

CAUSES OF BANKING CRISES REVISITED

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Abstract

We examine to what extent there exists heterogeneity in the causes of a banking crisis. For this purpose, we use a random coefficient logit model including 110 countries between 1970 and 2007. We conclude that there exists significant heterogeneity in the causes of a banking crisis. We find that a high credit growth, a negative GDP growth and a high real interest rate are on average the most important causes of a banking crisis. However, none of the variables is significant in more than 60 percent of the countries. Besides we find that the impact of the determinants differ between systemic and non-systemic crises and across stages of economic development.

Keywords: Banking crises, random coefficient logit model

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1. Introduction

Understanding similarities and differences across countries experiencing a banking crisis is important, both from a theoretical perspective and in guiding economic policy. In total, there were more than 130 banking crises in about 110 countries since the 1970s¹. A large number of empirical studies have already examined the determinants of a banking crisis (cf. Demirgüç-Kunt and Detragiache, 1998; Kaminsky and Reinhart, 1999; Garcia Herrero and Del Rio, 2003; Čihák, 2007).

However, most studies treat the determinants of a banking crisis as a homogeneous cause. Meaning, that a variable that is found significant (in a pooled model) should be significant for all individual banking crises. According to Englund (1999) and Kaminsky and Reinhart (1999) the majority of banking crises follows a common pattern of causes and consequences. Banking crises are initiated by deregulatory measures, which lead to overly rapid credit expansion. This in turn increases asset prices, which are unwarranted by fundamentals (a ‘bubble’). At some point the bubble bursts, with a dramatic fall in prices and disruption of the asset markets (in particular for real estate) and widespread bankruptcies. This is accompanied by an increase in non-performing loans, credit losses, and acute liquidity problems within the banking system. Finally, governments have to bail out the weak banking system by large scale recapitalization and nationalization operations.

In contrast, one can argue that the roots and causes of the financial crisis in Latin America in the late nineties are different from the crisis in the Nordic countries in the early nineties or the Asian crisis. According to Quintyn and Taylor (2003) there are two broad categories of banking crises each with different causes. First, microeconomic banking crises. These are mainly caused by poor banking practice which causes asset price bubbles and an excessive concentration of bank portfolios. Second, macroeconomic banking crises which are caused by developments external to the banking system. For example, bad macroeconomic economic conditions.

¹ we identify 132 systemic and nonsystemic banking crises over the period 1970 to 2007. This list is an updated, corrected, and expanded version of the Laeven and Valencia (2008), Honohan and Laeven (2005) and Demirgüç-Kunt and Detragiache (1998) banking crisis databases.

Many recent studies on banking crises are based on pooled estimation. However, Jiang *et al.* (2009) argue that a pooled estimation procedure for panel models can produce inconsistent and misleading estimates of the coefficients². The aim of this paper is to examine to what extent causes of banking crises differ across countries. For this purpose, we use a random coefficient logit model including about 130 banking crises between 1970 and 2007. We conclude that there exists significant heterogeneity in the causes of banking crises. In general, we find that a high credit growth, a negative GDP growth and a high real interest rate are *on average* the most important causes that increases the likelihood of a banking crisis. However, none of the variables is significant in more than 60 percent of the countries. Besides we find that the impact of the determinants differ between systemic and non-systemic crises and across stages of economic development.

The remainder of the paper is structured as follows. The next section discusses the empirical causes of banking crises and presents our heterogeneous model. Section 3 presents our results on the causes of a banking crisis. The final section discusses our results and concludes.

2. Empirical causes of banking crises

In the analyses of Garcia Herrero and Del Rio (2003) and Čihák (2007) banking crises are proxied by using a binary variable. Demirgüç-Kunt and Detragiache (1998) and Honohan and Laeven (2005) identify a crisis when at least one of the following conditions holds: 1) the ratio of non-performing assets to total assets in the banking system exceeds 10 percent; 2) the cost of the rescue operation is at least 2 percent of GDP; 3) Banking sector problems result in a large-scale nationalization of banks; 4) Extensive bank runs take place or emergency measures.

In Table 1 we summarize the results of a number of studies on the determinants of a banking crisis. The results indicate that there is no clear answer on what are the significant causes of a banking crisis. One explanation for the differences in the results is

² See also Jian *et al.* (1994)

sample selection. The results can be determined by the heterogeneity of the crises (and countries) included in the sample. This can be illustrated by the fact that GDP per capita is significant in most studies. This variable often captures not only the average income of a country but also the development in for example institutions and the financial system.

Up till now, most studies use a pooled discrete choice estimator to examine the causes of a banking crisis. However, it is questionable whether a pooled estimator is the appropriate estimation technique in view of the possible heterogeneity in our large sample. To examine this issue in more detail, we use a random coefficient logit model to examine the heterogeneity in the causes of a banking crisis.

