Is Sovereign Risk Related to the Banking Sector?*

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ABSTRACT

We examine whether the banking sector within a nation is related to sovereign risk. We hypothesize that more competitive and sophisticated financial systems will be less prone to panics or bank runs, and, consequently, be associated with superior sovereign credit ratings. Using Ordered Probit with Aggregate Time Effects methodology, our results show that banking sector characteristics such as Concentration in the Banking System, Liquidity of Bank Assets, and Size of Financial System are significantly related to sovereign credit ratings. Since the use of these sovereign ratings is ubiquitous in international finance in varied applications such as determination of the cost of international borrowing by governments, international cost of capital for FDI, and others, the relationships identified in this paper have important public policy implications.

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ABSTRACT

We examine whether the banking sector within a nation is related to sovereign risk. We hypothesize that more competitive and sophisticated financial systems will be less prone to panics or bank runs, and, consequently, be associated with superior sovereign credit ratings. Using Ordered Probit with Aggregate Time Effects methodology, our results show that banking sector characteristics such as Concentration in the Banking System, Liquidity of Bank Assets, and Size of Financial System are significantly related to sovereign credit ratings. Since the use of these sovereign ratings is ubiquitous in international finance in varied applications such as determination of the cost of international borrowing by governments, international cost of capital for FDI, and others, the relationships identified in this paper have important public policy implications.

Keywords: Sovereign credit ratings, banking, competition, liquidity

1. Introduction

Global markets have gained significant importance due to financial liberalization across the globe. As a result, many businesses operate internationally, and investment portfolios include securities from various exchanges. Financial liberalization has been linked to growth (see Bekaert, Harvey and Lundblad; 2005) and it is not surprising that emerging economies are increasingly embarking on such policies. The gains in these global markets are also associated with risks that can be different from those in domestic markets. As a result, an understanding of these risks is essential in efficient allocation of investment capital. Consequently, this paper focuses on the exposures within different territories, namely country risk. In particular, we examine whether banking sector characteristics are related to the unique risk level of a country, as proxied by its sovereign credit ratings. Our exploration into the importance of banking sector variables is especially timely given the recent bailout of banking institutions by governments across the international landscape.

Sovereign credit ratings are well suited for our purpose of examining sovereign risk since their use is ubiquitous in the field of international finance. First, they affect the cost of debt service for the borrowing nation, and superior ratings translate into cheaper access to international capital. Second, sovereign yield spreads, which are directly related to sovereign ratings are used by financial analysts to compute risk premia that are incorpo-

rated into cost of capital computations for international project evaluation, and stock/asset valuation.[1] Given this importance of sovereign ratings in international financial markets, we attempt to uncover the factors that affect those ratings. While macroeconomic, social and legal factors, as prior research has indicated, would naturally affect the ratings, we examine some other factors that are relatively new. In particular, we explore variables that capture unique aspects of a nation's financial system and its institutional environment. We believe that these factors may have some additional explanatory power over and above the variables already uncovered in the literature.

We can summarize our results regarding non-macroeconomic variables as follows. First, we confirm that the Corruption Index (from Transparency International) is significantly associated with the ratings under our panel setting and ordered probit methodology. Second, when we introduce the "Trade in Services" variable as a continuous variable, we find that it is also a significant factor. More importantly, we demonstrate that concentration in the banking sector, and increased liquid reserves of the banking system are associated with worse sovereign ratings, while nations with larger banking assets and higher market capitalization stock markets are associated with better ratings. The significance of these additional financial sector variables not only improves the explanatory power of the rating model, but also suggests some important policy implications related to the banking system for sovereign risk reduction.

The remainder of the paper is as follows. In section 2, we provide a literature review related to sovereign risk. Next, we formulate our hypotheses explicitly, lay out the econometric model, and describe how we will test our hypotheses in section 3. Then, in Section 4, we describe our data set and discuss the expected behavior of macroeconomic factors. We present our analysis and empirical findings in Section 5, and explain the intuition behind the results. Finally, we conclude in Section 6 with a discussion of our findings and potential directions for further exploration.

2. Literature review

In this section, we present some insights into the history of sovereign ratings, prior work on sovereign ratings, and within this context, we discuss the unique features that distinguish our study. Andritzky (2006) identifies the period between 1870 and World War I as "the golden age of sovereign lend-

[1] See, for example, Lessard (1996) .

ing" because of the huge capital flows to emerging markets. He asserts that a similar financial integration only resumed after a century. Sovereign rating history goes back to the end of "the golden age" when Moody's (established in 1900) assigned its first rating just before the war. Poor's Publishing had rated Yankee Bonds issued by 21 governments by 1929. Sovereign defaults spiked during the 1930s - Great Depression years, and following that, most sovereign ratings were suspended during World War II. After that war, Standard and Poor's (S&P) and Moody's resumed their business and rated 7 sovereigns at that time. Interest Equalization Tax (IET) which was introduced in 1963 pushed the agencies abroad. Modern Sovereign Ratings emerged after 1974 when the IET was abolished. By 1990, S&P and Moody's rated 35 and 33 sovereigns, respectively, and by 2002 the numbers were 93 and 109. In addition, Fitch rated 77 Sovereigns in 2002 (Bhatia; 2002). Thus, the growth in sovereign ratings points to an increasingly integrated global financial marketplace and an enhanced importance for the role played by such ratings.

In general, sovereign risk analysis focuses on the possibility of nations defaulting on their debt. Sovereign risk can be regarded as a measure of the level of economic, financial, and political stability of a country, generally used interchangeably with the broader concept of country risk (Frenkel, Karmann, and Scholtens, (FKS); 2004). Thus, even when a nation is not issuing bonds, a sovereign rating which proxies for sovereign risk provides an index of the credibility of the public and private sectors of that country. Sovereign credit ratings influence capital flows to developing countries through international bond, loan, and equity markets. Bond investors, for instance, rely heavily on credit ratings to monitor the borrower, and guide investment decisions. In developing countries, the sovereign rating has a significant impact on the ratings of the local firms and banks (and their cost of funds) whereas the impact is less significant in developed countries (Ratha, De, and Mohapatra; 2007) where there are alternate sources of information. Additionally, even if the country does not borrow money internationally, sovereign ratings are used by analysts to impute a country risk premium that is included in cost of capital computations. Such costs are then used in stock/asset valuation and for foreign direct investment (FDI) evaluation.

There are also other perspectives on the role of sovereign ratings. One view of sovereign debt is that a country can never default because the government could merely increase taxes to cover sovereign debt service. Under this view, sovereign ratings then become redundant and unnecessary. Undermining this view, Cantor and Packer (1995) find that sovereign defaults did indeed occur during the Great Depression period, early 1980s, and late 1994 time periods. Interestingly, Andritzky (2006) notes that a significant

number of defaults in Latin America and the Mediterranean area occurred during the earlier part of the 1850s. According to the Moody's definition of default, there have been only seven rated sovereign bond issuers that have defaulted on their foreign-currency denominated bonds since 1985 and all defaults occurred between 1998 and 2002.[2] In our context, the very existence of sovereign defaults suggests that sovereign bond ratings can provide useful information to financial markets on sovereign risk.[3]

Andritzky (2006) also discusses sovereign debt crises and the solutions thereof. He lists the common causes of the post 1990s sovereign debt crises as arising from maturity and currency mismatches, fragile banking systems, and exchange rate overvaluation. Hagen and Ho (2004) find that twin crises in the 1980s tended to show up as a currency crises followed up by a banking crisis. However, this pattern is said to change in the 1990s with twin crises showing up as a banking crisis followed by a currency crisis. Currency crises in the 1990s are strongly correlated with high M2 to foreign reserves ratio. Banking crises in the 1990s are more likely associated with a boom and bust cycle in credit growth.

There are, however, two major problems when one attempts to examine the determinants of sovereign defaults in an empirical study. The first problem is the limited number of sovereign defaults, and the second is the short time period for which reliable data exists. This situation does not apply to corporate defaults. In fact, when it comes to corporate default probabilities, the task seems easier since there are a sufficient number of corporate defaults over a much longer time period, and reliable data exists on these firms. Specifically, the three rating agencies sort rated corporate entities at the beginning of each year into "static pools" by rating level and then track the numbers of defaulters in each pool. This method is repeated over a range of time horizons for thousands of obligors. For instance, on average, 3-5 percent of speculative-grade corporate issuers default within one year, and 7-14 percent within 3 years (see Bhatia; 2002 and Sy; 2004).

Rating agencies consider historical information as well as forward looking information in their risk calculations. The rating committee considers the confidential information provided by the sovereign in addition to publicly available macroeconomic variables and follows a checklist methodology before a decision is made (Riley, Dawkins, McCormack, and Paiz-Fredel; 2007). S&P's checklist includes political risk, income and economic structure, fiscal

[2]Details regarding sovereign crises and default history are available from the authors.

