A Work Project, presented as part of the requirements for the Award of a Masters Degree in Finance from the NOVA – School of Business and Economics.

Banking Crises: the Impact of Financial Liberalization

Gustavo de Jesus da Eira Ferreira

Student Number 717

A Project carried out under the supervision of:

Professor Paulo Manuel Marques Rodrigues

January 2014

Banking Crises: The Impact of Financial Liberalization

Abstract

This paper intends to study whether financial liberalization tends to increase the likelihood of systemic banking crises. I used a sample of 79 countries with data spanning from 1973 to 2005 to run a panel probit model. I found that, if anything, financial liberalization as measured across seven different dimensions tends to decrease the probability of occurrence of a systemic banking crisis. I went further and did several robustness tests – used a conditional probit model, tested for different durations of liberalization impact and reduced the sample by considering only the first crisis event for each country. Main results still verified, proving the results' robustness.

Keywords: financial liberalization, banking crises, panel data probit model.

1. Introduction

In the last years, following the financial crisis of 2008, several voices raised against financial liberalization. Major concerns were that the deregulating measures initiated throughout the world economies several decades before were the main cause of this monumental systemic banking crisis. Fingers were pointed at government leaders and regulators were blamed and deemed irresponsible. This paper wants to challenge the general knowledge regarding this topic and answer the question: does financial liberalization increase the likelihood of a systemic banking crisis? Previous studies are contradictory and not comparable due to differences in sample, liberalization measures and crisis definition. Building on a previous study from Shehzad and Haan (2008) I am using a panel data probit to model the impact of financial liberalization in 79 countries for the period spanning from 1973 until 2005. This study adds value by extending the number of countries considered and therefore increasing the number of observations and estimation accuracy. Also, I am using the most recent databases on financial liberalization and crisis occurrence. Another difference regarding this paper is that I used different control variables which choice was backed on stronger theoretical grounds. Besides, the robustness tests conducted herein differ from those used by Shehzad and Haan (2008).

I found that, in fact, financial liberalization as measured by the seven dimensions: credit controls and reserve requirements, interest rate controls, entry barriers, state ownership, policies on securities markets, banking regulations, and restrictions on the capital account tends to reduce the likelihood of a systemic banking crisis. Results are robust to changes in sample related to the crisis occurrence variable and the model used (panel probit vs conditional logit models).

The paper is organized as follows: Section 2 is the literature review containing the major studies on this topic; Section 3 does a theoretical framing on banking crisis and financial regulation; Section 4 explains the data used to perform the analysis; Section 5 explains the model and estimation method; Section 6 presents the empirical findings on the topic being studied; Section 7 intends to test the robustness of the results and Section 8 concludes.

2. Literature Review

The first study of this kind dates from 1998, a paper by Demirgüç-Kunt and Detragiache (1998b) in which the authors argued that financial liberalization actually increases the likelihood of a banking crisis. For their study they looked at a sample of 53 countries (both developed and developing countries) for the period from 1980 to 1995. Great criticism is tied to the narrow proxy for measuring liberalization they used. They ignored the majority of the dimensions embodied in the financial liberalization phenomenon and looked only at interest rate liberalization. Even though, another interesting conclusion was drawn: financial liberalization tends to have a less negative impact in economies where the institutional environment is strong.

Kaminsky and Reinhart (1999) focused on twin crises and found that banking crises tend to precede currency crisis and both are more prone to happen in the aftermath of financial liberalization. In their study, they considered as indicators of financial liberalization the ratio of M2 over reserves, the ratio of domestic credit to nominal GDP and real interest rates among others. They further argued that financial liberalization shocks, in the sense that they provide eased access to financing, seem to be related with boom-bust cycles.

Also using a panel-probit model, Noy (2004) showed that financial liberalization can pose a threat to the banking sector in different ways. In the medium run, in fact, the risk taking behavior it promotes can have negative effects on banking stability. However, he also shows that the major problem is associated with the loss of monopoly power brought by this kind of liberalization in the short run. Fragility of results can be argued from the fact that it measures financial liberalization using very few dimensions of this phenomenon.

