ratings, a PCA is used. This method allows us to reduce the initial set of independent variables, noted x_i, with *i* varying from 1 to *n*, by removing redundant variables and extracting factors with the highest explanatory power. Factors, noted w, are a linear combination of *p* original variables with *p* = *1, 2, …, n:* $w = \sum_{i=1}^{p} \beta_i x_i$

The determination of the common factors affecting sovereign ratings involves two stages: identifying and interpreting the factors. The first stage consists in identifying factors which have the lowest correlation pairwise and then determine how much of the total variance of the variable they account for. The objective is to extract the factors that account for the highest portion of the variation in the original variables. The first factor explains the largest percentage of the total variation. Then, the second factor explaining the largest share of the remaining unexplained variance, and that has no correlation with the first factor, is extracted, and so on until the number of identified components equals the number of original variables. We then simply can extract the components which explain a share of variance above a certain threshold. In standard PCA, this threshold is expressed in terms of the amount of variance in the original variables explained by each component (or eigenvalue). This threshold is usually set at one.

Table 2. Proportion of variance explained by extracted variables

Component	Total	Percent of variance explained	Cumulative percent of variance explained
1	10.10	21.05	21.05
2	5.57	11.60	32.65
3	4.65	9.70	42.35
4	3.56	7.42	49.77
5	2.86	5.95	55.72
6	2.38	4.96	60.68
7	2.08	4.33	65.01
8	1.69	3.52	68.53
9	1.50	3.12	71.65
10	1.46	3.04	74.69
11	1.28	2.67	77.36
12	1.12	2.34	79.70
13	1.05	2.18	81.88

Table 2 shows the relative importance of the thirteen factors in explaining the variation of sovereign ratings. A total of 48 economic, political and social indicators were collected on 86 countries at the end of 2002. Column 2 exhibits the percent of variance explained by each factor, while column 3 gives the cumulative percent of variance explained by the factors.

A total of thirteen factors, having an eigenvalue higher than one, were extracted. Table 2 displays the results, and shows the relative importance of each factor in explaining the variation of sovereign ratings. The marginal contribution of each factor to the total amount of explained variation is decreasing. The factor with the largest explanatory power accounts for 21.05% of variance of all variables; the second largest for 11.60% and so on. In total, the thirteen extracted factors account for 81.88% of total variance. This indicates that the original data set can be reduced from 49 to 13 factors with only an 18.12% loss.

The next stage consists in determining the significance of the extracted components. For this purpose, we have to identify those variables which provide the best representation of the extracted factors. This can be done by computing the correlation matrix of components, which is shown in annex 3. The first component, i.e. the one with the largest explanatory power, is closely correlated with labour cost per worker, corruption perception index, and value added per worker. This factor is clearly associated with the level of development of countries. Public debt ratios – net and gross public external debt to current external receipts – and net external debt, are the variables most correlated with the second factor, which indicates that it is representative of countries' external and public indebtedness. Applying the preceding analysis to all correlation coefficients of 0.5 and higher allows us to identify the nature of the thirteen factors. Table 3 reports the list of the extracted factors and their significance. Three

striking features of this table need to be mentioned. First, the corruption level – measured by Transparency International Index - which could be a priori considered as a political factor, appears highly correlated with variables associated with the level of development. It follows that this index can be also considered as a proxy for the level of development. Second, we observed a link between the weight of non manufactured goods and measures of money supply, in particular M2 to GDP, which is also a proxy for the degree of bank intermediation in a country. This suggests that countries which export low value-added goods have economies with a low degree of bank intermediation. Nonetheless, this is not true for oil exporting countries, such as Bahrein or Kuwait. Third, our results show that high external debt is associated with trade dependency. These two indicators are associated with the degree of openness of the economy and its reliance on external sources of financing.

Table 3. Identification of extracted factors

Factor	Significance
1	Development level
2	Public indebtedness
3	Quality of governance / political stability
4	Economic growth
5	Money supply
6	External Liquidity
7	External indebtedness and openness
8	Inflationary pressure
9	Net investment inflows
10	Size of the economy
11	Competitiveness
12	Debt servicing
13	Balance of payments

Table 3 reports the thirteen factors and their interpretation.

This table indicates that any model which aims at determining the rating of countries could be reduced to the thirteen factors listed above. The classification of factors does not differ substantially from that proposed by rating agencies in their methodologies. The most important difference lies in the strong weight attached to development level, which is not

explicitly stated in such methodologies. PCA analysis, however, does not provide information regarding the effect of each factor on the ratings assigned by agencies.