[3]We do not discuss the issue of whether such ratings are timely in relation to their ability to predict default.

flexibility, general government debt burden, off-shore and contingent liabilities, monetary flexibility, external liquidity and debt burden (Beers and Cavanaugh; 2008). Technically, S&P ratings try to capture the probability of default, not the severity (i.e., loss) or timing of default.[4] Moody's ratings focus on expected loss which is a function of probability of default and expected recovery rate after the default has occurred. Ratings from Fitch are a mix of the two, focusing only on the probability of default until the default occurs, and incorporates the recovery rates after the default occurs (Bhatia; 2002).

Aside from sovereign ratings, there are periodicals such as Euromoney and Institutional Investor providing information on country risk. Euromoney bases its ratings on a selection of variables, whereas Institutional Investor bases the ratings on responses to a questionnaire sent to firms that are actively involved in international investments and transactions. Methodological changes between 1997 and 2002 emphasized the contingent claims (sovereign balance sheet) approach (as in Gray, Merton and Bodie; 2007), and international liquidity constraints. In addition, heavy emphasis was placed on corporate leverage and its linkages to fiscal and external risks. Lastly, in the face of global financial liberalization, the market is expected to expand towards rating the low-income countries which previously have never been rated before (Bhatia; 2002).

Our discussion on research into modeling of sovereign ratings begins with Cantor and Packer (1996), which is one of the pioneering studies in quantitative research on sovereign ratings.[5] The study is a cross sectional OLS analysis using the ratings of 49 countries assigned as of September 29th, 1995 by Moody's or S&P (transformed to numerical values: 1 to 16). The explanatory variables are mostly macroeconomics based. They are: GNP per capita (1994), GDP growth (average 1991-94), Inflation (average 1992-94), Fiscal Balance (average budget surplus/GDP 1992-94), External Balance (average current account surplus/GDP 1992-94), Foreign Currency Debt relative to Exports (1994), Indicator for Economic Development (IMF classification as of 1995, 1 for industrialized countries, 0 for others), and Indicator for Default History (default on foreign currency debt since 1970 using data acquired from S&P; 1 for any defaults, 0 for no defaults). Out of these eight variables, GDP growth, fiscal balance, and external balance came out as insignificant. The regressions explained around 92% of variation in ratings.

[4]Presumably, the rating is timely; otherwise such ratings would have no information content at all.

[5]A summary of prior quantitative models which examine sovereign credit ratings appears in Appendix 1.

However, the explanatory power of the Cantor and Packer (1996) model is shown to deteriorate by Juttner and McCarthy (2000) for the period 1996-98, and by Monfort and Mulder (2000) with a sample of twenty emerging market economies for the period 1994-1999, which includes the Asian Crisis of 1997. Thus, the relationship between ratings and the explanatory variables are not necessarily stable over time. Mulder and Perelli (2001) used a panel of twenty five emerging markets for the period 1992-1999, and came up with a static equation of six macroeconomic variables. However, the evidence thus far suggests skepticism that all of these variables will remain significant over different time periods.

Butler and Fauver (2006) examine cross-sectional determinants of sovereign credit ratings. They find that the quality of a country's legal and political institutions has a significant role in determining these ratings even when they account for obvious factors such as GDP per capita, inflation, foreign debt per GDP, previous defaults, and general development. Their index that captures the quality of the legal and political institutions is calculated by summing up the voice of the people, political stability, government effectiveness, regulatory quality, rule of law, and corruption control indicators, all of which are based on the work done by Kaufman, Kraay, and Mastruzzi (2003). Their source of legal origin variables is LaPorta, Lopez, Shleifer, and Vishny (LLSV, 1999). In this respect, we differ from Butler and Fauver, in that we use a variable called Corruption Index as our proxy for the institutional environment. This variable is recalculated every year, as opposed to the time invariant legal variable used by Butler and Fauver (2006). The static variable used by Butler and Fauver is appropriate for their study since it is a cross-sectional analysis. However, given that we use a panel data setting, we speculate that our proxy variable which is measured more frequently is thus, more timely, and therefore, better able to capture changes in the legal environment, and social and institutional aspects. We also suggest that the corruption index possibly measures the efficacy and enforcement of a given legal system and adherence to the legal system by citizens of the nation.

With respect to methodological concerns, the goal of our ordered logistic (logit or probit) model is to express the probability of a rating score as a function of economic and political factors, and most importantly, financial system development and banking sector characteristics. Mellios and Paget-Blanc (2006) assert that OLS analyses of ratings make a very strong assumption that the dependent variable (i.e., the rating) is a continuous variable, while logistic models do not. They employ this latter methodology to study the determinants of sovereign ratings of the three major rating agencies; Fitch,

Moody's, and S&P. Their data are composed of the ratings of 86 countries on December 31st 2003, and 49 economic and political variables observed at December 31st 2002 (covering the period 1998 to 2002). Principle Component Analysis (PCA) is employed to identify the factors, and linear and ordered logistic models reduce the number of factors to eleven and nine respectively (mostly due to multi-collinearity and significance issues). The most significant variables are per capita income, government income, real exchange rate, inflation rate, default history, and corruption index (Transparency International) which is introduced as a proxy for both economic development and quality of the governance of a country. Our study is different from Mellios and Paget-Blanc (2006) in that we demonstrate the significance of the Corruption Index under a panel data setting covering more time periods.

Another recent paper by Afonso, Gomes, and Rother (AGR, 2007) also performs quantitative modeling of sovereign ratings, where the authors study the determinants of ratings of the three major agencies. The study covers 78 countries from 1995 to 2005. The explanatory variables are divided into four main blocks: Macroeconomic Performance (per capita GDP, unemployment rate, inflation rate, real GDP growth), Government Performance (government debt, fiscal balance, government effectiveness), External Balance (external debt, foreign reserves, current account balance), and other factors (default history, EU, regional dummies). Their main finding is that GDP per capita, real GDP growth, government debt, government effectiveness, external debt, external reserves, sovereign default indicator and EU dummy are the major determinants of sovereign ratings. Their main contributions to the literature are the new estimation method used, the functional form specification, and the large dataset employed. Their study suggests that a random effects ordered probit (REOP) model which considers errors to be normally distributed and maximizes the log-likelihood, is the best model. However, the AGR (2007) specification (REOP) deteriorates for smaller samples. In addition, the extensive number of variables used in their models (around 25-30) raises the possibility of over-fitting. Our specification employs a simpler methodology and fewer macroeconomic variables (8 to 15 variables) to obtain similar explanatory power (pseudo R^2). Furthermore, we introduce additional financial and banking system variables which are not explored in AGR.

Overall, and different from the current literature, we examine the impact of financial system soundness on sovereign ratings. Our ideas stem from Demirguc-Kunt and Levine (DKL, 2001) on the relationship between financial structure and economic growth. However, the variable of interest in our study is economy-wide risk as opposed to growth as in DKL. A small

but noteworthy improvement is the confirmation of the significance of legal system variables, and corruption index (Transparency International) in the panel setting and with ordered probit modeling. Further, we include the "Trade in Services" variable in our model as a continuous proxy for economic diversification; another institutional environment variable. After controlling for these macroeconomic and institutional environment factors, we show that variables that measure various aspects of the banking sector are strongly related to sovereign ratings.

3. Hypotheses and methodology

Our aim is to build a quantitative model that explores the variables that pertain to sovereign credit ratings. Our methodology, ordered probit, and the use of panel data also help in confirming some of the previous results in literature which use simpler methods (OLS) and fewer observations (cross-sectional data setting). The papers that are close benchmarks to our study are by Butler and Fauver (2006), Mellios and Paget-Blanc (2006), and Afonso, Gomes and Rother (AGR, 2007). Our contribution is to introduce a practical model which includes financial and institutional environment variables. By including a smaller set of explanatory variables, we hope to bypass the criticisms related to over-fitting. In terms of methodology, we propose the use of Ordered Probit Regression with year dummies rather than the more advanced Random Effects Ordered Probit Regression (REOP) as in AGR (2007). A major problem with REOP employed by AGR (2007) is that it deteriorates (or does not converge) if we do not have enough observations. With sufficient observations both methods give very similar results in terms of the significance of the variables.[6] In sum, our method is comparable to the AGR study in its efficacy with the added advantages of its easy logic, fewer explanatory variables employed, and less time/data-related problems.

Additionally, we examine the importance of institutional environment variables similar to Butler and Fauver (2006), and Corruption Index similar to Mellios and Paget-Blanc (2006). However, we perform our analysis on panel data via the ordered probit approach. This is at the heart of our first hypothesis below:

H1o: Institutional environment variables are *not* significant determinants of sovereign risk ratings with ordered probit approach in a panel setting after

[6]In tests that are not reported here, we created various models using only independent variables that were macroeconomics-based, and confirmed that the variables specified in these models have virtually the same significance level with both the REOP and the Ordered Probit with Aggregate Time Effects (OPAT) approaches.

controlling for macroeconomic factors.

H1a: Institutional environment variables are significant determinants of sovereign risk ratings with ordered probit approach in a panel setting after controlling for macroeconomic factors.