Tornell, Westermann and Martinez (2004) analyzed the link between financial liberalization, growth and crises in the developing world. For this, they took a slightly different approach by looking at the impacts on the tradables and non-tradables sectors of the economy. They reached the conclusion that crises are the price to pay to have growth in the presence of weak enforceability environments. Due to weaker financial controls and increased credit availability, financial fragility may lead to occasional crises. In fact, financial liberalization brings growth in a not so smooth way and needs therefore to be followed by judicial reforms and contract enforceability. In general, tradables sector tends to recover faster from a crisis comparing to the non-tradables sector.

Ranciere, Tornell and Westermann (2006) found that the benefits of financial liberalization in spurring growth outweigh the bad economic impact caused by the financial crises it facilitates. They look at the so called twin crises – the occurrence of both a banking crisis and a currency crisis – given that these are more common in financially liberalized economies. By using an empirical model which combines a growth model and a crisis model, they allow for the financial liberalization to have a

double impact: a direct effect on fostering growth and an indirect cost associated with a higher tendency for financial crises.

More recently, taking advantage of a more complex and accurate database on financial liberalization, Shehzad and Haan (2008) changed the paradigm that financial liberalization increased the likelihood of banking crises. In their study, they split systemic and non-systemic banking crises and found that liberalization may actually have different impacts, depending on the type of banking crisis. Regarding systemic banking crises, financial liberalization does not seem to impact positively on the likelihood of its occurrence. On the other hand, when dealing with non-systemic banking crises, liberalization may play an important role.

3. Theory

a. Banking system and crises

Banking crises have hit the financial system in a repetitive way over the last decades. Their increased severity and comprehensiveness has created many problems that range from the lack of credit to the economy to the malfunctioning of the payments system. All in all, banking crises tend to jeopardise economic growth through the reduction of investment and consumption, forcing many viable firms into bankruptcy. On a greater scale, confidence in the whole financial system can be deeply harmed, leading to the close of hugely important banks.

With the role of funds allocators, banks shift money from the economic agents that are net lenders to those that assume a role of net borrowers. As such, banks are given the difficult task of turning short-term deposits into long-term loans making money on the spread between the rates charged and the ones they offer. During this activity, risk arises

due to the fact that the two kinds of individuals have different investment horizons. Credit risk is related with the possibility of shrinkage in the value of the banks' assets due to incapacity of the borrowers to service their debt. In an attempt to reduce this risk, banks can become more demanding with the screening of loan applicants; they can pay special attention to portfolio diversification or they can opt to ask for collateral. However, all of these measures have associated costs. Should banks screen their applicants too severely then they would lose money simply due to the fact that riskier projects are charged higher interest rates. On the other hand, small banks may have difficulties in diversifying their portfolio because they are either focused on a specific sector or region. Lastly, collateral may become too costly to monitor and its value may be hard to measure. Whenever the loan losses exceed the capital reserves of the institution, the bank enters into a crisis. To consider this as a systemic crisis, a great portion of the banking system needs to face this same problem. Indirectly, shocks affecting the performance of bank borrowers will have a tremendous impact on banks' sustainability. Caprio and Klingebie (1996) and Kaminsky and Reinhart (1999) identify some of these shocks to be related with asset prices reductions, depreciations in the terms of trade and also cyclical output downturns.

Another important way in which banks can face difficulties is related with the increase in short-term real interest rates. Given that banks have a fixed return on their assets – long-term loans typically have fixed rates – an increase in the interest rates granted to the depositors would cause a decrease on its overall rate of return. This deterioration of the banks' balance sheet position could be partly passed on to the customers by charging more on future loans, however, this poses a problem of nonperforming loans. Theoretically, the determinants of sharp increases in short-term interest rates can

indirectly increase the likelihood of a systemic banking crisis. Among these determinants are a restrictive monetary policy, inflation rate increases, reduction of interest rate controls resulting from liberalization (Galbis, 1993) or even measures taken to protect currencies from speculative attacks (Kaminsky and Reinhart, 1999).