3.2. Ordinary least square regression

The second step of our empirical work aims at identifying which variables have the most significant influence over agencies' ratings. The ultimate goal is to build a model allowing us to determine rating in year *t* with data of year *t*-1. We opted for a cross sectional regression analysis, as the literature on sovereign ratings determinants demonstrated that this type of model yielded good quality results. Each factor identified through PCA is correlated with a certain number of variables. Our objective is then to select, among them, the variable which has the most signifcant impact on the ratings. This can be achieved by testing several equations in order to obtain the model which provides the best relationship between the set of independent variables, x_i, and the rating score for a country k, y_k. For that purpose, an ordinary least squares (OLS) regression analysis was performed: the intercept b_0 and coefficients a_0, b_1, …, b_n of the equation (1) were estimated:

$$y_k = b_0 + a_0 d + b_1 x_1 + b_2 x_2 + ... + b_n x_n + \varepsilon_k \qquad (1)$$

where *d* is a dummy variable taking the value of 0 if the rated country has no default history and the value of 1 if the country has rescheduled its debt to official creditors at least once. The residuals, ε_k, are assumed to be independent and identically distributed across countries and have zero mean and unit variance.

An empirical analysis was conducted for the average ratings of the three agencies. For each equation tested, the R^2 is calculated and the t-test is applied to the estimators of the intercept and coefficients, as well as the F test to the whole model. The correlation coefficients between dependant variables were calculated in order to assess colinearity. The model with the highest R^2, 0.953, included fourteen variables and the dummy. After removing the variables which exhibit high correlations, a reduced form of this model, including eleven variables, was finally selected, yielding a R^2 of 0.934 and a F Statistics of 205.9 significant at the 1% level. This model is more robust than those presented by any of the empirical studies presented so far.

The matrix of correlation coefficient between the eleven selected variables (see, annex 4) was computed. Only one pair of variables, the Gross National Income (GNI) per capita (in USD) and the corruption perception index, exhibits strong correlation (0.88). No violation of

OLS regression hypotheses has been detected. The Durbin Watson test, at 1.999, allows us to reject the hypothesis of first order correlation of residuals.

Table 4. Ordinary Least Square regression : model specification

Independent selected variables	Coefficient	t-statistics
Intercept	8.8296*	13.9245
Default history	-1.5748*	-5.0849
GNI PPP(1) per capita (in USD)	0.0001*	5.7590
Consumer prices (annual average % change)	- 0.1204*	-6.2482
REER(2) (% change)	0.0769*	6.1873
GPXD(3) (% of CXR)	-0.0067*	-3.7989
Corruption perceptions index	0.6738*	7.4533
Non-manufactured goods (% of export)	-0.0247*	-5.7057
Trade dependency (%)	-0.0201*	-4.3127
Gross domestic savings (% of GDP)	0.0748*	5.9333
Government revenue (% of GDP)	0.0564*	4.6051
Reserves (% of M2)	-0.0043*	-2.7123

Table 4 shows the results for the OLS regression. Data collected include the ratings, of 86 countries, published at December 2003, and a set of eleven selected variables available at the end of 2002. The model allows determining rating in year *t* with data of year *t*-1. * denotes significance at the 1% level. R^2 = 0.934. F Statistic: 205.9. Durbin-Watson Statistic: 1.999. (1) Gross National Income, Power Purchase Parity. (2) Index of Real Effective Exchange Rate. (3) Gross Public External Debt, Current External Receipt.

The comparison of the variables included in the OLS regression model (equation (1)), listed in table 4, with the factors extracted in PCA (table 3) shows that all the factors extracted are included in the model except three: the amount of money in circulation, the size of the economy, and debt service (this can be explained by the fact that the effect of debt service is captured by indebtedness indicators). The t-statistic indicates that countries' development level (represented by the corruption index, per capita income and government revenue), competitiveness (changes in the Real Effective Exchange Rate (REER)) and inflation (consumer prices) are the factors exhibiting the most significant influence on credit rating. It is worthwhile noting that the corruption perception index is also a good proxy for the quality of governance.

The regression results, reported in table 4, also reveal that all the regression coefficients have the expected sign and are statistically significant at the 1% level. Per capita income, changes in real exchange rate, gross domestic savings, government revenue and corruption index have a significant positive impact on ratings. Notice that the coefficient of

the corruption index is positive since the highest note (10) is attributed to uncorrupted countries. These findings corroborate the idea that developed and more competitive countries have higher ratings, in general, than developing countries. Negative effect on ratings is produced by inflation, external debt, non-manufactured goods, trade dependency and reserves. This effect reflects the fact that countries with lower level of foreign debt and low inflation are less likely to default and get a better rating. The results underpin the strong influence of the default history of sovereign borrowers over rating agencies' decisions. The coefficient of the dummy variable is high and statistically different from zero. This means that countries which have defaulted once on their official debt are rated, on average, 1.6 notches below countries with good track records. This result has to be interpreted carefully, as the default history is linked with a country's wealth and government debt, which have been captured in other variables. However, it constitutes an important indicator of a country's willingness to repay its debt. Indeed, several countries rescheduled their official debt in recent years, while their economic fundamentals did not deteriorate to the point where they could not assume the service of external debt: this was the case, for instance, of Gabon or Nigeria.