Our dependent variable is binary, and takes the value one if a banking crisis is recognized in a particular year and country. We base our dependent variable on the studies by Laeven and Valencia (2008), Honohan and Laeven (2005) and Demirgüç-Kunt and Detragiache (1998) including systemic and non-systemic banking crises³. We estimate our model employing a random coefficient logit model. In the case of a binary choice variable with panel data the model can be given as:

$$y_{it}^* = x'_{it} \beta + \alpha_i + v_{it}. \quad (1)$$

This function can be interpreted as the inclination of a banking crisis, which is dependent on observed variables (x), unobserved individual (country) characteristics (α), and a random error term (v). The probability that we observe a replacement is:

$$P(y_{it} = 1) = P(v_{it} > -x'_{it} \beta - \alpha_i) = F(x'_{it} \beta + \alpha_i). \quad (2)$$

³ For the systemic crises we used Laeven and Valencia (2008) as our main source and supplement it with Honohan and Laeven (2005) and Demirgüç-Kunt and Detragiache (1998), while for non-systemic crises Honohan and Leaven (2005) is our main source.

Random coefficient logit probabilities are the integrals of standard logit probabilities over a density of parameters. Stated more explicitly, a random coefficient logit model is a logit model whose choice probabilities can be expressed in the form:

$$P(y_{it} = 1) = \int \left(\frac{e^{x'_{it}\beta - \alpha_i}}{\sum_j e^{x'_{jt}\beta - \alpha_j}} \right) f(\beta) d\beta \quad (3)$$

We assume $f(\beta)$ is normal distributed. In essence, the random coefficient logit estimator compares all observations within a given country when there is a banking crisis with all the observations when there is no such crisis.⁴ The random coefficient model allows us to estimate the coefficient for each individual country.

Furthermore, we make use of a Bayesian estimation method. According to Hsiao *et al.*, (1999), Bayesian estimators have considerably smaller biases than the standard OLS estimators in case of a random coefficient model.⁵ In part this is because Bayesian methods allow for using simulation methods that reduce problems due to the limited amount of data that is available per country. Although in any case, the mean is calculated over all countries, while the variance terms related to the country-specific parts of the coefficients is based on just T observations. Repeated simulations, provides a solution for this loss in accuracy.

Another advantage of the Bayesian estimator is that it allows for hierarchical estimation. In contrast to standard panel models, hierarchical models allow for causal heterogeneity across countries. Time-series coefficients are estimated for each country and these are specified to depend on time-invariant conditions (Western, 1998). Parameters can be simulated in different stages, such that the country-specific coefficients depend in part on the population-wide estimates.

The random parameters can be considered as the outcomes of a common mean plus an error term, representing a mean deviation for each individual country. The ran-

⁴ There is one obvious drawback in employing the random coefficient logit model: we cannot include explanatory variables that do not vary over time.

⁵ See Bryk and Raudenbusch (1992).

dom coefficient model starts from the assumption that the parameter differences across groups are caused by stochastic variation.

We use a panel model between 1970 to 2007 comprising more than 110 countries including about 130 crises⁶. Since some of the data are not available for all country-years, the panel data are unbalanced. The estimated model is given by:

$$bankcris_{it} = \alpha_i + x'_{j,t-1} \beta_i + v_{it} \quad (4)$$

Where $\alpha_i = \alpha_0 + \kappa_i$ and $\beta_i = \beta_0 + \varpi_i$. The parameters κ , and ω are normally distributed with mean zero. The dependent variable *bankcris* is one in country *i* in year *t* when at least one banking crisis occurred in that year, and x'_j is a vector of control variables with *j* elements and v_{it} is an error term.

The vector of control variables is mainly based on Demirgüç-Kunt and Detragiache (1998). First, we control for macroeconomic factors: *inflation, economic growth, depreciation of the exchange rate, and shocks to the terms of trade* (see also Beck *et al.*, 2006). Adverse shocks affecting the economy will increase the instability of the financial system, for example, by affecting the solvency of borrowers, by increasing uncertainty, or by unexpected and excessive exposure to foreign exchange risk.⁷ We also include *GDP per capita* to control for differences in economic development.

According to Demirgüç-Kunt and Detragiache (1998) high short-term *real interest rates* affect bank balance sheets adversely if banks cannot increase their lending rates quickly enough.

Next, we include a number of measures to capture to which extend financial liberalization has progressed. Improperly implemented financial liberalization is likely to cause banking crises as financial institutions are allowed more opportunities for risk-taking in a liberalized financial market (Kaminsky and Reinhart, 1999). We proxy financial liberalization by including the *growth rate of credit, the ratio of credit to the*

⁶ Appendix A3 list the countries included in the regressions.

⁷ Goldstein *et al.* (2000) find that overvaluation of the real exchange rate is the key determinant of a financial crises.

private sector to GDP and a variable indicating *financial market regulation*. The latter is measured by the credit market regulations index of the Fraser Institute.