More importantly, and additional to the institutional environment, we explore whether the inclusion of financial system variables will increase the explanatory power of our models. The null hypothesis below is that these additional financial system variables will not be significant after we control for the major macroeconomic dimensions. Consequently, rejecting the null hypothesis below will support our view. Our hypothesis in this regard takes the form:

H2o: Financial system variables do *not* have significant additional explanatory power for sovereign risk ratings after controlling for macroeconomic variables.

H2a: Financial system variables have significant additional explanatory power for sovereign risk ratings after controlling for macroeconomic variables.

To test the above hypotheses, major macroeconomic variables are first identified, and a general model with high explanatory power is constructed. Then, additional institutional environment and financial system variables are introduced and the significance of these variables is examined. After the significance of the variables is confirmed, the intuition behind the results and policy implications are explored. In terms of econometrics, we borrow from the methodology suggested by Wooldridge (2002). Our notation is provided below:

R_{it}: The Sovereign Credit Rating assigned by a major agency for an individual country, i, at time t, and which are elements of the vector, $\mathbf{R}$. The actual variable is a numerical transformation of an alphabetically based sovereign credit rating.

x_{it}: The observed independent variables that change across t and i, and which are elements of the matrix of independent variables, $\mathbf{X}$

a_t: Aggregate time effects, dummies for each year, t, which are elements of the vector, $\mathbf{A}$

f_{it}: Financial System Indicators, assumed to be fixed (or variable depending

on data availability) for each country, i in year, t, which are elements of the matrix, $\mathbf{F}$

e_i: The individual effect that changes across country, i, only, which are elements of the vector, $\mathbf{e}$

v_{it}: The idiosyncratic disturbances that change across i and t, which are elements of the vector, $\mathbf{v}$.

Using the abovementioned notation, the following model (where $\mathbf{B}$ is the vector of estimated coefficients) is the basic unobserved effects model for a randomly drawn cross-sectional observation i:

$$\mathbf{R} = \mathbf{XB} + \mathbf{e} + \mathbf{v} \tag{1}$$

The crucial point in making the difference between the random effects and fixed effects is whether we treat e_i as random or not. In accordance with Wooldridge (2002), we treat e_i as random since we have a large number of observations from the cross section of countries. Depending on the year and on the model, we have between 33 to 57 observations every year, and our total number of observations is 541. We also make the following assumptions:

$$\text{Cov}(x_{it}, e_i) = 0,$$

$$\text{Cov}(x_{it}, v_{it}) = 0,$$

$$\text{and } u_{it} = e_i + v_{it}$$

In our model, we ignore the individual error e_i. So, the new specification becomes:

$$\mathbf{R} = \mathbf{XB} + \mathbf{u} \tag{2}$$

where Cov $(x_{it}, u_{it}) = 0$, and $\mathbf{u}$ is the vector of u_{it}.

Next, we propose Ordered Probit with Aggregate Time Effects to control for time series problems, especially for the state of the economy and business cycles (Wooldridge; 2002). The difference from Random Effects Ordered Probit is that our methodology gives a broader view and more robust results, whereas the REOP is a more efficient one that works best with larger samples. Our ordered probit model with time effects is:

$$\mathbf{R} = \mathbf{X}\mathbf{B}_1 + \mathbf{A}\mathbf{B}_2 + \mathbf{u} \tag{3}$$

where a_t is a dummy variable for each year. When we add the financial system variables to our specification, our final model is as follows:

$$\mathbf{R} = \mathbf{X}\mathbf{B}_1 + \mathbf{A}\mathbf{B}_2 + \mathbf{F}\mathbf{B}_3 + \mathbf{u} \tag{4}$$

where, an element of $\mathbf{u}$, is given by $u_{it} = e_i + v_{it}$, and $\mathbf{B}_1$, $\mathbf{B}_2$, and $\mathbf{B}_3$ are coefficient matrices to be estimated.[7]

4. Data

Overall, the data used in our study can be best described as an "Unbalanced Panel." We employ S&P Sovereign Ratings provided by AGR (2007).[8] The alphabetical ratings were then converted into a number through a numerical transformation scheme for use in our empirical methods. We obtained explanatory variables from the World Bank, the IMF, various central banks' websites and publications, Inter-American Development Bank (IADB), and Bloomberg. In addition, values for the Corruption Index (1 to 10) are taken from Transparency International (1995-2009). It must be noted that these indexes are updated every year. Third, we use the data from "Financial Structure and Economic Growth" by Demirguc-Kunt and Levine (2001) and the updated version of this dataset by Beck (2009).

[7] While our econometric methodology may *theoretically* not be as efficient as the AGR (2007) specification, it is consistent and robust. Importantly, we avoid the problems related to the REOP approach such as convergence, overfitting, and the large sample size requirement.

[8] AGR also provide ratings by Moody's and Fitch, which we do not discuss in this paper due to the qualitative similarity in results.

For the Central Government Debt variable, we could have used the WDI-2008 data but Jaimovich and Panizza (2006) argue that the figures reported in WDI are subject to errors. In their paper, Jaimovich and Panizza (2006) publish a new data set containing better estimates of central government debt. Comparing the data sets, the one in Jaimovich and Panizza (2006) has more observations during the 1995-2005 period. AGR (2007) also use the Jaimovich-Panizza (JP) data set in their analysis. Sources for our data and the variables we employ appear in Table 1.[9] When observations with missing variables across the dataset are eliminated, we are left with 541 panel observations for use in our models. The major variables employed in our analysis, their expected impacts, the logic behind their inclusion[10], and their sources are provided below. We present these variables in the same order as they are discussed subsequently in the results section.

- **Gross National Income Per Capita** (based on Purchasing Power Parity) - positive impact.

This variable is a good proxy for the income level of the average citizen, and thus measures the standard of living in a given territory. A higher income level reduces default risk for the government since the citizens' propensity to pay taxes is higher, and consequently, the nation can increase taxes to balance the budget, if necessary, and obtain the funds to avoid sovereign default. Similar variables have been used in literature. For example, Cantor and Packer (1996) used GNP Per Capita; Borio and Packer (2004) and AGR(2007) included GDP per capita in their models. More importantly, this measure accounts for more than 60% of variation in ratings by itself and is thus, a basic component of most sovereign rating models. The Purchasing Power Parity adjustment suggests that the variable is adjusted for the differences in price levels and exchange rates. We obtained this variable from the World Bank Development Indicators (WDI - 2008) database. In our estimations, we use the commonly employed natural log of this variable.

- **Inflation** - negative impact.

A higher price level is usually a sign of a decrease in purchasing power, and a more volatile economy, and therefore, a deterioration in credibility. In the face of high inflation and loss of purchasing power, political pressure may dissuade governments from raising taxes to pay for sovereign debt service. This variable also comes from WDI - 2008 database, and is defined as the

[9]Table 1 contains variables that we used in our exploratory analysis and some of these variables may not be discussed further since they were not important in the models we present subsequently.

[10]The intuition behind some of these variables, and some other new variables which we subsequently employ, is further discussed in Section 5.

percentage change in consumer price index. Borio and Packer (2004), Mellios and Paget-Blanc (2006), and AGR(2007) also use this variable.

- **Central Government Debt** - negative impact.

A higher government debt load is associated with a higher interest expense burden, thus making it more likely that the government will experience difficulties in servicing its debt. Consequently, this will affect ratings negatively. This variable is taken from Jaimovich-Panizza (2006) rather than the WDI - 2008 due to possible errors in the latter. AGR (2007) also prefer the former database in their paper. This variable is expressed as a percentage of GDP, and is one of the crucial variables of such a macroeconomic model since the debt level is directly related to the creditworthiness of an entity. Moreover, contingent claims models, for example Gray, Merton, and Bodie (2007), place a special emphasis on this variable since it functions as a distress barrier.

- **Real Effective Exchange Rate** - positive impact.

This variable is calculated as a weighted average against the main trading partners' currencies. If the exchange rate increases (a stronger currency for the home country), purchasing power, reputation and credibility of the economy will increase. Further, the increase in the exchange rate will make it easier to service sovereign debt denominated in a relatively weaker foreign currency. The rate is expressed as an index which equals to a hundred in year 2000 (base year), and is obtained from the WDI-2008 database.[11] It should be noted that this variable is different from the nominal effective exchange rate since it is deflated by the price indices of the sovereign and its trading partners. In other words, real effective exchange rate accounts for the price level differences between trading partners. Trends in real effective exchange rates indicate how a country's aggregate external price competitiveness evolves over time (OECD).[12] Juttner and McCarthy (2000) and Mellios and Paget-Blanc (2006) have employed this measure in their models.

- **Current Account Balance** - positive impact.

A positive current account balance implies a surplus in the current account (i.e., the country is generating positive cash flow from exports exceeding imports), whereas a negative balance exacerbates the picture on overall debt burden. A surplus also suggests that the government will have inflows of foreign currencies that can be used for sovereign debt service. This measure

[11] For some of the missing values from this database, we hand collected the required data from various central banks' websites, IMF, or World Bank publications.