An important issue is to examine the accuracy of the model as measured by its predictive power. Residuals provide a measure of the accuracy of the model, as they are obtained by the difference between estimated value and observed value of y_k. It is interesting to point out, as table 5 shows, the exceptional predictive power of the model. Indeed, for our sample of eighty-six countries, the difference between predicted and observed rating values is less than two notches for seventy-two countries, and three notches for eighty-three countries.

Table 5. Comparison between observed and predicted rating values

Difference between observed and predicted rating notches	Total number of countries	Cumulative number of countries	Cumulative percent of countries
4 notches and more	1	1	1.16%
3 to 4 notches	2	3	3.49%
2 to 3 notches	11	14	16.28%
1 to 2 notches	25	39	45.35%
Less than one notch	47	86	100%

Table 5 displays the results related to the accuracy of the model measured by the difference between observed and predicted rating values. It shows the number (total and cumulative) of countries (columns two and three) and the cumulative percent of countries (column four) corresponding to differences, in notches, between these ratings.

The analysis of the absolute value of residuals leads to the conclusion that the model is fairly accurate: the mean absolute value of residuals is 1.10, which indicates that the average difference between predicted and observed ratings is slightly above one notch. Only one estimated rating (see tables 6A and 6B), Luxembourg, deviates by more than four notches from the observed ratings and only two, Ecuador and Ukraine, by three rating notches. For Luxembourg, the model predicts a score of 25.37, which is four notches above the maximum, 21. This would not even appear as a prediction error if we associate the highest rating, AAA, to a score of 21 and more. This limitation in the scoring system used helps explain the prediction error for Norway and Sweden. Ecuador and Ukraine which defaulted on official debt respectively in 2000 and 2001, provide a good illustration of the negative impact that recent defaults produce on the perception of creditworthiness. They are both rated on average three notches below the predicted rating score. Although their economic fundamentals have been somewhat improved since then, rating agencies prefer to wait before upgrading the rating to a level corresponding to economic fundamentals. The same argument can be brought forward to explain the low ratings assigned by agencies to Cape Verde, Indonesia, which restructured their debt in 2002, and Uruguay, which defaulted in 2003. The Dominican Republic, with an observed rating 2.3 notches below the predicted score, saw its financial situation deteriorate considerably in the course of the year 2003, which was reflected in the December 2003 rating, but does not appear in the economic data of 2002. These facts reveal, for some cases, the difficulty in using a prediction model based on lagged dependant variable

Table 6A. Analysis of residuals

Residuals with absolute value higher than two notches			
Observed rating < predicted rating		Observed rating > predicted rating	
Luxembourg	-4.37	Slovenia	2.06
Ukraine	-3.46	Poland	2.17
Ecuador	-3.04	Spain	2.18
Dominican Rep.	-2.33	Greece	2.47
Cape Verde	-2.2	South Africa	2.47
Uruguay	-2.13	Egypt	2.76
Indonesia	-2.12		
Papua N. Guinea	-2.09		

Table 6B. Analysis of residuals

Residuals with absolute value higher than one notch			
Observed rating < predicted rating		Observed rating > predicted rating	
Norway	-1.88	El Salvador	1.06
Israel	-1.85	Australia	1.08
India	-1.81	Ireland	1.10
Korea	-1.80	Italy	1.14
Lebanon	-1.70	Kazakhstan	1.16
Brazil	-1.45	Mexico	1.21
Sweden	-1.38	Germany	1.24
Bahrain	-1.37	Russia	1.35
Iran	-1.35	Taiwan	1.47
Hong Kong	-1.12	France	1.66
		Latvia	1.70
		Chile	1.72
		Portugal	1.80
		United States	1.86
		San Marino	1.88

Tables 6A and 6B report the absolute value of residuals, for each country, when observed ratings are higher or lower than predicted ratings.