Furthermore, large capital inflows and capital flight, particularly in the case of emerging countries, may affect the stability of the financial sector as well. Frankel (1999) argues that since the 1990s international private capital inflows have rapidly increased, raising financial vulnerability and the transmission of financial crises. To test whether banking sector problems are related to sudden capital outflows or changes in the foreign exchange reserves, we include the *net financial flows* and *the ratio of M2 to foreign exchange reserves*.

The *government surplus* as a percentage of GDP captures the financial room a government has to intervene in a banking crisis. Thus, when fiscal deficits are large, the banking system may be more vulnerable. Furthermore, adverse macroeconomic shocks should be less likely to lead to crises in countries where the banking system is liquid. To capture the liquidity of the banking system we use the *ratio of bank cash and reserves to bank assets*.

Explicit *deposits insurance* influences the occurrence of a banking crisis in two opposite ways. On the one hand, bank runs are less likely to occur when deposits are insured against the risk of bank insolvency. On the other hand, deposit insurance motivates banks to engage in overly risk-taking investments if the insurance scheme is under-priced and the premiums fail to fully reflect the risk of bank portfolios. We include the ratio between the guaranteed deposits to total deposits.

Next, Keefer (1999) and Jo (2006) argue that not only the economic situation matters for banking crises but also the political setting of a country. Keefer (1999) finds that the determinants of banking crises are substantially different in countries that exhibit high levels of check and balances compared to those countries that exhibit lower levels. According to Jo (2006), the type of regime affects the timing of financial crisis. To control for the effect of political institutions we include a number of variables that capture the different dimensions of the political system of a country. First, we include the *democratic history* since 1945 using the Polity IV. It has been argued that institutions in countries with a long democratic history have greater political capital to implement ad-

justment policies to restore financial stability (Jo, 2006). Second, political instability will increase the uncertainty about future government economic and financial policies and may thereby increase uncertainty in financial markets. Political instability is proxied by a dummy indicating a regime change and a government stability measure taken from the International Country Risk Guide (2006).

Furthermore, countries lacking a sound legal system and good governance might have more financial system problems due to corruption or inefficient enforcement of law and government ineffectiveness (Demirgüç-Kunt and Detragiache, 1998). To capture this, we use the first principal component of the control of corruption, bureaucratic quality, rule of law and democratic accountability of the International Country Risk Guide (2006).

In addition to the variables suggested by Demirgüç-Kunt and Detragiache (1998), we add a variable to check whether *globalization* affects the likelihood of a banking crisis. This effect can be positive or negative, depending on the correlation with foreign financial shocks. If the correlation is positive globalization will increase the likelihood of a banking crisis, but when the correlation is negative globalization can have a smoothing effect on financial markets.

Finally we include central bank independence (CBI). Greater independence from outside political pressures implies that the central bank is less constrained in preventing banking crisis, which should allow the bank to act earlier and more decisively before a crisis erupts (Čihák, 2007). When politicians influence the central bank in their policy on how to react to a crisis, there is possibility of conflicts of interests. We measured CBI by the average over economic and political independence of the CBI index by Arnone *et al.* (2007). All explanatory variables are listed in Table A2 of the appendix and are lagged by one year to avoid simultaneity and endogeneity problems⁸.

⁸ In Appendix A1 we show a correlation matrix of the control variables. We do not find any evidence for multicollinearity.

3. Estimation results

3.1 Basic results

In this section we present the estimation results of the model presented above. We start in Table 2 by estimating a common used regression in the banking crisis literature with various causes (or determinants) (cf. Demirgüç-Kunt and Detragiache, 1998). To test the robustness of significance, the standard errors are obtained by using the bootstrap estimator with 1,000 replications.

We report the marginal effect of the determinants in both the pooled logit model (conditional fixed effect) and the random coefficient logit model. If we compare the marginal effects between the two models, we find that they significantly differ. However, the F-test on heterogeneity in column (3) indicates that there exists significant heterogeneity across the individual causes of a banking crisis. This test compares the model under the restriction of common slopes across countries with the model that allows for heterogeneous slopes (Baltagi, 1995). The null hypothesis that the data can be pooled is rejected at conventional significance levels (the p-value of the test is for all coefficients smaller than 0.05). Also the joint test on the homogeneity of the coefficients indicates that the heterogeneous model is still preferred above the homogenous model ($p = 0.02$). This is confirmed if we compare the root mean squared error of both models (pooled 0.612, random coefficient 0.561). This means that we should make use of the heterogeneity model⁹.