[12] We also employed changes in currency exchange rates which were hand collected from Bloomberg to check the robustness of the results when compared to the real effective exchange rate. The results were qualitatively similar.

(expressed as a percentage of GDP) is taken from WDI-2008 database, and has also been used by Monfort and Mulder (2000) and AGR(2007).

- **Advanced Economy Dummy** - positive impact.

This variable is created according to the classification provided by the World Economic Outlook 2009 by the IMF. An advanced economy typically is subject to less risk compared to a developing one. Considering the composition of our large dataset, we concluded that it was necessary to control for the difference between these two groups of countries. This variable has been employed in previous studies, such as Cantor and Packer (1996) and AGR (2007).

- **Corruption** - negative impact.

Transparency International (TI) produces a corruption index measure that tracks the legal/social environment within a country in an accurate and timely manner. In TI's scaling, a higher corruption index value (on a scale of 1 to 10) implies a less corrupted system. Thus, we expect a positive coefficient for this variable in our estimations. Specifically, a higher corruption index country (i.e., a less corrupt nation) should be associated with higher sovereign ratings. Lower corruption probably arises as a result of a sound and superior legal and social environment. It is to be expected that such an environment would also be associated with appropriate fiscal and governance mechanisms that would prevent the government from overborrowing. An allied view is that the corruption index variable reflects the outcome and efficacy of the systems in place. For example, a country could have a very involved and sophisticated legal system in place and yet, enforcement may be lacking, leading to a very corrupt environment. Consequently, we believe that this variable better captures the legal, social and political climate than other measures used in the literature. This variable was previously employed by Mellios and Paget-Blanc (2006) in their cross-sectional study with ordered logistic regression methodology.[13]

- **Trade in Services** - positive impact.

As economies advance and they become open, foreign demand for their services or their demand for foreign services expands. This variable, thus, measures the diversification of an economy and the degree of integration with world markets. An economy that has a high income level but is not diversified (e.g, relying on a single natural resource) tends to be less credible, and more vulnerable to shocks. Thus, a high trade in services level would suggest

[13]However, we are the first to demonstrate the importance of this variable in a panel data setting with the ordered probit approach.

that the economy is diversified, open, and better able to withstand economic shocks. We obtain this variable (expressed as a percentage of GDP) from the WDI-2008 database. In prior literature, Monfort and Mulder (2000) use Terms of Trade, and AGR (2007) use industrialized country dummies to account for the importance of trade and economic development. We believe that our variable, being a continuous measure, is better able to capture this aspect of degree of integration and diversity of economic resources.

- **Concentration in Banking System** - negative impact.

A concentrated banking system is more likely to be subject to systemic risk and panics. The multiplier effect in times of bank runs is higher for concentrated systems, which implies a faster and more destructive credit crunch (Paroush; 1988). For our study, we use a measure derived from the Beck (2009) database which contains yearly data on the share of the assets of the three largest banks relative to total banking assets.[14] Considering, the noise involved in the data for various emerging market economies, we prefer to use a dummy variable, *beckconcd*75, for concentration in the banking sector. For this variable, we define a concentrated banking system as one where the top three banks constitute 75% or more of the banking system. In our review of the literature, there appears to be no prior study connecting this measure to sovereign risk.

- **Liquid Reserves of Banking System** - negative impact.

This variable, *bankliqra*, is defined as the ratio of domestic currency holdings and deposits with the monetary authorities to claims on other governments, nonfinancial public enterprises, the private sector, and other banking institutions (WDI 2008). We believe that in a more efficient, stable, and sophisticated financial system, banks will maintain fewer liquid reserves because of the ease with which capital can be raised at short notice. Therefore, holding large cash reserves may be viewed with alarm as if banks are waiting for an impending crisis to unfold.[15] On the other hand, in a risky and less developed system, the banks will self-insure with a higher liquidity buffer (Ratnovski; 2007). Thus, maintaining large stocks of liquid assets by banks implies a poorly developed banking system, and in turn, higher default risk and a worse sovereign rating. As far as we are aware, this measure has not been examined in research examining sovereign risk.

[14] Demirguc-Kunt and Levine (2001) also provide a similar variable to measure banking concentration, but their dataset is somewhat limited given its vintage for our study. The Beck (2009) data set is an update for the Demirguc-Kunt and Levine (2001) dataset, and uses exactly the same methodologies.

[15] This view is espoused in a recent Heard on the Street article in the Wall Street Journal (Eavis; 2009) which states, "There is a $1 trillion stash of cash idling in the banking system. It's too big to ignore, and it's a cause for concern."

- **Size of the Financial System** - positive impact.

A large and well developed financial system is more efficient and less subject to shocks, and is therefore more credible from a sovereign risk perspective. To proxy for the size of the financial system, we use two variables which measure different aspects of the financial system. Our first variable is related to the size of the banking system. This variable, *beckbanka*, is obtained from Beck (2009), and is equal to the claims of deposit money banks as a share of GDP. It essentially measures the supply of loanable funds via the indigenous banking system. We have not noticed its use in prior literature examining sovereign ratings.[16] Our second proxy variable is related to the stock market. This variable, *beckmcap*, is obtained from Beck (2009) and is computed as the ratio of market capitalization of listed companies to GDP. Our prediction here is that larger financial systems should be associated with lower sovereign risk (i.e., higher ratings).

Continuing with our description of the data, in Panel A of Table 2, the distribution of events across years and rating categories is presented.[17] While there appears to be a concentration of observations in the top three rating categories, there are a sizeable number in other categories as well. For example, there are 42 observations that are rated A- and BBB-, respectively out of a total of 541 observations. Over the time dimension, there appears to be fairly uniform coverage in each year except for the first couple of years. Panel B of Table 2 provides the distributional details with respect to country coverage. "Advanced Economies" as defined by World Economic Outlook (2009) published by the IMF make up 265 out of 541 observations in our sample. The remaining 276 observations are from "Emerging Markets" as per the same classification source. Finally, descriptive statistics on key variables described previously and otherwise used in our analyses appear in Panel C of Table 2. The S&P rating variable, *spscore*, has a mean of 12.067, which is equivalent to a rating slightly higher than an A-. There is a large range in ratings going from a minimum value of 1 to the highest value of 18.[18] We also note that there is considerable dispersion in the other variables as well; thus, our results are not likely due to systematic bias in a single variable.

As mentioned before, a major problem we detected during our dataset formation process was related to the errors in the Central Government Debt

[16]We note that Juttner and McCarthy (2000) emphasize the riskiness of the banking system as an important determinant of sovereign credit ratings.

[17]This panel also illustrates the scheme used for numerical transformation of S&P sovereign credit ratings.

[18]Empirically, it is beneficial to have a large dispersion of values in the independent variable.

variable taken from the World Bank Dataset (WDI-2008). To increase the number of observations and, more importantly, to increase the validity of our results we, as in AGR (2007), include the Central Government Debt variable from Jaimovich and Panizza (2006) in our analysis instead of the equivalent variable from the World Bank dataset. Further, in addition to problems related to data availability, we also contended with issues related to multi-collinearity. Thus, we chose the variables that have the least amount of correlation problems while we try to increase the explanatory power of the model. Correlation information for the variables employed is provided in Appendix 2.[19]

5. Results and related discussion

Considering the data available and possible estimation issues, the Ordered Probit with Aggregate Time Effects (OPAT) approach is proposed for our empirical estimation method.[20] We first present the results using this estimation methodology of our baseline model which uses only the primarily macroeconomic variables based on our review of the literature. The first column in each of Tables 3 (with year dummies) and Table 4 (without year dummies) show these results. In both cases, the macroeconomic variables discussed earlier are significant, and with the predicted signs except for the real exchange rate variable.[21] As seen in Table 3 and Table 4, the effects of the macroeconomic variables are strong, both with and without year dummies. Consequently, the effects associated with the macroeconomic variables are not due to any time-specific effects in the data.[22]

5.1. Institutional environment variables

After estimating the baseline model using macroeconomic variables, we next layer onto it, our proxy variables for the institutional environment. We employ two variables: (a) Corruption Index, and (b) Trade in Services. Our results for this estimation, with and without year dummies, appear in the

[19] In Appendix 2, we only provide Spearman values. The Pearson values were similar and are omitted for brevity.

[20] We thank Youngsoo Bae, Stefan Boes, and Shin-Yi Chou for their comments on our estimation process.

[21] With respect to the real effective exchange rate variable, which is defined as a weighted average of the exchange rate proportional to trading partners of a given country, there is a significant deterioration in significance (compared to the literature) throughout the period we examine. Therefore, the use of this variable by previous studies is questionable. However, we retain this variable throughout the remaining estimations for consistency.

[22] Since the macroeconomic variables were intended to act as controls in our examination of institutional and financial sector variables, we will not further discuss them.

second column of Table 3 and Table 4, respectively.