Other large residuals can be attributed to factors linked with political issues and external affairs, which are not entirely captured by the model. This is particularly true for a number of developed countries which benefit from a rating premium due to their favourable political context: the ratings of Australia, France, Germany, Ireland, Italy, Portugal, the United States, New Zealand, Singapore and the United Kingdom. The political rating premium is particularly high for countries which were among the last to join the European Union (EU) (Spain and Greece) or who joined EU on May first 2004 (Poland and Slovenia), which indicates that being part of the EU may be a factor worth being integrated in a rating model. Few developing countries benefit from ratings higher than those predicted by the model: this is due to the fact that the political context in most of these countries is considered negatively by rating agencies. Two exceptions have to be mentioned however: Egypt and South Africa. Political stability explains the fact that observed ratings are more than two notches higher than the ratings predicted by the model. On the other hand, most countries which have been assigned a rating lower than that predicted by the model are countries suffering from political instability or from some kind of external threat: most Middle East

countries (Bahrein, Iran, Israel and Lebanon) fall into this category, while the ratings of Hong Kong and South Korea are affected by the particular relationship they have with China.

3.3 Logistic modelling

An ordered logistic model is used to compare these results with those obtained by the OLS regression. Logistic models are used when dealing with discrete dependent variables. Logistic regressions relate the probability of occurrence of an event, dichotomous outcomes (binary models) or multinomial outcomes (multinomial models), to a host of explanatory variables. Within the multinomial models, ordered logistic models are used when the dependent variable is an ordinal variable which measures ranks such as ratings.

Using a logistic model allows us to relax the strong assumption made by the OLS model, i.e. a rating is a continuous variable. It follows that the ordered logistic model is well adapted for modelling sovereign ratings which are clearly ordinal variables: the range of values taken by the sovereign ratings, the dependent variable, is equal to the number of rating classes. The goal of this model is to express the probability of a rating score assigned to a country as a function of the economic and political determinants of this country. The probability is obtained by applying a logistic function to a score obtained by a linear combination of independent variables. Only the most statistically significant variables are retained. Hence, the model also helps identify which variables have the largest influence over the rating agencies' choices.

Table 7. Logistic regression: model specification

Independent selected variables	Estimated coefficient	Wald Test
REER[(1)] (% change)	0.115*	15.398
Gross domestic savings	0.079*	5.100
GPXD[(2)] (in % of CXR)	-0.013*	7.814
GNI PPP [(3)] per capita (in USD)	0.000*	19.427
Consumer prices (% change)	-0.133*	10.398
Trade dependency	-0.034*	6.748
Government revenue (% of GDP)	0.070*	5.423
Corruption perception index	0.736*	8.773
Default history (dummy)	1.394*	4.411

Table 7 reports the results of the logistic regression. Data collected include the ratings, of 70 countries, published at December 2003, and a set of nine selected variables available at the

end of 2002. The model allows determining rating in year *t* with data of year *t*-1. * denotes significance at the 1% level. Likelihood ratio chi square: 177.529. Mc Fadden pseudo R^2 = 0.478. (1) Index of Real Effective Exchange Rate. (2) Gross Public External Debt, Current External Receipt. (3) Gross National Income, Power Purchase Parity.

Table 7 exhibits the estimated coefficients for each independent variable and the value of the Wald test for each parameter. The independent variables are those obtained from the OLS regression. However, two variables (non-manufactured goods to exports and reserves to M2), which were not significant at the 5% level, are omitted. The logistic estimated coefficients for these variables have the same sign as for the regression coefficients and, therefore, the same conclusions can be derived.

The value of the Wald statistic indicates that all parameters are significant at the 5% level. Goodness of fit of the full model can be measured by the ratio of likelihood; comparing it with a chi square distribution with nine degrees of freedom shows that the parameters of the model are significant at the 1% level. The McFadden R^2, which measures the explanatory power of the model, is also computed and stands at 0.478.

Table 8A. Analysis of residuals

Residuals with absolute value higher than three notches			
Observed rating < predicted rating		Observed rating > predicted rating	
Ukraine	-4	Egypt	4
		Philippines	3

Table 8B. Analysis of residuals

Residuals with absolute value higher than two notches			
Observed rating < predicted rating		Observed rating > predicted rating	
Azerbaijan	-2	Portugal	2
Croatia	-2	Singapore	2
Dominican Rep.	-2	South Africa	2
Ecuador	-2	Spain	2
Hong Kong	-2	Taiwan	2
Iceland	-2	Turkey	2
Indonesia	-2		
Japan	-2		
Korea	-2		

Tables 8A and 8B report the absolute value of residuals, when observed ratings are higher or lower than predicted ratings, for each country.