In the case of the heterogeneous model, we find that *on average* GDP growth, growth rate of the credit to the private sector and the real interest rate are significant determinants of the likelihood that a banking crisis occurs. We can interpret the marginal effects as elasticities, meaning that a one percent increase in the GDP growth decreases the likelihood of a banking crisis by 0.8 percent, while an increase of one percent in the growth rate of the credit supplied to the private sector increases the probability of a banking crisis by 0.3 percent. Furthermore, an increase of one percent in the real interest

⁹ These results are also confirmed by a Chow-test on heterogeneity (results are available upon request).

rate increases the likelihood of a crisis by 0.1 percent. On average we do not find any significant effect for the real GDP level, inflation and credit to the private sector. However, these results cannot be interpreted that these determinants are unimportant, they are not significant *on average*, however, they are significant in *individual* crises. Besides the average effect, we report the percentage of countries in which a variable has a significant positive and negative impact.

The direction of the effect found is not uniform, meaning that we found significant results for the variables both positive and negative. This is one explanation why some of the control variables are not significant on average. For example, the real GDP level and inflation have about an equal share of positive and negative significant cases.

For the variables found significant on average, the effect is more directed in one direction. Although the real interest rate has on average a significant effect, it only increases the likelihood of a banking crisis in about 49 percent of the crises. Credit growth has a significant positive effect in about 51 percent of the cases. The most significant is economic growth, which has a negative effect in about 53 percent of the cases. This is due that a negative economic shock affects the economy as a whole including the banking sector.

In Table 3 we include a number of additional variables motivated above. In Column (1) we estimate a financial variable regression. We do not find evidence that the liquidity within the banking system is a significant contributor to a banking crisis. The same holds for deposits insurance. This is due to the reason that deposit insurance has two opposite effects. This can also be seen in the large shares being significant in individual crises. In about 31 percent of the cases deposit insurance has a positive effect, while for 37 percent it has a significant negative effect. Furthermore, we do find some evidence that an increase in M2 to the foreign exchange reserves raises the probability of a banking crisis.

In Column (2) we include some additional macroeconomic variables to our baseline model. We do not find any evidence that financial flows or the exchange rate influences significant the likelihood of a banking crisis. The same counts for the budget surplus of the government. This latter result can be interpreted that the size of the rescue

packages of the government to recapitalize and nationalize the banking system to restore the peace on the financial markets are not related to budget balances. We do find a significant positive effect of globalization on the probability of a banking crisis.

Next, in Column (3) we include a number of institutional variables. We do not find any evidence that the political institutional environment has on average a significant impact on the stability of the banking sector.

In Column (4) we include all variables. The results are similar compared to the results reported in Column (1) to (3). However, by including all control variables the sample is reduced by about 70 percent. Therefore in Column (5) we estimate a reduced model including the variables that have the most significant observations and are available for more than 70 percent of the country years. The results on the additional variables indicate that an increase in globalization and the ratio between M2 and the foreign exchange reserves significantly increases the likelihood of a banking crisis. The significance of the remaining additional variables varies between 5 and 39 percent. Meaning that the additional variables have a significant effect on individual crises.

To sum up the results so far, we find *on average* a significant effect of real GDP growth, real interest rate, credit growth, globalization and the ratio between M2 and the foreign exchange reserves significantly influences the occurrence of a banking crisis.

3.2 Sensitivity analysis

The results in Table 2 and 3 indicate that some of the variables have different effects (positive as well as negative) across countries and crises. So far we ignored the heterogeneity across crises and countries. To assess further this heterogeneity we employ two sensitivity tests. In the first test we distinguish between systemic and non-systemic banking crises, while in the second test we divide our sample into industrialized countries and emerging markets and developing countries¹⁰¹¹.

¹⁰ Following the classification in the IMF World Economic Outlook Report April 2008.

¹¹ We also performed a robustness test by dividing the sample in a pre-1990 and post-1990 sample. However, the results are in line with the main results reported in Table 3. Meaning, we do not find evidence that the determinants of banking crises changed overtime (results are available upon request)

Honahan and Laeven (2005) distinguish between two broad types of crises: systemic and non systemic banking crises. In a systemic banking crisis, a country's corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, non-performing loans increase sharply and all or most of the aggregate banking system capital is exhausted. This situation may be accompanied by depressed asset prices (such as equity and real estate prices) on the heels of run-ups before the crisis, sharp increases in real interest rates, and a slowdown or reversal in capital flows. In some cases, the crisis is triggered by depositor runs on banks, though in most cases it is a general realization that systemically important financial institutions are in distress.

Table 4 reports our results if we divide our sample in systemic and non-systemic crises. We find that GDP per capita significantly increases the likelihood of a systemic crisis. This indicates that systemic crises are more pronounced in less developed countries. Furthermore, we find that sudden outflows of capital and globalization significantly increase the likelihood of a systemic banking crises. Meaning, that when negative financial shocks are correlated and lead to large capital outflows due to uncertainty the instability of the financial sector will increase.