Our first contribution is to show that the Corruption Index variable, *corruptti*, is positive and highly statistically significant in our panel specification. Traditionally, corruption is defined as the abuse of public office for private gain. Technically, the Corruption Index is a composite index that combines various expert opinion surveys to track perceptions of public sector corruption in 180 countries. It scores countries from 0 to 10, with zero indicating high levels of perceived corruption and ten indicating low levels of perceived corruption. In 2009, Somalia had the lowest score at 1.1; Afghanistan, Myanmar and Sudan were the worst after Somalia. New Zealand, Denmark, Singapore, Sweden, and Switzerland shared the top five spots respectively. The sources of data used to construct the index are reliable and of the highest quality, such as the World Bank, the Asian and the African Development Banks, the Economist Intelligence Unit, Global Insight, the Freedom House, and IMD International - World Competitiveness Center (Transparency International, 2009).

Corruption lowers growth through limiting development of small and medium-sized enterprises, and has serious implications for a country's public finances. It also deters foreign investment, distorts prices, and undermines legal and judicial systems. Previously, the Corruption Index was used in cross-sectional studies, or for smaller data sets with different methodologies. In our study, the index is shown to be significant in ordered probit and random effects ordered probit specifications; a new finding in the literature. The positive sign for the coefficient is consistent with the discussion above. Specifically, economies with less corruption, i.e., higher value for *corruptti* are more credible, and have lower sovereign risk, i.e., a higher sovereign rating, *spscore*.

The Corruption Index variable, *corruptti*, captures the effects related to legal, social, and political factors. We believe that the legal environment is an important aspect that cannot be ignored because of its implicit relationship with financial development. Laporta, Lopez, Schleifer, and Vishny (LLSV, 1999) argue that a carefully designed legal system might catalyze financial development and economic growth. This approach is known as the "law and finance view" in the literature, and asserts that the legal system directly determines the effectiveness of the financial system in promoting innovation and growth.

A potential drawback of the version of the legal system variable as used by LLSV when using panel data is that this variable is constant over time

for any particular country. In this regard, since *corruptti* is recalculated every year and captures additional socio-political dimensions, we prefer this variable to capture the institutional environment rather than the static legal system variables employed by LLSV. Additionally, a nation may have a particular type of legal system that supposedly creates conditions for growth, but if that legal system is not enforced adequately, then that legal system variable will not be related in the hypothesized manner with growth. Specifically, that legal system, while good in theory, has "no teeth", and will not be conducive to growth. Our use of the corruption index measures the validity and more importantly, the outcome of the legal system and any deterioration/improvement thereof over time. Further, the corruption index also measures if a nation has a code of ethics, and whether citizens adhere to cultural and religious values that may encourage growth, without the need for any specific legal system. Our stance in this regard is supported by Stulz and Williamson (2001) where they state,

> "... a country's principal religion helps predict the cross-sectional variation in creditor rights better than a country's openness to international trade, its language, its income per capita, or the origin of its legal system."

Given the evidence of Stulz and Williamson, it is no surprise that the corruption index variable, which is an outcome measure, is significantly related to sovereign risk.

Our next contribution is to use the Trade in Services variable, *tradeservg*, as another proxy for the institutional environment to augment our basic model. This variable, expressed as a percentage of GDP, captures the diversification of the economy, i.e., whether or not the wealth comes from a single natural resource. It is an established fact that economies shift to a more service oriented character as they give up the less profitable sectors (such as manufacturing and agriculture) as they advance. This variable is significant and comes up with the expected positive sign in our models as shown in the second column in Table 3 and Table 4. The main takeaway from this subsection is that sovereign ratings are related significantly to our institutional environment variables. From a public policy perspective, nations should attempt to eradicate corruption and increase their trade in services.

5.2. Financial system variables

We next explore the nature of the relationship between banking/financial sector characteristics and sovereign credit ratings. The literature has suggested a high correlation between banking crises and credit events. Therefore, our initial focus is on the banking system rather than the stock market

in measuring financial development. In his speech about financial system soundness, Fischer (1997) suggests better regulation and supervision as the remedies for the financial crises in developing as well as developed countries. He argues that, in many cases, the crises have been exacerbated by banking system fragilities. In discussing the role of the central bank as the lender of last resort, he draws an important line between a system-wide crisis and an individual bank problem. Parallel to this point of view, we claim that confidence related shocks will be minimized if there is a more competitive and well developed banking system.

In our tests, we first employ a dummy variable, *beckconcd*75, to capture concentration in the banking system. This dummy variable is equal to one if the ratio of the assets of the three largest banks scaled by the assets of the entire banking system, is greater than or equal to 75%, and zero otherwise. This variable is introduced as a proxy for financial system fragility into the model. Specifically, we intend this variable to reflect the competitiveness of the banking industry. A less competitive (i.e., **more** concentrated) industry, is expected to be less efficient and more subject to big swings or systemic crises. Thus, a higher concentration should be associated with lower sovereign ratings. As seen in the third and fourth columns of Tables 3 and 4, respectively, this variable enters the model with a significant coefficient and with the expected negative sign.

Next, we tested whether other additional proxies for financial development were related to sovereign ratings. Specifically, we seek to formulate a sound proxy for the level of sophistication in a nation's banking system and examine how it relates to sovereign ratings. Borrowing from the literature on Sovereign Crises and Defaults History (see Appendix 1), and the efficiency measures suggested by Levine (2002), we included a variable called Liquid Reserves of Banking System in our estimations. This proxy captures the behavior and expectations of the banking system.

The Liquid Reserves of Banking System variable, *bankliqra*, is highly significant in both Tables 3 and 4. More importantly, the liquidity variable is negatively related to sovereign ratings.[23] In other words, the higher the liquid reserves held by banks, the more inferior the sovereign rating. We believe that this finding is logical since the liquidity variable implicitly reflects the efficiency and sophistication of the banking system, as well as the confidence in the economy. Specifically, higher liquidity ratios imply that banks keep

[23]In addition, this result was robust to simultaneously including variables measuring the size of the financial system via size of the banking system, *beckbanka*, or size of the stock market, *beckmcap*.

excess reserves (or liquid assets) as a buffer against weak fundamentals (see Hildebrand, 2007). In other words, in a financial system which is unsophisticated, funds travel slower since confirmations need to occur at each step of the process. Conversely, in a sophisticated and transparent system, liquidity stocks can be maintained at lower levels. This is analogous to an inventory system wherein sophisticated lean supply chains exhibit lower inventory levels. Thus, liquidity ratios are expected to be smaller in stable and advanced, sophisticated financial systems in which the banks and investors are more confident.

The third banking sector variable we used was the size of the financial system, namely Deposit Money Bank Assets, *beckbanka*. This variable is defined as the claims of deposit money banks on non-financial domestic sectors scaled by GDP. Demirguc-Kunt and Levine (DKL; 2001) state that the banks, non-banks, stock markets, and bond markets are larger, more active, and more efficient in wealthier countries. In other words, they claim that the financial systems grow in size as the economies prosper. Consequently, a larger banking system, *ceteris paribus*, should result in a more resilient economic system and thus result in higher sovereign ratings. Our results for this estimation appear in Tables 3 and 4. This variable, *beckbanka*, is significant at the 0.01 level, and has the expected positive sign. The significance of the two variables, the concentration (*beckconcd*75) and the size of the banking system (*beckbanka*) jointly suggest important policy implications. If a government wants to borrow from the international markets at a lower rate, it has to undertake measures to increase the size of the banking system, and also to promote competition and reduce concentration to reduce the risk of contagion.

Next, we introduce another financial sector variable, Capitalization of Listed Companies in Stock Market as a percentage of GDP, *beckmcap*, to examine the relationship between stock market development and sovereign ratings. By this, we aim to explore the effect of financial development of the stock market over and above the previously shown effects of the banking sector variables. The results of this estimation are also shown in Table 3 and Table 4, where we see that the size of the stock market is significant at the 0.01 level together with all the banking system variables used in estimation, and is positively related to sovereign ratings.

Demirguc-Kunt and Levine (2001) suggest that, in general, non-bank financial intermediaries and stock markets grow relative to banks in size and importance as economies advance.[24] They found that banks, non-bank in-

[24]Also see Ergungor (2004) for capital market versus bank-based systems.

termediaries, stock markets, and bond markets are larger, more active, and more efficient in wealthier countries. They argue that when both the banking industry and the stock market exist, the structure of the financial system transforms to a more market oriented one as the economy advances. In this respect, we have to point out that our dataset manifests a correlation between the variables measuring the size of the banking system and the size of the stock market. However, the effect of banking sector characteristics appear to persist even in the presence of the stock market variable.

Lastly, in Table 5, we present results of robustness checks using standardized coefficients across various subperiods. These standardized coefficients enable comparability across time and illustrate the marginal effects of the variables. In Table 5, the banking sector variables are consistently significant in many subperiods as well as over the entire period. This clearly and robustly answers our question that the banking sector and sovereign risk are significantly related to one another.