The model provides, for each rating class *j*, the probability that the country k is assigned the rating y_k, *j* varying from one to eighteen[13]. The difference between predicted and observed rating, i.e. the residuals, is then calculated. The analysis of residuals (see tables 8A and 8B) provides information on the robustness of the model. In total, the model provides an exact prediction of countries' ratings in thirty-one cases out of seventy. Differences of two notches occur in fifteen cases and one notch in twenty-one cases. Overall, the model can predict in sixty-seven out of seventy cases the rating within a two notches confidence interval. Only two predicted ratings differ by four notches from the observed rating - Ukraine and Egypt – and only one by three notches – the Philippines. The accuracy of the model appears slightly higher than that of the OLS model. However, more detailed comparison with OLS is made impossible by the fact that residuals are continuous variables in OLS, while they are discrete for the logit model. Except for the Philippines, outliers are the same as for the OLS model. A number of the predicted ratings differing from the observed rating by two notches are distinct from those obtained with OLS (Azerbaijan, Croatia, Iceland, Japan and Turkey). The rating premium for developed countries noted in the OLS analysis does not appear clearly in the results from the logit model.

4. Conclusion

The objective of this paper was to study the determinants of sovereign credit ratings of the three major rating agencies. These agencies use a host of variables in their assignment of sovereign ratings. A Principal Component Analysis allows the identification of thirteen factors, each of which is highly correlated with certain variables that appear to explain sovereign ratings. Both economic and political factors have a significant impact on sovereign ratings. In order to examine the variables having the most important influence on the ratings, the results obtained by a least square regression are compared with those of an ordered logistic model. The latter model retains nine variables instead of eleven variables for the former (non-manufactured goods to exports and reserves to M2 are excluded). Our findings reveal that six variables seem to have the most significant impact on sovereign ratings. As would be expected from theoretical arguments, per capita income, government income and changes in the real exchange rate have a positive effect on the ratings, while inflation rate has a negative one. Moreover, the default history of a country turns out to be a crucial determinant of sovereign

[13] The original number of rating classes, 24 , is reduced to 18, due to the absence of observations in classes D, CC, CCC- and CCC.

ratings. It is interesting to mention that the corruption index may be interpreted as an economic variable, since it is an indicator of a country's development level, but also as a political variable, since it reflects the quality of governance.

The regression model and the logistic model successfully predict sovereign rating levels. Respectively, approximately 55% (74%) of the ratings are predicted with a difference of one notch. A spread of two notches between predicted and observed ratings is respectively about of 84% (95%). The logistic model behaves better than the regression model.

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Appendix

Annex 1. Rating score of sample countries by agencies

Country	Fitch	Moody's	S&P	Average
Argentina	0	4	0	1.33
Aruba	13	na	na	13.00
Australia	20	21	21	20.67
Austria	21	21	21	21.00
Azerbaijan	9	na	na	9.00
Bahrain	15	12	15	14.00
Belgium	19	20	20	19.67
Bermuda	19	20	19	19.33
Brazil	8	7	8	7.67
Bulgaria	11	10	11	10.67
Cameroon	7	na	na	7.00
Canada	20	21	21	20.67
Cape Verde	8	na	Na	8.00
Chile	15	14	15	14.67
China	15	16	13	14.67
Colombia	10	10	10	10.00
Costa Rica	10	11	10	10.33
Croatia	12	12	12	12.00
Cyprus	17	16	16	16.33
Czech Rep	15	17	15	15.67
Denmark	21	21	21	21.00
Dominican Republic	7	8	6	7.00
Ecuador	5	4	5	4.67
Egypt	11	11	11	11.00
El Salvador	11	12	11	11.33
Estonia	15	17	15	15.67
Finland	21	21	21	21.00
France	21	21	21	21.00
Gambia	6	na	na	6.00
Germany	21	21	21	21.00
Ghana	7	na	8	7.50
Greece	17	17	17	17.00
Hong Kong	18	17	17	17.33
Hungary	15	17	15	15.67
Iceland	18	21	17	18.67
India	10	11	10	10.33
Indonesia	8	7	7	7.33
Iran	8	na	na	8.00
Ireland	21	21	21	21.00
Israel	15	16	15	15.33
Italy	19	19	19	19.00
Japan	19	20	18	19.00
Kazakhstan	11	12	11	11.33
Korea	16	15	15	15.33
Kuwait	18	16	17	17.00
Latvia	14	16	14	14.67
Lebanon	6	7	6	6.33
Lesotho	8	na	na	8.00
Lithuania	13	14	14	13.67
Luxembourg	21	21	21	21 .00
Malawi	5	na	na	5.00
Malaysia	14	14	15	14.33
Malta	16	15	16	15.67
Mexico	12	13	12	12.33
Moldova	6	5	na	5.50
Mozambique	7	na	na	7.00
Netherlands	21	21	21	21.00
New Zealand	20	21	20	20.33
Norway	21	21	21	21.00
Panama	11	11	10	10.67
Papua New Guinea	7	8	7	7.33