A third way in which a bank is exposed to returns mismatch results from the existence of international business – borrowing in foreign currency to lend in domestic currency. In this scenario, sharp depreciations of the domestic currency can leave banks in an extremely uncomfortable position. Once again, financial institutions have the possibility of passing on the risk to its customers by lending in foreign currency, facing the consequent possible increase in nonperforming loans. Examples of this type of crises were the ones in Mexico in 1995, in the Nordic Countries in the early 1990s and in Turkey in 1994.

A very special characteristic of the banking system is its inexorable dependence of the confidence the depositors have on the system. According to Diamond and Dybvig (1993), bank runs may be self-fulfilling which leaves banks in the hands of an overall strong confidence in the system. To fight down the fact that groundless panic can cause the whole banking system to struggle, deposit insurance can be introduced. There are two types of deposit insurance – explicit or implicit. In the former, there is a clear insurance on behalf of the depositors, purchased by the bank from either the government or a private institution. Regarding the latter, there is a generalized belief that in case of need, the government will either prevent the bank to collapse or in case the institution falls, it will step in to make up for the depositors' losses. Researchers, however, disagree on the benefits of having deposit insurance. If, on the one hand, it can calm down investors avoiding self-fulfilling crises, on the other it can introduce a problem of

moral hazard. Whenever the premium paid for the insurance is not reflecting the risk of the portfolio being secured, there is room for a risk-taking action from the bank. Also, the effects of the deposit insurance increase when we are in the presence of financial liberalization. The theory, being ambiguous on this field, demands that these mechanisms are well designed, implemented and monitored, bringing supervision into play. A strong legal system that makes sure the law is enforced may reduce the possibilities of bad management arising from a strong liberalization allied to a deposit insurance facility. As such, rule of law appears to be important when looking at financial health.

Lastly, capital inflows may have a word on banking crisis. With the globalization, the banking sector became more exposed to foreign causes of distress. Liquidity shortages are one example of such fragilities. When we have economies with high interest rates combined with a period of financial liberalization, large capital inflows may occur, leading to an expansion in the supply of credit. The moment these conditions change – foreign interest rates increase or confidence is reduced – the national credit market will face a problem of lack of liquidity as explained by Calvo, Leidermand, and Reinhart (1993). The same kind of problem can be caused by a capital outflow driven by a possible devaluation of a fixed exchange rate currency due to a speculative attack.

b. Financial liberalization

Governments play a decisive role in determining the financial liberalization degree of a specific country. Governing institutions can impose controls on several financial variables to either tighten or ease liberalization of the banking sector. Among them are capital controls, credit controls, interest rate controls, barriers to entry and banking

sector ownership. In this section, I intend to explain to what extent the manipulation of these variables is related to a more or less liberalized financial system as well as the connections that may arise with a banking crisis.

Starting with capital controls, these can be of two different natures: administrative or market-based. While the former ones deal essentially with limits imposed on capital transference and authorizations on capital movements, the latter ones translate into taxes levied on capital inflows, extraordinary reserve requirements for foreign institutions or even the obligation to invest part of the money in non-interest bearing loans, acting as a hidden tax. Regarding the duration of these measures, they can appear as a temporary measure which tends to be used to smooth macroeconomic fluctuations or as long-term restrictions aiming at increasing capital allocation resulting in output growth and life standards improvements. Historically, capital restrictions evolved along major global financial and economic events. Going back to the gold standard period, capital moved freely across borders with almost no restrictions, John Maynard Keynes was at the time a fervent supporter of this kind of system. His view, however, changed slightly by the time the Great Depression broke out in 1929 and so did the view of the majority of the world leaders. The fear of a major contagion trough external capital flows led to a surge in the imposition of capital controls. Once again, the new *status quo* would only be reversed with the next big financial change – the end of the Bretton Woods system in 1973. From then onwards, floating exchange rates led to the relaxation of capital movements restrictions in the richer countries. Money flowing to the emerging market economies allowed for greater returns on savings of the developed economies as well as an increase in employment opportunities and living standards in the developing economies. More recently, the world was shaken by the 2008 financial crisis that