6. Summary

Sovereign credit ratings are widely used in finance but there is some ambiguity about whether these ratings are related to financial sector variables. Given this situation, our paper explores this issue using a carefully assembled dataset and the ordered probit methodology. We show that institutional environment variables such as corruption index and trade in services are significantly related to sovereign credit ratings after controlling for macroeconomic variables previously documented in the literature. Specifically, lower corruption and higher trade in services are both associated with higher sovereign credit ratings.

More importantly, we believe that ours is the first paper that shows very robustly that financial sector variables such as high banking sector concentration and high liquid reserves in the banking system are negatively related to sovereign credit ratings. These results imply that nations who desire better sovereign credit ratings should strive to lower the concentration in their banking sector. In this endeavor, nations may want to restrict bank mergers and encourage the establishment of new banks.[25] Additionally, our results suggest that banking regulation should enable reductions in the amount of

[25]Given the current financial crisis which has witnessed numerous mergers of banks, our results suggest that such mergers may only exacerbate systemic risk instead of alleviating it.

liquid reserves needed in the system so that funds may be deployed to their best use instead of languishing as reserves in the system. Investment in technology to reduce the float in the system and assurance that there is trust in the system so that contracts and transactions will be honored will help reduce liquid reserves.

Finally, a larger banking sector and a well capitalized stock market are crucial in establishing deeper domestic financial markets and lowering sovereign risk. In other words, efficient local financial markets alleviate the need to borrow internationally. Consequently, being able to borrow domestically in terms of local currency, rather than internationally in terms of foreign currency, reduces sovereign risk and enables international debt to be obtained on better terms.

References

Afonso, A., Gomes P. M., and Rother P. C., (2007). What 'Hides' Behind Sovereign Debt Ratings? ECB Working Paper Series No 711.

Andritzky, J., (2006). Sovereign Default Risk Valuation. Implications of Debt Crises and Bond Restructurings, Springer.

Beck, T.H.L., A. Demirg-Kunt, and R. Levine, (2000). A new database on financial development and structure. World Bank Economic Review, 14(3), 597-605.

Beck, T., and E. Al-Hussainy, (2009). Financial Structure Dataset. Revised: January 2009. Tilburg University, Netherlands and The World Bank, Washington, D.C.

Beers, D., and M. Cavanaugh, (2008). Sovereign Credit Ratings: A Primer. S&P Ratings Direct.

Bekaert, G., C. R. Harvey, and C. Lundblad, (2005). Does financial liberalization spur growth? Journal of Financial Economics 77, 3-55.

Bhatia, A. V., (2002). Sovereign Credit Ratings Methodology: An Evaluation. IMF Working Paper.

Borio, C., and F. Packer, (2004). Assessing New Perspectives on Country Risk. BIS Quarterly Review, 47-65.

Butler, A. W. and L. Fauver, (2006). Institutional Environment and Sovereign Credit Ratings. Financial Management 35(3), 53-79.

Cantor, R. and F. Packer, (1996). Determinants and impacts of sovereign credit ratings. Federal Reserve Bank of New York, Research Paper.

Demirguc-Kunt, A., and R. Levine, (2001). Financial Structure and Economic Growth. A Cross-Country Comparison of Banks, Markets, and Development. The MIT Press.

Eavis, P. (2009). Banks' Hefty Reserves Create Disquiet, Heard on the Street, Wall Street Journal, Nov 30th.

Ergungor, O. E., (2004). Market- vs. bank-based financial systems: Do rights and regulations really matter? Journal of Banking and Finance 28, 2869-2887.

Fischer, S., (1997). Financial System Soundness. Finance & Development. March 1997.

Frenkel, M., A. Karmann, and B. Scholtens, (2004). Sovereign Risk and Financial Crises. Springer.

Gray, D.F., R. C. Merton, and Z. Bodie, (2007). Contingent Claims Approach to Measuring and Managing Sovereign Credit Risk. Journal of Investment Management, Vol. 5, No. 4, Fourth Quarter.

Hagen, J., and T. Ho, (2004). Empirical Links between Twin Crises in the 1980s and the 1990s: Were There Differences? in Frenkel, M., Karmann, A., Scholtens, B., Sovereign Risk and Financial Crises (Springer).

Hildebrand, P., (2007). Financial Stability - Objectives and Challenges for Central Banking. BIS Review 141/2007.

Jaimovich, D., and U. G. Panizza, (2006). Public Debt Around the World: A New Dataset of Central Government Debt. Inter-American Development Bank Working Paper No. 561.

Juttner, D. J., and J. McCarthy, (2000). Modeling a Rating Crisis. Working paper, Macquarie University, Sydney.

Kaufmann, D., A. Kraay and M. Mastruzzi, (2003). Governance Matters III: Governance indicators for 1996-2002. World Bank Working Paper, Washington DC.

La Porta, R., A. Shleifer, A., F. L. Silanes, and R. W. Vishny, (1999). The Quality of Government. Journal of Law, Economics, and Organization 15, 222-279.

Lessard, D. R., (1996). Incorporating Country Risk in the Valuation of Offshore Projects. Journal of Applied Corporate Finance, 52-63.

Levine, R., (2002). Bank-Based or Market-Based Financial Systems: Which is better? Journal of Financial Intermediation 11, 398-428.

Mellios, C., and E. Paget-Blanc, (2006). Which Factors Determine Sovereign Credit Ratings? European Journal of Finance 12, 361-377.

Monfort, B and C. Mulder, (2000). Using Credit Ratings for Capital Requirements on Lending to Emerging Market Economies: Possible Impact of a New Basle Accord. IMF Working Paper No. 69, IMF: Washington.

Mulder, Chris and Roberto Perelli, (2001). Foreign currency credit ratings for emerging market economies. IMF Working Paper 01/191 (Washington: International Monetary Fund).

Paroush, J., (1988). The Domino Effect and the Supervision of the Banking System. The Journal of Finance 43, 1207-1218.

Ratha, D., P. De, and S. Mohapatra, (2007). Sovereign Ratings for Unrated Developing Countries. World Bank Policy Research Working Paper No. 4269.

Ratnovski, Lev, (2007). Liquidity and Transparency in Bank Risk Management, Presentation paper, EFA 2006 Zurich Meetings.

Riley, D., P. Rawkins, J. McCormack, T. Paiz-Fredel, (2007). Sovereign Rating Methodology Criteria Report. Fitch Ratings.

Stulz, R. and R. Williamson, (2001). Culture, Openness, and Finance, NBER Working Paper No. 8222.

Sy, A.N.R., (2004). Sovereign Ratings and Financial Crises, in Frenkel, M.,

Karmann, A., Scholtens, B., Sovereign Risk and Financial Crises (Springer).

Transparency International Press Release, (2009).

Wooldridge, J., (2002). Econometric Analysis of Cross Section and Panel Data. The MIT Press, Cambridge, Massachusetts, U.S.A.

World Economic Outlook, (2009). Crisis and Recovery. World Economic and Financial Surveys, April. International Monetary Fund.

Table 1
Variables and sources of data

Variable	Description	Coverage	Source
spscore	Sovereign long-term foreign currency ratings for S&P	1970-2006	Afonso, Gomes, Rother (2007)
bankliqra	Bank liquid reserves to bank assets ratio	1960-2005	World Development Indicators (2008), WB.
infcpi	Inflation - percentage change in CPI	1960-2005	World Development Indicators (2008), WB.
lngni	Log of gross national income per capita - purchasing power parity	1960-2005	World Development Indicators (2008), WB.
marketcap	Market capitalization of listed companies (% of GDP)	1960-2005	World Development Indicators (2008), WB.
*reer**	Real effective exchange rate	1960-2005	World Development Indicators (2008), WB.
tradeservg	The sum of service exports and imports (% of GDP - current US$)	1960-2005	World Development Indicators (2008), WB.
corruptti	Corruption Index, 1 to 10, a country with a score of 10 is corruption free	1995-2009	Transparency International (2009).
jpgdebt	Central government debt (% of GDP)	1970-2005	Jaimovich, D., Panizza, U., (2006).
adveco	Dummy variable; 1 if Advanced, 0 if Developing		World Economic Outlook (2009), IMF.
beckconc	Share of the assets of 3 largest banks in total banking assets	1987-2007	Financial Structure Dataset by Beck and Al-Hussainy (2009) World Bank.
*beckconcd*75	Dummy variable; 1 if *beckconc* is greater than 75%, 0 otherwise		Financial Structure Dataset by Beck and Al-Hussainy (2009) World Bank.
beckbanka	Deposit money bank assets (% of GDP)	1960-2007	Financial Structure Dataset by Beck and Al-Hussainy (2009) World Bank.
beckmcap	Stock Market Capitalization (% of GDP)	1976-2007	Financial Structure Dataset by Beck and Al-Hussainy (2009) World Bank.
changefx	Change in Exchange Rate (in terms of the number of U.S. dollars per local currency unit)	1990-2010	Bloomberg

* A small part of the Real Effective Exchange Rate data is acquired from the central banks' websites and various World Bank, and IMF reports