Peru	9	9	9	9.00
Philippines	10	11	10	10.33
Poland	14	16	14	14.67
Portugal	19	19	19	19.00
Romania	10	8	10	9.33
Russia	11	12	10	11.00
San Marino	19	na	na	19.00
Singapore	21	21	21	21.00
Slovakia	13	15	13	13.67
Slovenia	17	18	17	17.33
South Africa	13	13	13	13.00
Spain	21	21	20	20.67
Sweden	20	21	20	20.33
Switzerland	21	21	21	21.00
Taiwan	17	18	18	17.67
Thailand	13	12	16	13.67
Tunisia	13	13	13	13.00
Turkey	7	8	8	7.67
Turkmenistan	3	7	na	5.00
Ukraine	8	7	7	7.33
UK	21	21	21	21.00
USA	21	21	21	21.00
Uruguay	6	6	6	6.00
Venezuela	6	5	6	5.67
Vietnam	9	8	9	8.67
Mean	**13.57**	**14.60**	**14.39**	**13.66**
Standard deviation	**5.53**	**5.39**	**5.28**	**5.50**

* na: non available

This table provides the rating score for each country assigned by the three agencies, as well as the average score.

Annex 2. Initial set of quantitative independent variables

Economy	GDP in USD million	**External assets and liabilities**	Short-term external debt (% of GXD)
	Real per capita GDP growth (%)		Reserves incl. Gold (USD million)
	Real GDP growth (%)		Reserves (in months of CXP cover)
	Gross domestic savings (% of GDP)		Reserves (% of M2)
	Gross domestic investment (% of GDP)		NXD (% of GDP)
	Consumer prices (ann. Avg. % change)		NXD (% of CXR)
Money and banking	Private sector credit (% change)		NPXD (% of CXR)
	M2 (% of GDP)		Net external borrowing (% of CXR)
	M2 (% change)		Liquidity ratio (%)
	Domestic credit (% of GDP)		GXD (% of GDP)
Government finance	Government revenue (% of GDP)		GXD (% of CXR)
	Government primary balance (% of GDP)		GPXD (% of GXD)
	Government interest payments (% of revenue)		GPXD (% of CXR)
	Government debt (% of GDP)		External debt service (% of CXR)
	Government balance (% of GDP)	**Income**	GNI per capita (in USD) at PPP
Exchange rate and competitiveness	REER (% change)		GDP per head at market exchange rates (USD)
	Labor cost per worker (USD)	**Demographics and society**	Corruption perceptions index*
	Value-added per worker (USD)		Population growth (%)
Trade openness	CAB (in % of GDP)		Political stability index**
	FDI (% of GDP)		Government effectiveness index**
	CXR (% change)		Accountability index**
	Non-manufactured goods (% of export)		Regulatory quality index**
	Average tariff level (%)		Rule of law index**
	Trade dependency (%)		Unemployment (%)

* Source: Transparency International. ** Source: World Bank.

This table exhibits the set of independent variables. GDP: Gross Domestic Product ; REER: Real Effective Exchange Rate ; CAB: Current Account Balance; FDI: Foreign Direct Investment; CXR: Current External Receipts; CXP: Current External Payments ; NXD: Net External Debt; NPXD: Net Public External Debt; GXD: Gross External Debt; GPXD: Gross Public External Debt; GNI : Gross National Income ; PPP: Purchasing Power Parity.