Furthermore in the second part of Table 4 we perform the country sample split. We find that banking crises in emerging markets and developing countries are significantly caused by low institutional quality and low level of financial regulations. Meaning that in these countries banking crises are driven by ineffective government policy which could lead to corruption, inefficient bureaucracy and inadequate regulation.

In both sample splits, we still find (on average) the growth rate of GDP, the real interest rate, the credit growth and M2 to foreign exchange reserves as a significant determinant of the likelihood of a banking crisis. Meaning, that these variables are robust to sample and variable selection.

4. Conclusion

Understanding similarities and differences across countries experiencing banking crises is important, both from a theoretical perspective and in guiding economic policy. In to-

tal, there were more than 130 banking crises in about 110 countries since the 1970s. A number of empirical studies have examined the determinants of a banking crisis (cf. Demirgüç-Kunt and Detragiache, 1998; Kaminsky and Reinhart, 1999; Garcia Herrero and Del Rio, 2003; Čihák, 2007).

Up till now, most studies use a kind of pooled logit estimator to examine the causes of a banking crisis. However, it is questionable whether a pooled estimator is the appropriate estimation technique in view of the possible heterogeneity in our large sample.

The aim of this paper is to examine to what extent heterogeneity influences the causes of a banking crisis using a panel model between 1970 to 2007. For this purpose, we use a random coefficient model. We conclude that there exists significant heterogeneity in the causes of banking crises. In general, we find that credit growth, GDP growth and the real interest rate are *on average* the most important causes of a banking crisis. However, none of the variables is significant in more than 60 percent of the crises. Furthermore, we find some evidence that an increase in globalization or the ratio between M2 and the foreign exchange reserves significant increases the likelihood of a banking crisis. Besides, we find that the impact of the determinants differ between systemic and non-systemic crises and the level of economic development.

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Appendix A1: Correlation diagram

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
GDP per capita	(1)	1.000															
GDP per capita growth	(2)	0.150	1.000														
real interest rate	(3)	0.022	-0.097	1.000													
Inflation	(4)	-0.217	-0.182	0.223	1.000												
M2 to foreign exchange reserves	(5)	-0.090	0.014	0.027	0.019	1.000											
Change terms of trade	(6)	0.029	0.015	0.058	-0.150	-0.005	1.000										
Credit to GDP	(7)	0.710	0.162	-0.107	-0.298	-0.034	0.018	1.000									
Credit growth	(8)	0.102	0.050	-0.012	-0.114	-0.026	0.021	0.147	1.000								
Net financial flows	(9)	-0.026	0.272	-0.078	-0.017	-0.063	-0.105	-0.035	0.008	1.000							
Bankassets to reserves	(10)	-0.408	-0.128	-0.025	0.353	-0.025	-0.158	-0.428	-0.110	0.127	1.000						
Depreciation	(11)	0.232	0.338	-0.098	-0.850	0.042	0.173	0.264	0.101	0.025	-0.325	1.000					
Government deficit	(12)	-0.258	-0.370	-0.120	0.193	0.021	0.023	-0.077	0.001	0.129	0.170	-0.199	1.000				
Institutional quality	(13)	0.688	0.271	-0.103	-0.327	0.013	0.055	0.651	0.191	0.059	-0.319	0.329	-0.138	1.000			
Financial regulation	(14)	0.701	0.175	-0.047	-0.410	-0.069	0.075	0.436	0.092	-0.037	-0.351	0.384	-0.302	0.431	1.000		
Deposit insurance	(15)	-0.015	-0.091	-0.007	-0.042	0.037	-0.065	-0.072	-0.027	0.013	0.070	-0.012	0.073	-0.050	0.056	1.000	
Central Bank Independence	(16)	0.000	0.045	-0.055	0.073	-0.005	-0.038	-0.031	-0.033	-0.002	-0.039	0.005	-0.027	0.006	0.070	0.028	1.000