Table 2
Sample details

Panel A. Distribution of observations across years and rating categories

S&P Ratings	Numerical Transformation *spscore*	Year											Total by rating
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
AAA	18	11	11	11	8	8	12	13	14	15	17	16	136
AA+	17	3	4	4	4	7	7	6	5	4	2	2	48
AA	16	3	5	5	5	2	2	3	2	2			29
AA-	15	2	1	1					1	1	3	3	12
A+	14	1	1		1	1	1	1		2			8
A	13		1	2		1	1	1	2	2	4	5	19
A-	12	1	2	2	3	4	4	5	4	5	6	6	42
BBB+	11			1	2	1	2	1	3	3	3	3	19
BBB	10	2	2		2	5	3	3	2	4	3	4	30
BBB-	9	2	4	5	5	6	5	6	5	2	2		42
BB+	8	2	1	3	2	4	3	3	3	2	2	2	27
BB	7	1	1	3	5	5	3	2	5	5	5	3	38
BB-	6	2	3	2	3	1	2	3	1	1	2	3	23
B+	5	3	1	1	1	1	4	2	2	3	3	3	24
B	4		2	1	1	4	1	2	1	2	2	1	17
B-	3						3	1	2	2	2	2	12
CCC+	2				1	1		1	3	1	1	1	9
CCC	2							1					1
CCC-	2				1								1
SD (Selective Default)	1					1		1	1	1			4
Total by year		33	39	41	44	52	53	55	56	57	57	54	541

Table 2 continued
Panel B. Distribution across countries and years

Advanced Economies (N = 265)												
Australia	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Canada	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Denmark	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Finland	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Germany	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Italy	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Japan	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Norway	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Singapore	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Spain	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Sweden	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Switzerland	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
United States	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Czech Republic		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	10
Israel		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	10
New Zealand		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	10
Belgium	1995	1996	1997			2000	2001	2002	2003	2004	2005	9
France	1995	1996	1997			2000	2001	2002	2003	2004	2005	9
Ireland		1996	1997	1998	1999		2001	2002	2003	2004	2005	9
Netherlands	1995	1996	1997			2000	2001	2002	2003	2004	2005	9
Portugal	1995	1996	1997	1998	1999	2000	2001	2002	2003			9
UK		1996	1997	1998	1999	2000	2001	2002	2003	2004		9
Austria	1995	1996				2000	2001	2002	2003	2004	2005	8
Greece	1995	1996	1997		1999			2002	2003	2004	2005	8
Luxembourg	1995		1997			2000	2001	2002	2003	2004	2005	8
Slovenia					1999	2000	2001	2002	2003	2004	2005	7
Iceland				1998	1999	2000	2001					4
Cyprus									2003	2004	2005	3
Emerging Markets (N = 276)												
Brazil	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Chile	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Colombia	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Hungary	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Indonesia	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Malaysia	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Mexico	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Philippines	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
South Africa	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Turkey	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Venezuela, RB	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	11
Poland		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	10
Russian Federation		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	10
Costa Rica			1997	1998	1999	2000	2001	2002	2003	2004	2005	9
Argentina	1995	1996	1997	1998	1999	2000	2001	2002				8
Bolivia				1998	1999	2000	2001	2002	2003	2004	2005	8
Latvia				1998	1999	2000	2001	2002	2003	2004	2005	8
Tunisia				1998	1999	2000	2001	2002	2003	2004	2005	8
Croatia					1999	2000	2001	2002	2003	2004	2005	7
Egypt, Arab Rep.					1999	2000	2001	2002	2003	2004	2005	7
Lithuania					1999	2000	2001	2002	2003	2004	2005	7
Morocco				1998	1999	2000		2002	2003	2004	2005	7
Peru					1999	2000	2001	2002	2003	2004	2005	7
Thailand					1999	2000	2001	2002	2003	2004	2005	7
Bulgaria					1999	2000	2001	2002	2003	2004		6
Ecuador						2000	2001	2002	2003	2004	2005	6
Paraguay				1998	1999			2002	2003	2004	2005	6
China	1995	1996	1997	1998	1999							5
El Salvador				1998	1999	2000	2001	2002				5
Trinidad and Tobago							2001	2002	2003	2004	2005	5
Uruguay			1997	1998	1999					2004	2005	5
Estonia				1998	1999	2000	2001					4
Ukraine							2001	2002	2003	2004		4
Ghana									2003	2004	2005	3
Saudi Arabia									2003	2004	2005	3
Total by year	33	39	41	44	52	53	55	56	57	57	54	541

Table 2 continued

Panel C. Descriptive statistics for variables

Only variables employed in our analyses are shown below. The variables are obtained from the sources listed in Table 1 and the sample consists of 541 observations with all variables available for the analyses.

Variable Description	Variable	Mean	Standard deviation	Minimum	Maximum
S&P Sovereign Credit Rating (transformed)	*spscore*	12.067	5.139	1.000	18.000
Log of Gross National Income PC - PPP	*lngni*	9.414	0.833	6.908	10.951
Inflation (% change in CPI)	*inflationcpi*	0.068	0.128	-0.014	0.999
Central Government Debt (% of GDP)	*jpgdebt*	0.495	0.285	0.016	1.523
Real Effective Exchange Rate	*reer*	101.914	14.015	40.110	162.453
Current Account Balance (% of GDP)	*cabg*	0.005	0.062	-0.128	0.285
Advanced Economy Dummy	*adveco*	0.490	0.500	0.000	1.000
Corruption Index	*corruptti*	5.705	2.436	1.500	10.000
Trade in Services (% of GDP)	*tradeservg*	0.189	0.201	0.021	1.789
Concentration in Banking System Dummy (75%)	*beckconcd*75	0.288	0.453	0.000	1.000
Bank Liquid Reserves to Bank Assets	*bankliqra*	0.068	0.074	0.000	0.387
Deposit Money Bank Assets (% of GDP)	*beckbanka*	0.773	0.488	0.106	2.926
Stock Market Capitalization (% of GDP)	*beckmcap*	0.581	0.552	0.005	3.034

Table 3
Models with year dummies

These results are from estimations using the ordered probit methodology. Variables are as defined in Table 1. The first column is the baseline model employing only macroeconomic variables. The model in the second column augments the variables in the baseline model by including two variables designed to capture the institutional environment. The third column augments the model in the second column by including banking sector related variables. The fourth column presents standardized coefficients related to the model in the third column.

Variable Definition	Variable Name	Baseline model (macroeconomic variables)	Model with institutional variables	Final model with financial system variables	
		Coefficients	Coefficients	Coefficients	Standardized Coefficients*
Gross National Income PC - PPP	*lngni*	1.329***	1.019 ***	1.272 ***	0.285 ***
Inflation (% change in CPI)	*inflationcpi*	-4.178***	-3.663***	-3.144***	-0.108***
Central Government Debt (% of GDP)	*jpgdebt*	-1.544***	-1.318***	-1.613***	-0.124***
Real Effective Exchange Rate	*reer*	-0.001	0.000	-0.001	-0.002
Current Account Balance (% of GDP)	*cabg*	2.826***	2.304**	0.571	0.010
Advanced Economy Dummy	*adveco*	2.414***	2.040***	1.950***	0.262***
Corruption Index	*corruptti*		0.344***	0.311***	0.204***
Trade in Services (% of GDP)	*tradeservg*		1.958***	1.737***	0.094***
Concentration in Banking System Dummy (75%)	*beckconcd75*			-0.221*	-0.027*
Bank Liquid Reserves to Bank Assets	*bankliqra*			-3.946***	-0.079***
Deposit Money Bank Assets (% of GDP)	*beckbanka*			1.264***	0.166***
Stock Market Capitalization (% of GDP)	*beckmcap*			0.391***	0.058***
Year Dummy 1996	*iyear1996*	-0.241	-0.291	-0.291	-0.020
Year Dummy 1997	*iyear1997*	-0.494*	-0.542**	-0.559**	-0.040**
Year Dummy 1998	*iyear1998*	-0.612**	-0.746***	-0.798***	-0.059***
Year Dummy 1999	*iyear1999*	-0.788***	-0.877***	-0.891***	-0.071***
Year Dummy 2000	*iyear2000*	-0.741***	-0.832***	-0.934***	-0.075***
Year Dummy 2001	*iyear2001*	-0.917***	-1.000***	-1.091***	-0.089***
Year Dummy 2002	*iyear2002*	-0.936***	-0.931***	-0.998***	-0.082***
Year Dummy 2003	*iyear2003*	-0.840***	-0.813***	-0.819***	-0.068***
Year Dummy 2004	*iyear2004*	-0.820***	-0.769***	-0.805***	-0.067***
Year Dummy 2005	*iyear2005*	-0.846***	-0.764***	-0.834***	-0.067***
Number of Observations		541	541	541	541
Pseudo R^2		0.334	0.372	0.431	0.431

*, **, *** : significant at .1, .05, and .01 levels, respectively

Table 4
Models without year dummies

These results are from estimations using the ordered probit methodology. Variables are as defined in Table 1. The first column is the baseline model employing only macroeconomic variables. The model in the second column augments the variables in the baseline model by including two variables designed to capture the institutional environment. The third column augments the model in the second column by including banking sector related variables. The fourth column presents standardized coefficients related to the model in the third column.