incentivised decision makers to think about the not so pretty side of globalization. As history repeats itself, a reversal in terms of capital restrictions was seen once again with some countries tending to have greater caution on capital flows allowed. Money stopped flowing to less developed countries jeopardizing the steady growth they had achieved so far while investments in less risky projects/financial products led to a reduction in the rates of return in developed countries. All this swings in capital flows controls leads us to the question on whether a relaxation of these measures is beneficial to the health of the financial system. Theoretically, liberalization of this field should allow for a more efficient capital allocation, as it has been said, and also to a reduction in volatility of the nations' national income. Since crises across borders are not totally synchronized, having investments abroad can reduce the impact of macroeconomic shocks. Other advantages relate to the incentives created for decision makers to keep up the good work under penalty of having capital outflowing from its economies. Lastly, the transference of both technological and managerial knowledge is fostered with capital controls easing.

Regarding interest rate controls, these are often taken as the first sign of financial deregulation (Demirgüc-Kunt and Detragiache, 1998a). Such restrictions can be imposed to reduce the impact of asymmetric information faced by lenders, to favor a crucial sector or industry for the economy (Miller, 2013) or even to protect consumers from arbitrarily set interest rates (Maimbo and Gallegos, 2014). In the presence of strong market power of the financial system, it can also help limiting the price of credit. Given that interest rate caps distort the market, it causes banks to ask for more collateral, to reduce the supply of credit or even to operate at a loss. Other negative effects are tied to an increase in shadow banking, increase in total cost of loans through alternative charges such as fees and commissions and a decrease in the product diversity

as shown by (Maimbo and Gallegos, 2014). According to Weller (1999), interest rate ceiling removal should make it easier for commercial banks to attract deposits and also for them to provide loans. Imposing caps on interest rates charged by banks would mean that riskier projects, with consequent higher rates of return, would be ruled out of the banks' balance sheet. If, on the one hand it reduces risk taking behaviors, on the other hand it certainly reduces profitability. All in all, interest rate controls abolishment should increase efficiency in allocating capital as it eliminates distortions in financial intermediaries' willingness to supply credit to the real side of the economy by reducing the incentives for adverse selection.

Another dimension of financial liberalization are the barriers to entry that foreign financial institutions might face when trying to enter new markets. Levine (1996) stresses out the main advantages of removing such barriers as being related with increased competitiveness, a broader offer of financial services and eased access to the most recent technology and banking skills. At the same time, the development of all the underlying regulatory institutions would be fostered by an increase in market players. Finally, access to foreign capital would be much more facilitated. Concerning the negative impact of reducing controls on which banks can operate in the domestic market, these are mainly related with the dimension of the brand and institutions. Given that foreign banks are normally big companies with strong reputational background, governments, customers and domestic competitors may suffer. Governments may actually lose power when dealing with these banks; customers might face the same old credit suppliers due to the fact that these banks tend to have their business channeled to multinational corporations; domestic competitors will see their costs increasing to be able to compete with stronger and more mature brands. In their study, Claessens,

Demirgüç-Kunt and Huizingaa (2001), found that international banks tend to realize higher profits in developing countries by taking advantage of exemptions on credit allocation and several other restrictions. On the contrary, in the case of developed countries, foreign banks have lower margins than domestic banks. The cause might be a more sophisticated and competitive system allied with information disadvantages. They also prove that the impacts of allowing foreign banks to operate domestically are felt immediately and not only after they win market share. Overall, the reduction in margins and the increased competition might leave domestic banks vulnerable by "reducing their chartered values" (Claessens, Demirgüç-Kunt and Huizingaa, 2001). Should the regulatory system be fragile, the stability of the financial system can be endangered.

4. Data

To test whether financial liberalization increases the likelihood of a systemic banking crisis, several datasets are needed: data on banking crises, data on financial liberalization and data regarding control variables. Concerning the data on systemic banking crises, it is based on Laeven and Valencia (2012) which provide an extensive database spanning from the late 1970's until 2008. It takes the form of a dummy variable assuming the value 1 if the country was living a systemic banking crisis in that year or zero otherwise. According to the researchers, banking crises were defined as events that meet two criteria: "i) significant signs of financial distress in the banking system (as indicated by bank runs, losses in the banking system, and/or bank liquidations) and ii) significant banking policy intervention measures in response to significant losses in the banking system." (Laeven and Valencia, 2012: 4). Moreover, a crisis was deemed systemic by the year that both criteria were met simultaneously.