Annex 3. Principal component analysis - Rotated component matrix

	Components												
Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Labor cost per worker (USD)	**0.83**	0.03	0.18	-0.04	0.03	-0.08	0.01	-0.08	-0.05	0.24	0.09	0.04	0.04
Value-added per worker (USD)	**0.76**	0.04	0.01	-0.03	0.05	-0.06	0.10	0.02	0.00	0.44	0.01	0.06	-0.03
Corruption perceptions index	**0.75**	-0.11	0.23	-0.10	-0.15	-0.02	0.01	-0.24	0.12	0.05	0.07	0.07	0.16
Government Revenue (% of GDP)	**0.71**	-0.24	0.08	-0.12	-0.07	-0.15	-0.17	0.05	0.06	-0.21	0.05	-0.11	-0.09
GNI PPP per capita (in USD)	**0.70**	-0.28	0.09	-0.16	-0.26	-0.15	0.06	-0.18	0.31	0.14	0.09	0.27	0.18
Average tariff level (%)	**-0.67**	0.08	-0.23	-0 .04	0.07	-0.04	-0.08	0.09	-0.02	0.09	0.01	0.12	0.01
GDP per head at market exchange rates (USD)	**0.65**	-0.26	0.04	-0.14	-0.20	-0.09	0.06	-0.18	0.27	0.18	0.13	0.39	0.19
Short-term external debt (% of GXD)	**0.49**	-0.24	0.07	-0.05	-0.39	0.02	0.37	-0.16	0.19	0.09	0.14	0.16	0.03
GPXD (% of CXR)	-0.12	**0.85**	-0.03	-0.16	0.17	0.01	-0.13	0.01	-0.04	0.06	-0.01	0.13	-0.20
Government debt (% of GDP)	0.14	**0.80**	-0.12	-0.14	0.11	0.24	0.01	0.07	-0.13	0.04	-0.09	-0.10	-0.08
NPXD (% of CXR)	-0.15	**0.79**	0.02	-0.01	0.07	-0.40	0.01	0.00	-0.03	0.11	-0.18	0.09	-0.06
NXD (% of CXR)	-0.19	**0.70**	0.05	-0.04	0.17	-0.40	-0.14	0.00	-0.27	0.04	-0.14	0.06	-0.05
Government interest payments (% of revenue)	-0.26	**0.70**	-0.17	-0.11	-0.21	0.17	-0.10	0.19	-0.04	-0.14	0.32	0.00	0.01
Government balance (% of GDP)	0.33	**-0.63**	0.04	-0.21	0.48	-0.05	-0.13	0.06	0.04	-0.06	0.23	0.01	0.03
GPXD (% of GXD)	-0.42	**0.51**	-0.13	0.11	0.44	0.02	-0.20	0.19	-0.06	-0.02	-0.19	-0.24	-0.08
Regulatory quality	0.09	-0.07	**0.96**	-0.01	-0.06	-0.03	0.05	-0.04	0.00	0.02	0.03	-0.04	-0.03
Government effectiveness	0.11	-0.01	**0.95**	0.06	-0.01	-0.05	0.10	-0.04	-0.04	0.04	0.05	-0.02	0.00
Rule of law	0.14	0.00	**0.95**	0.09	-0.02	-0.08	0.08	-0.04	-0.01	0.01	0.08	-0.02	0.02
Accountability	0.09	-0.02	**0.90**	-0.17	-0.08	-0.04	-0.01	0.04	-0.08	-0.02	-0.02	0.04	0.00
Political stability	0.17	-0.05	**0.82**	0.06	0.05	0.05	-0.03	-0.05	0.01	-0.10	-0.09	-0.01	-0.08
Real per capita GDP growth (%)	-0.04	-0.08	0.04	**0.93**	0.06	0.03	-0.03	0.16	-0.04	0.00	0.10	-0.02	-0.07
Real GDP growth (%)	-0.09	-0.04	0.03	**0.89**	0.16	0.11	0.04	0.14	0.00	-0.02	0.19	-0.09	-0.04
CXR (% change)	-0.06	0.09	-0.01	**0.72**	-0.13	0.03	-0.36	0.11	-0.02	-0.05	-0.04	-0.17	-0.03
Gross domestic investment (% of GDP)	-0.21	-0.29	-0.06	**0.63**	-0.18	0.01	0.09	-0.14	0.05	0.09	-0.03	-0.16	-0.03
Population growth (%)	-0.19	0.18	-0.05	-0.42	0.38	0.28	0.30	-0.13	0.15	-0.06	0.32	-0.27	0.10
Non-manufactured goods (% of export)*	-0.18	0.15	-0.04	-0.10	**0.77**	-0.03	0.15	0.04	-0.12	-0.07	0.07	0.06	-0.08
M2 (% of GDP)	0.23	-0.06	0.06	-0.09	**-0.65**	0.48	0.17	-0.28	0.02	0.05	0.20	0.02	-0.05
Domestic credit (% of GDP)	0.44	0.01	-0.03	-0.14	**-0.54**	0.35	0.04	-0.27	-0.20	0.11	0.23	0.10	-0.02
Reserves (% of M2)	0.13	0.17	-0.22	0.42	**0.49**	0.34	0.18	0.00	-0.05	-0.30	-0.25	-0.02	0.15
Reserves (in months of CXP cover)	-0.22	0.06	-0.14	0.03	-0.09	**0.85**	-0.13	-0.02	-0.10	0.06	-0.02	0.09	0.05
Liquidity ratio (%)	-0.31	-0.26	0.07	0.20	0.01	**0.64**	-0.06	-0.02	0.14	0.08	-0.09	-0.32	-0.02
GXD (% of GDP)	0.26	0.01	0.16	-0.15	-0.09	-0.09	**0.82**	-0.03	0.03	-0.16	0.09	0.18	-0.12