Appendix A2: Data sources

Variable		Source
Real GDP level	GDP measures the total output of goods and services for final use occurring within the domestic territory of a given country, regardless of the allocation to domestic and foreign claims. Data are in constant 2000 U.S. dollars.	World Bank (2007)
Real GDP growth	Annual percentage growth rate of GDP at market prices based on constant 2000 U.S. dollars	World Bank (2007)
Real interest rate	the deposit interest rate less the rate of inflation measured by the GDP deflator.	World Bank (2007)
Inflation	Change in the consumer price index	World Bank (2007)
M2 to foreign exchange reserves	the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government.	World Bank (2007)
Change in terms of trade	The capacity to import less exports of goods and services in constant prices	World Bank (2007)
Credit to the private sector	gross credit from the financial system to individuals, enterprises, nonfinancial public entities not included under net domestic credit, and financial institutions	World Bank (2007)
Growth of credit	Growth rate of credit to the private sector	World Bank (2007)
International financial flow	Total inflow of capital minus the outflow of capital. This including disbursements of loans and credits less repayments of principal.	World Bank (2007)
Bank reserves to assets	Total bank reserves to total bank assets	International Monetary Fund (2007)
Deposit insurance coverage	Percentage of the total value on savings deposits guaranteed by an insurance coverage scheme	Demirgüç-Kunt and Detragiache (1998)
Depreciation	Depreciation of the official exchange rate	World Bank (2007)
Government budget deficit	Government revenue minus government spending	International Monetary Fund (2007)
Institutional quality	Quality of institutions measured by a PCA of bureaucratic quality, corruption, Rule of law and government stability	International Country Risk Guide (2003)
Financial regulation	Credit market regulations index	Fraser Institute (2007)
Central Bank Independence	Average of economic and political independence. Measuring from 0 (full dependent) to 1 (full independent)	Arnone <i>et al.</i> (2007) and Acemoglu <i>et al.</i> (2008)
Democratic history	Number of democratic years since 1945	Polity IV
Regime instability	Dummy variable taking the value one if the Polity IV changed more than 3 points in one year, otherwise zero.	Polity IV
Government instability	Stability of the incumbent government on a scale from 1 to 7	International Country Risk Guide

Appendix A3: Countries included,

Albania	Djibouti	Jordan	Poland
Algeria	Dominican Republic	Kenya	Romania
Angola	Ecuador	Korea	Russian Federation
Argentina	Egypt	Rep.	Rwanda
Armenia	Arab Rep.	Kuwait	Samoa
Australia	El Salvador	Kyrgyz Republic	Senegal
Azerbaijan	Equatorial Guinea	Lao PDR	Sierra Leone
Bangladesh	Eritrea	Latvia	Singapore
Belarus	Estonia	Lebanon	Slovak Republic
Benin	Ethiopia	Lesotho	Slovenia
Bolivia	Finland	Liberia	South Africa
Bosnia and Herzegovina	France	Lithuania	Spain
Botswana	Gabon	Macedonia	Sri Lanka
Brazil	Gambia	Madagascar	Swaziland
Brunei Darussalam	Georgia	Malaysia	Sweden
Bulgaria	Germany	Mali	Tajikistan
Burkina Faso	Ghana	Mauritania	Tanzania
Burundi	Greece	Mauritius	Thailand
Cameroon	Guatemala	Mexico	Thailand
Canada	Guinea	Morocco	Togo
Cape Verde	Guinea-Bissau	Mozambique	Trinidad and Tobago
Central African Republic	Guyana	Myanmar	Tunisia
Chad	Haiti	Nepal	Turkey
Chile	Hong Kong	New Zealand	Uganda
China	China	Nicaragua	Ukraine
Colombia	Hungary	Niger	United Kingdom
Dem. Congo	Iceland	Nigeria	United States
Dem Rep. Congo	India	Norway	Uruguay
Costa Rica	Indonesia	Panama	Venezuela
Cote d'Ivoire	Israel	Papua New Guinea	Vietnam
Croatia	Italy	Paraguay	Yemen
Czech Republic	Jamaica	Peru	Zambia
Denmark	Japan	Philippines	Zimbabwe

Table 1: Banking crises studies

	Demirgüç-Kunt and Detriache (1997)	Beck <i>et al.</i> (2006)	Garcia Herrerro and Del Rio (2003)	Cihak (2007)	Demirgüç-Kunt and Detriache (1998)	Glick and Hutchi- son (2000)	Eichengreen and Arteta (2002)	Domac and Peria (2003)	Hutchison and McDill (1999)	Komulainen and Lukkarila (2003)	Tanveer and De Haan (2008)
GDP growth	s, -	s, -	s, -	ns,+	s, -	s, -	ns, -	ns, +	ns, +		s, -
Changes terms of trade	ns, -	ns, -		ns, -	s, -			ns, -			ns,+
Depriciation	ns, +/-	ns, +		s/ns,-			ns, +		ns, +	s, +	s/ns,+
Real interest rate	s, +	s, +	ns, +	s,+, ns,-	s, +			ns, -	ns, -		s/ns,+
Inflation	s, +	ns, +	ns,-	ns,+/-	s, +	ns, +		ns, -	ns, +	s, -	ns,-
Government budget	ns, -						s, +		ns, -	s, +	
M2 to foreign exchange reserves	s, +	ns/s, +		ns, +/-	s, +		s, +	ns, -	ns, +	s, +	ns/s,-
Private credit to GDP	s/ns, +				ns, +/-					s, -	ns,+
Bank reserves to assets	ns, +		s,-		ns, -			ns, +/-		s, -	
Credit growth	ns, +/-, s, +	ns/s, +	ns,+	s, +	s, +		s, +	s, +	ns, +		
Real GDP per capita	ns/s, -	s, -	s, -		s, -			s, -		s, -	s,-
Deposit insurance	s, -		ns,-								
Law and order	s, -										
Period	1980-1994	1980-1997	1970-1999	1980-2003	1980-1995	1975-1995	1975-1995	1980-1997	1975-1995	1980-2001	1981-2002
Countries	Mixed	Mixed	Mixed (79 Coun- tries)	Mixed (48 Coun- tries)	Mixed (53 Coun- tries)	Mixed (90 Coun- tries)	Mixed	Mixed	Mixed (49 coun- tries)	Emerging mar- kets (31 coun- tries)	Emerging mar- kets (33 coun- tries)
Method	Probit	Logit	Logit	Logit	Logit	Probit	Probit	Logit	Probit	Logit	Probit