The dataset on financial liberalization is from Abiad, Detragiache, and Tressel (2008). Using the same methodology, in which the components are scaled from 0 (not liberalized) to 3 (fully liberalized) and then summed, this is an updated version of the dataset created in 2005 that contemplated six dimensions that potentially contributed to financial liberalization. The new indicator has now a broader scope including the following seven dimensions: credit controls and reserve requirements, interest rate controls, entry barriers, state ownership, policies on securities markets, banking regulations, and restrictions on the capital account. Table 1 shows the descriptive statistics for the period being analyzed and Table 2 presents the correlation coefficients.

Table 1 - Summary statistics for financial liberalization components and index. Data for 79 countries with time window restricted by data availability for each country.

Variables	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Credit Controls	945	1.911	1.005	0	3
Interest Rate Controls	945	2.201	1.173	0	3
Entry Barriers	945	2.005	1.139	0	3
Banking Supervision	945	1.019	0.989	0	3
Privatization	945	1.472	1.237	0	3
Capital Account Controls	945	1.858	1.061	0	3
Security Markets	945	1.608	1.021	0	3
Liberalization Index	945	12.075	5.877	0	21

Control variables to be included in the model were selected based on both data availability and literature results. I based my choice of this set of variables on previous papers by Demirgüç-Kunt and Detragiache (1998a), Mehrez and Kaufmann (1999) and Glick and Hutchison (2000). The macroeconomic variables are: real GDP growth rate lagged by one period, real GDP per capita growth, real interest rate, inflation rate using the CPI[1] and change in the terms of trade. Among the financial variable are: M2 to

[1] I transformed inflation rates according to the formula $(\pi/100)/(1+(\pi/100))$ to reduce the impact of extreme events.

international reserves ratio and credit to private sector as a percentage of GDP lagged by two periods. Table 3 shows the expected sign of the coefficients associated with each of the control variables based on the theoretical explanation given in Section 3.

Table 2 - Correlations among Financial Liberalization Components

	Credit Controls	Interest Rate Controls	Entry Barriers	Banking Supervision	Privatization	Capital Account Controls	Security Markets	Liberalization Index
Credit Controls	1.00							
Interest Rate Controls	0.58	1.00						
Entry Barriers	0.44	0.55	1.00					
Banking Supervision	0.55	0.50	0.52	1.00				
Privatization	0.42	0.52	0.46	0.52	1.00			
Capital Account Controls	0.48	0.61	0.44	0.55	0.51	1.00		
Security Markets	0.53	0.55	0.51	0.65	0.51	0.68	1.00	
Liberalization Index	0.73	0.81	0.73	0.78	0.74	0.79	0.81	1.00

Table 3 - Expected signs of control variables according to the theoretical basis described in Section 3.

Variables	Expected Sign	Source
Real GDP Growth (t-1)	-	WDI
Real GDP per capita growth	-	WDI
Real Interest Rate	+	WDI
Inflation	+	WDI
M2/ Reserves	+	WDI
Terms of Trade	+/-	WDI
Credit to Private Sector (t-2)	+	WDI

5. Model Specification

To model the impact of financial liberalization on the likelihood of a systemic banking crisis, a panel data probit model was used. Systemic banking crisis were modeled as a

binary variable that takes the value of 1 during the years of the systemic banking crisis and zero otherwise. It was then assumed that for each country, every year, this type of banking crisis is a function of a series of control variables X(i) and the liberalization index L according to the following equation:

$$Y^*=\alpha+\beta_0 L+\beta_1 X_1+\ldots+\beta_k X_k+\varepsilon \quad (1)$$

To proceed to the coefficient estimation, the log-likelihood function in equation (2) will be maximized. The LHS is a latent variable used in the determination of the probability of a systemic crisis. For country i at time t, Y(i,t) will either be 1 or zero should it have suffered a crisis or not, respectively. Associated with each term is the probability of occurrence of a crisis which, in turn, will be given by a combination of n variables (both the financial liberalization indicators and control variables) represented as X(i,t) and a vector of unknown coefficients β. F(β'X(i,t)) is the cumulative probability distribution function and the log-likelihood function of the model takes the form:

$$\text{Ln } L=\sum_{t=1}^{T}\sum_{i=1}^{n}\left[Y(i,t)\ \ln\{F(\boldsymbol{\beta}'\ \mathbf{X(i,t)})\}+(1-Y(i,t))\ \ln\{1-F(\boldsymbol{\beta}'\ \mathbf{X(i,t)})\}\right] \quad (2)$$

Given that the probability is being modeled using a normal distribution, the interpretation of the coefficients is different from the linear regression models. In this case, they do not represent the increase in the probability of a banking crisis given a unitary increase in the associated explanatory variable. Instead, the imputed change depends on the initial probability and will amount to $\beta_i f(x_i)$.

6. Systemic banking crises and financial liberalization: empirical findings

Table 4 shows the results using the panel data probit model described above. It is important to stress that the possibility of multicollinearity is ruled out by the matrix of correlations in Table 5 in the appendix that shows the low correlations between control

variables. This analysis was made for 79 countries[2], for a period that spans from 1973 until 2005. Data availability may condition the number of observations per country.

Model I is a regression of the systemic banking crisis dummy against all control variables. In this first model, no liberalization measure was included. Only four variables (real GDP growth, GDP per capita growth, M2/reserves and credit to private sector) appear to be significant at the 1% level. The signs of the coefficients for the significant variables are in line with the predictions made in Table 3. The real side of the economy, as shown by the real GDP growth seems to have had a big impact on shaping the systemic banking crises for the period under analysis. Another interesting characteristic is that it loses significance if it is lagged by two periods. This indicates that the impact of swings in output tend to vanish relatively quickly from the banks' balance sheets. External exposure, as proxied by M2 over reserves increases the likelihood of a systemic crisis. External shocks become more meaningful in economies with greater international openness and have a positive impact on the probability of a crisis.

The second model includes all control variables and the liberalization index. To capture the effect of liberalization, I used the average of the previous 5 years' index values as was done by Mehrez and Kaufmann (2000). In this model, besides the four control variables that continue to be significant at the 1% level, the liberalization index is also significant at this level. Moreover, its coefficient is negative, showing some evidence that liberalization measures taken in the previous five years actually tend to reduce the likelihood of a systemic banking crisis.

[2] See Table 6 in the appendix

In models III to IX one component of the liberalization index was included at a time. The four control variables (real GDP growth, GDP per capita growth, M2/reserves and credit to private sector) continue to be statistically significance at 1% with exception of M2/reserves that is only significant at a 5% when banking supervision and security market components were used. Looking at the individual components of the liberalization measure, all of the seven present negative coefficients meaning that, if anything, they tend to reduce the likelihood of a systemic banking crisis in the 5 years following the financial liberalization measures take place. Regarding statistical significance, only banking supervision is significant at 1% level; credit controls, entry barriers, privatization and security markets are significant at 5% only and interest rate controls and capital account controls are not statistically significant at all. Wald tests indicate that all models are jointly significant at the 1% level.