Net external borrowing (% of CXR)	0.26	0.22	-0.05	0.10	-0.25	0.07	**-0.64**	-0.08	0.01	-0.14	0.01	0.06	-0.15
Trade dependency (%)	0.15	-0.18	0.05	0.25	-0.11	0.07	**0.54**	-0.16	0.13	-0.42	-0.15	-0.30	0.16
M2 (% change)	-0.18	0.17	-0.04	0.15	0.11	-0.01	0.01	**0.88**	-0.03	-0.04	-0.08	-0.02	0.03
Private sector credit (% change)	-0.19	-0.19	-0.04	0.32	0.14	-0.10	-0.06	**0.67**	-0.10	-0.03	-0.03	-0.04	-0.38
Consumer prices (ann. avg. % change)	-0.25	0.45	-0.13	-0.13	0.10	-0.10	-0.05	**0.55**	0.00	-0.15	-0.09	-0.04	0.34
Inward FDI (% of GDP)	0.08	-0.06	-0.09	0.01	0.01	-0.10	-0.02	-0.03	**0.93**	-0.02	-0.01	0.09	0.02
NXD (% of GDP)	-0.19	0.42	0.05	0.05	0.13	-0.15	-0.15	0.05	**-0.79**	0.05	-0.14	-0.04	-0.10
GDP (USD million)	0.25	0.09	0.01	0.00	-0.06	-0.02	-0.05	-0.07	0.00	**0.79**	-0.01	-0.01	0.04
Reserves including gold (USD million)	0.12	-0.10	-0.13	0.06	-0.28	0.43	-0.03	-0.10	-0.06	**0.70**	-0.02	-0.08	0.17
REER (% change)	0.08	-0.18	0.10	0.49	-0.15	-0.20	-0.07	-0.13	0.00	-0.11	**0.66**	0.06	0.04
Unemployment (%)	-0.27	0.14	-0.01	-0.20	0.04	-0.07	-0.18	0.16	-0.12	-0.14	**-0.63**	0.00	-0.06
Government primary balance (% of GDP)	0.35	-0.21	-0.04	-0.38	0.40	0.04	-0.21	0.24	-0.02	-0.20	**0.49**	-0.01	0.00
External debt service (% of CXR)	0.04	0.04	-0.06	-0.18	0.01	-0.01	0.03	-0.03	0.10	-0.04	-0.02	**0.89**	0.03
GXD (% of CXR)	0.31	0.43	0.09	-0.29	-0.09	-0.13	0.33	-0.08	0.26	0.14	0.17	**0.43**	-0.24
CAB (in % of GDP)	0.22	-0.43	-0.06	-0.27	0.02	0.16	-0.07	0.02	0.06	0.10	0.05	-0.08	**0.71**
Gross domestic savings (% of GDP)	0.03	-0.52	-0.09	0.07	-0.07	-0.05	0.19	-0.10	0.11	0.13	0.09	0.16	**0.63**

This table displays the correlation coefficients between the thirteen components and the independent variables.

Annex 4. Correlation coefficients between selected variables

	GNI PPP per capita (in USD)	Consumer prices (annual average % change)	REER (% change)	GPXD (% of CXR)	Corruption perceptions index	Non-manufactured goods (% of export)	Trade dependency (%)	Gross domestic savings (% of GDP)	Government revenue (% of GDP)	Reserves (% of M2)
GNI PPP per capita (in USD)	1.00									
Consumer prices (annual average % change)	-0.38	1.00								
REER (% change)	0.20	-0.24	1.00							
GPXD (% of CXR)	-0.37	0.36	-0.29	1.00						
Corruption perceptions Index	0.88	-0.38	0.13	-0.33	1.00					
Non-manufactured goods (% of export)	-0.39	0.26	-0.18	0.31	-0.32	1.00				
Trade dependency (%)	0.12	-0.18	0.10	-0.34	0.16	-0.17	1.00			
Gross domestic savings (% of GDP)	0.42	-0.19	0.16	-0.50	0.30	-0.10	0.24	1.00		
Government Revenue (% of GDP)	0.58	-0.20	0.16	-0.25	0.63	-0.22	0.07	0.06	1.00	
Reserves (% of M2)	-0.27	0.15	-0.20	0.05	-0.46	0.29	0.31	-0.23	-0.24	1.00

This table shows the correlation coefficient between the selected variables.