s = significant at a 10 percent level, ns = not significant at a 10 percent level.

Table 2: Estimation results I - Baseline results

	Pooled model	Heterogeneity model	Pooled model
	(1)	(2)	(3)
Real GDP level	-0.761 [-2.36]**	-0.894 [-1.34] (21.56;22.39)	0.000
Real GDP growth	-0.881 [-5.84]**	-0.787 [-2.57]** (4.35;53.04)	0.000
Real interest rate	0.029 [4.90]**	0.107 [2.31]** (48.87;3.96)	0.000
Inflation	0.734 [3.70]**	0.597 [1.49] (14.88;12.90)	0.000
Credit to the private sector	0.007 [0.48]	0.024 [1.23] (24.79;4.13)	0.000
Growth of credit	0.483 [2.04]**	0.291 [2.14]** (51.40;3.04)	0.000
Number of observations		2674	
Number of countries		110	
Average time series		24.31	
Joint homogeneity		0.023	
Likelihood ratio test p-value		0.000	

Note: z-values between brackets. **/** indicates significance at 10/5 percent.

Table 3: Estimation results II - additional variables

	Heterogenous model				
	(1)	(2)	(3)	(4)	(5)
Real GDP level	-0.964 [-1.06] (18.27;18.25)	-0.833 [-1.37] (17.97;19.91)	-1.024 [-1.33] (21.38;25.64)	-0.692 [-1.10] (20.61;20.92)	-0.906 [-1.38] (20.53;16.89)
Real GDP growth	-0.769 [-2.59]** (3.58;55.76)	-0.775 [-2.28]** (3.68;59.08)	-0.700 [-2.00]** (4.08;53.10)	-0.697 [-2.18]** (3.65;45.32)	-0.780 [-2.86]** (3.80;52.23)
Real interest rate	0.091 [2.23]** (38.35;3.00)	0.117 [1.93]* (49.36;4.30)	0.120 [1.81]* (54.78;3.12)	0.105 [2.32]** (53.53;3.04)	0.118 [1.92]* (47.66;3.06)
Inflation	0.558 [1.18] (13.38;11.60)	0.556 [1.30] (15.35;11.18)	0.684 [1.21] (11.56;10.16)	0.678 [1.18] (11.98;10.58)	0.655 [1.20] (12.28;13.94)
Credit to the private sector	0.020 [1.31] (22.20;4.06)	0.022 [1.16] (26.76;3.17)	0.025 [1.04] (22.88;3.95)	0.018 [0.94] (19.02;4.26)	0.021 [1.15] (19.93;3.26)
Growth of credit	0.283 [1.98]** (49.95;2.52)	0.281 [2.28]** (48.08;2.97)	0.258 [2.00]** (57.63;2.97)	0.263 [2.31]** (58.94;3.04)	0.261 [1.93]* (55.76;2.93)
M2 to foreign exchange reserves	0.207 [1.97]** (53.77;13.04)			0.184 [1.76]** (50.75;10.17)	0.197 [2.21]** (51.98;9.64)
Bank reserves to assets	-0.003 [-0.47] (15.29;15.29)			-0.003 [-0.50] (9.98;9.65)	
Deposit insurance coverage	-0.025 [-1.44] (31.13;37.14)			-0.020 [-1.50] (7.51;30.48)	
Depreciation		0.191 [1.35] (19.90;8.71)		0.138 [1.34] (16.44;6.64)	0.136 [1.40] (20.09;9.18)
Change in terms of trade		0.094 [0.87] (6.78;3.39)		0.095 [1.00] (6.36;2.96)	0.107 [1.02] (6.13;3.59)
Net financial flows		-0.087 [-1.01] (16.19;15.24)		-0.096 [-0.94] (15.17;14.68)	-0.100 [-1.08] (19.57;18.95)
Government budget deficit		-0.089 [-1.44] (5.97;23.04)		-0.054 [-1.63] (5.81;15.24)	
Globalization		0.165 [1.88]* (44.87;10.25)		0.153 [1.84]* (31.04;7.26)	0.151 [1.92]* (39.48;8.21)
Institutional quality			-0.115	-0.075	-0.077