Variable Definition	Variable Name	Baseline model (macroeconomic variables)	Model with institutional variables	Final model with financial system variables	
		Coefficients	Coefficients	Coefficients	Standardized Coefficients*
Gross National Income PC - PPP	*lngni*	1.202***	0.912***	1.145***	0.265***
Inflation (% change in CPI)	*inflationcpi*	-3.510***	-3.041***	-2.465***	-0.088***
Central Government Debt (% of GDP)	*jpgdebt*	-1.561***	-1.282***	-1.561***	-0.123***
Real Effective Exchange Rate	*reer*	0.000	0.002	0.001	0.005
Current Account Balance (% of GDP)	*cabg*	2.740***	2.367***	0.635	0.011
Advanced Economy Dummy	*adveco*	2.602***	2.140***	2.046***	0.284***
Corruption Index	*corruptti*		0.356***	0.328***	0.222***
Trade in Services (% of GDP)	*tradeservg*		1.594***	1.346***	0.075***
Concentration in Banking System Dummy (75%)	*beckconcd75*			-0.249**	-0.031*
Bank Liquid Reserves to Bank Assets	*bankliqra*			-3.701***	-0.076***
Deposit Money Bank Assets (% of GDP)	*beckbanka*			1.254***	0.170***
Stock Market Capitalization (% of GDP)	*beckmcap*			0.392***	0.060***
Number of Observations		541	541	541	541
Pseudo R^2		0.325	0.363	0.421	0.421

*, **, *** : significant at .1, .05, and .01 levels, respectively

Table 5
Estimation over different time periods

Variable Definition	Variable Name	Standardized coefficients over period						
		1995 to 2000	1996 to 2001	1997 to 2002	1998 to 2003	1999 to 2004	2000 to 2005	1995 to 2005
Gross National Income PC - PPP	*lngni*	0.261***	0.267***	0.265***	0.273***	0.293***	0.298***	0.265***
Inflation (% change in CPI)	*inflationcpi*	-0.122***	-0.098***	-0.100***	-0.102***	-0.103***	-0.079***	-0.088***
Central Government Debt (% of GDP)	*jpgdebt*	-0.111***	-0.111***	-0.109**	-0.086***	-0.088***	-0.100***	-0.123***
Real Effective Exchange Rate	*reer*	0.029	0.033*	0.012	-0.005	-0.011	-0.010	0.005
Current Account Balance (% of GDP)	*cabg*	-0.018	-0.018	-0.029	-0.009	0.004	0.016	0.011
Advanced Economy Dummy	*adveco*	0.308***	0.303***	0.316***	0.311***	0.267***	0.246***	0.284***
Corruption Index	*corruptti*	0.209***	0.217***	0.203***	0.227***	0.238***	0.238***	0.222***
Trade in Services (% of GDP)	*tradeservg*	0.078**	0.099***	0.118***	0.083***	0.085**	0.102**	0.075***
Concentration in Banking System Dummy (75%)	*beckconcd75*	-0.055**	-0.043**	-0.024	-0.012	-0.012	-0.012	-0.031*
Bank Liquid Reserves to Bank Assets	*bankliqra*	-0.059**	-0.055***	-0.068***	-0.078***	-0.087***	-0.091***	-0.076***
Deposit Money Bank Assets (% of GDP)	*beckbanka*	0.235***	0.214***	0.185***	0.139***	0.115***	0.094***	0.170***
Stock Market Capitalization (% of GDP)	*beckmcap*	0.044	0.04	0.031	0.016	0.028	0.051*	0.060***
Number of Observations		262	284	301	317	330	332	541
Pseudo R^2		0.428	0.432	0.449	0.445	0.445	0.436	0.421

*, **, *** : significant at .1, .05, and .01 levels, respectively

Appendix 1
Previous studies analyzing sovereign ratings

Study	Details of data	Variables used and details	Empirical methodology
Cantor and Packer (1996)	Cross Sectional, 1995, 49 Countries Numerical Transformation of S&P and Moody's Credit Ratings	GNP per capita (1994), Inflation (avg. 1992-94), Foreign Currency Debt to Exports (1994) Indicator for Economic Development (IMF 1 or 0) Indicator for Default History (since 1970, 1 or 0)	OLS
Juttner and McCarthy (2000)	1996-98 Period	Replicated Cantor and Packer; showed results were not robust Interest rates differentials for currency risk, over or under valuation in real exchange rates. Institutional and operating environment indicator, riskiness of the banking system Private sector credit growth	OLS
Monfort and Mulder (2000)	Panel, 1995-99 20 Emerging Markets S&P, Moody's	Debt to Exports, Reserves, Current Account Surpluss, Real Effective Exchange Rate, Export Growth,Terms of Trade, GDP Growth, Investment to GDP, Spread over T-Bonds	OLS Static and Dynamic Specifications
Borio and Packer (2004)	Panel, 1996-2003, 52 countries S&P, Moody's	Per Capita GDP, GDP Growth, Inflation, debt to GDP, debt to exports Corruption Perception Index, Political Risk, years since default, frequency of high inflation,	OLS Year Dummies
Mellios and Paget-Blanc (2006)	Cross Sectional, Lagged Explanatory Var. 86 countries Dec 31st 2003, Fitch, Moody's, S&P	49 economic and political variables as of December 31st 2002 (1998 to 2002). Per capita income, government income, real exchange rate, inflation rate, default history, and corruption index (TI) Principle Component Analysis used to identify the explanatory variables.	OLS, Logistic, Ordered Logistic
Afonso, Gomes, and Rother (2007)	Unbalanced Panel, 1995-2005, 78 Countries S&P, Moody's, Fitch	GDP per capita, real GDP growth, government debt, government effectiveness, inflation external debt, external reserves, sovereign default indicator, EU dummy, industrialized country dummy and country specific time averages as additional regressors	OLS, Ordered Probit, Random Effects Fixed Effects Random Effects Ord. Probit

Appendix 2
Spearman rank correlation matrix for variables employed in analysis

The correlation matrix is for the 541 observations used in our analysis. Bold type indicates significant correlation coefficients. For statistical significance, p-values appear in italics below the correlation coefficient. Variables shown are described in Table 1.

Variables	*spscore*	*lngni*	*inflationcpi*	*jpgdebt*	*reer*	*cabg*	*adveco*	*corruptti*	*tradeservg*	*beckconcd75*	*bankliqra*	*beckbanka*	*beckmcap*
spscore	1.00												
lngni	**0.89**	1.00											
	0.00												
inflationcpi	**-0.59**	**-0.51**	1.00										
	0.00	*0.00*											
jpgdebt	-0.07	-0.02	-0.09	1.00									
	0.12	*0.59*	*0.03*										
reer	0.27	0.22	-0.14	-0.06	1.00								
	0.00	*0.00*	*0.00*	*0.14*									
cabg	0.20	0.25	-0.26	0.17	-0.06	1.00							
	0.00	*0.00*	*0.00*	*0.00*	*0.14*								
adveco	**0.86**	**0.86**	**-0.50**	0.13	0.27	0.19	1.00						
	0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*							
corruptti	**0.86**	**0.82**	**-0.53**	-0.02	0.20	0.17	**0.79**	1.00					
	0.00	*0.00*	*0.00*	*0.66*	*0.00*	*0.00*	*0.00*						
tradeservg	0.28	0.23	-0.18	0.07	0.13	0.08	0.21	0.30	1.00				
	0.00	*0.00*	*0.00*	*0.10*	*0.00*	*0.07*	*0.00*	*0.00*					
beckconcd75	0.25	0.24	-0.21	0.00	0.16	0.10	0.27	0.39	0.18	1.00			
	0.00	*0.00*	*0.00*	*0.97*	*0.00*	*0.02*	*0.00*	*0.00*	*0.00*				
bankliqra	**-0.74**	**-0.68**	**0.50**	0.00	-0.24	-0.15	**-0.65**	**-0.66**	-0.09	-0.16	1.00		
	0.00	*0.00*	*0.00*	*0.97*	*0.00*	*0.00*	*0.00*	*0.00*	*0.04*	*0.00*			
beckbanka	**0.74**	**0.59**	**-0.54**	0.12	0.18	0.26	**0.67**	**0.60**	0.28	0.19	**-0.65**	1.00	
	0.00	*0.00*	*0.00*	*0.01*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*		
beckmcap	**0.64**	**0.58**	-0.44	0.03	0.13	0.35	**0.51**	**0.63**	0.11	0.26	**-0.61**	**0.62**	1.00
	0.00	*0.00*	*0.00*	*0.51*	*0.00*	*0.00*	*0.00*	*0.00*	*0.01*	*0.00*	*0.00*	*0.00*	