			[-1.54]	[-1.54]	[-1.43]
			(8.70;23.04)	(5.52;34.81)	(6.84;31.87)
Financial regulation			-0.056	-0.051	-0.060
			[-1.48]	[-1.22]	[-1.28]
			(8.70;23.04)	(8.70;19.08)	(8.92;19.71)
Central Bank Independence			-0.135	-0.119	
			[-0.87]	[-0.82]	
			(12.76;19.82)	(10.37;13.35)	
Democratic history			-0.176	-0.173	-0.162
			[-1.25]	[-1.31]	[-1.50]
			(6.25;24.00)	(5.66;20.68)	(6.17;26.95)
Government instability			0.089	0.097	
			[1.09]	[1.09]	
			(2.89;19.87)	(2.26;15.59)	
Regime instability			0.044	0.043	
			[0.67]	[0.54]	
			(2.73;14.87)	(2.05;8.93)	

Number of observations	1910	2224	1544	738	1863
Number of countries	91	94	87	61	91
Average time series	20.987	23.659	17.747	12.0965	20.476
Likelihood ratio test p-value	0.000	0.000	0.000	0.000	0.000

Note: z-values between brackets. ** indicates significance at 10/5 percent.

Table 4: Estimation results III - Sensitivity analysis

	Systemic crises	Non-systemic crises	Developing countries	OECD countries
	(1)	(2)	(3)	(4)
Real GDP level	-1.261 [-2.70]** (53.62;14.35)	-0.830 [-0.87]** (12.40;13.69)	-0.912 [-2.51]** (51.25;16.38)	-0.789 [-1.21] (12.16;13.03)
Real GDP growth	-0.952 [-2.66]** (3.90;58.28)	-0.459 [-2.49]** (3.82;55.87)	-0.935 [-4.81]** (4.02;68.21)	-0.252 [-1.80]* (3.93;47.32)
Real interest rate	0.125 [2.45]** (48.83;3.22)	0.152 [1.55]** (38.79;2.72)	0.150 [2.29]** (44.93;2.62)	0.153 [2.50]** (50.17;3.00)
Inflation	0.716 [1.46] (9.99;13.05)	0.710 [1.01] (23.72;12.37)	0.605 [1.15] (13.51;14.81)	0.740 [1.55] (11.30;13.20)
Credit to the private sector	0.039 [2.23]** (40.90;2.66)	0.017 [1.24] (22.26;2.94)	0.040 [1.89]* (35.56;2.80)	0.014 [1.27] (23.50;3.14)
Growth of credit	0.472 [3.28]** (61.29;2.95)	0.259 [1.38] (34.97;2.37)	0.164 [1.77]* (31.91;3.20)	0.416 [2.50]** (57.93;2.40)
M2 to foreign exchange reserves	0.201 [2.52]** (11.41;20.37)	0.175 [2.32]** (12.25;16.72)	0.244 [2.57]** (10.84;21.25)	0.195 [2.78]** (9.93;21.04)
Change in terms of trade	0.098 [1.21] (5.07;3.48)	0.111 [1.09] (6.48;3.11)	0.111 [1.15] (6.24;3.43)	0.123 [0.93] (5.26;3.23)
Net financial flows	-0.099 [-1.96]* (47.76;15.89)	-0.120 [-1.33] (16.93;18.31)	-0.129 [-1.38] (20.25;18.59)	-0.087 [-1.26] (19.89;17.91)
Globalization	0.153 [2.12]** (52.90;7.14)	0.120 [1.55] (21.60;5.60)	0.122 [1.99]** (47.93;8.38)	0.130 [1.43] (29.71;6.07)
Depreciation	0.138 [1.37] (18.74;9.42)	0.110 [1.55] (17.45;8.10)	0.169 [1.41] (16.75;7.45)	0.140 [1.56] (16.23;9.53)
Institutional quality	-0.071 [-1.54] (6.82;31.37)	-0.098 [-1.41] (7.09;26.22)	-0.078 [-2.03]** (8.67;59.04)	-0.047 [-1.10] (7.38;32.60)
Financial regulation	-0.093 [-1.40] (9.21;20.33)	-0.054 [-1.14] (8.07;21.22)	-0.141 [-1.98]** (9.33;51.49)	-0.038 [-1.14] (7.52;19.34)
Democratic history	-0.110 [-1.11]	-0.129 [-1.02]	-0.197 [-1.48]	-0.133 [-1.05]

	(5.85;22.08)	(5.47;24.74)	(5.43;37.25)	(6.34;17.82)
Number of observations	1349	1349	673	676
Number of countries	75	75	48	27
Average time series	17.987	17.987	14.012	25.054
Likelihood ratio test p-value	0.000	0.000	0.000	0.000

Note: z-values between brackets. ** indicates significance at 10/5 percent.