Table 4 - Systemic Banking Crisis: Panel Data Probit Model estimation results

	I		II		III		IV	
Control variables								
Real GDP Growth (t-1)	-6.3154	***	-5.8852	***	-5.848	***	-6.2749	***
	(1.4662)		(1.4896)		(1.4786)		(1.4726)	
Real GDP per capita growth	-0.0001	***	-0.0001	***	-0.0001	***	-0.0001	***
	(0.000)		(0.0000)		(0.0000)		(0.0000)	
Real Interest Rate	-0.2013		-0.0530		-0.0888		-0.1830	
	(0.3179)		(0.3203)		(0.3146)		(0.3227)	
Inflation	-5.2195		-7.4594		-7.9778		-5.3935	
	(8.7891)		(11.4766)		(11.9614)		(9.0688)	
M2/ Reserves	0.0074	***	0.0066	**	0.0069	***	0.0073	***
	(0.0026)		-0.0027		(0.0026)		(0.0026)	
Terms of Trade	-0.0059		-0.0042		-0.0047		-0.0057	
	(0.0047)		(0.0046)		(0.0046)		(0.0047)	
Credit to Private Sector (t-2)	0.9509	***	1.1745	***	0.9509	***	0.9608	***
	(-0.334)		(0.3689)		(0.3310)		(0.3370)	
Financial Liberalization								
Liberalization Index			-0.0450	***				
			(0.0168)					
Credit Controls					-0.1636	**		
					(0.0713)			
Interest Rate Controls							-0.0199	
							(0.0642)	
Constant	-1.3102	***	-1.0327	***	-1.06602	***	-1.2770	***
	(0.1795)		(0.2056)		(0.2038)		(0.2087)	
Wald Chi-Square	44.30		48.51		49.32		44.35	
AIC	609.545		603.897		606.260		611.449	
Number of observations	945		945		945		945	
Number of Countries	79		79		79		79	

*** indicates significance at 1% level whereas ** indicates significance at 5% level and * indicates significance at 10%

Table 4 (Continued) - Systemic Banking Crisis: Panel Data Probit Model estimation results

	V		VI		VII		VIII		IX	
Control variables										
Real GDP Growth (t-1)	-6.14394	***	-5.9433	***	-5.9559	***	-6.1146	***	-5.9107	***
	(1.4824)		(1.4515)		(1.4990)		(1.4833)		(1.4829)	
Real GDP per capita growth	-6.9E-05	***	0.0000	***	-0.0001	***	-0.0001	***	-0.0001	***
	(0.0000)		(0.0000)		(0.0000)		(0.000)		(0.0000)	
Real Interest Rate	-0.08322		-0.0118		-0.0638		-0.2121		-0.0890	
	(0.3206)		(0.3120)		(0.3233)		(0.3200)		(0.3197)	
Inflation	-6.10774		-7.9860		-7.0723		-7.1446		-6.3116	
	(9.2729)		(11.7373)		(10.8178)		(11.1681)		(10.5709)	
M2/ Reserves	0.007851	***	0.0065	**	0.0076	***	0.0069	***	0.0066	**
	(0.0026)		(0.0025)		(0.0026)		(0.0026)		(0.0026)	
Terms of Trade	-0.00481		-0.0044		-0.0051		-0.0055		-0.0045	
	(0.0047)		(0.0045)		(0.0046)		(0.0046)		(0.0046)	
Credit to Private Sector (t-2)	1.095379	***	1.0662	***	1.0367	***	1.0133	***	1.1066	***
	(0.3647)		(0.3318)		(0.3474)		(0.3462)		(0.3505)	
Financial Liberalization										
Entry Barriers	-0.1750	**								
	(0.0689)									
Banking Supervision			-0.3787	***						
			(0.1048)							
Privatization					-0.1984	**				
					(0.0794)					
Capital Account Controls							-0.1162			
							(0.0816)			
Security Markets									-0.2113	**
									(0.0985)	
Constant	-1.06671	***	-1.1135	***	-1.1491	***	-1.1604	***	-1.1207	***
	(0.2044)		(0.1751)		(0.1877)		(0.2074)		(0.1953)	
Wald Chi-Square	47.48		56.12		48.11		45.37		47.72	
AIC	604.702		597.745		604.701		609.455		606.782	
Number of observations	945		945		945		945		945	
Number of Countries	79		79		79		79		79	

*** indicates significance at 1% level whereas ** indicates significance at 5% level and * indicates significance at 10%

7. Robustness

Several changes were imposed to the data to test for robustness. Firstly, I conducted a sensitivity analysis by using different average periods (4, 3 and 2 years) for the liberalization index. The results are very similar to the ones obtained with the 5 year average: significance of variables does not change as well as coefficient signs.

Another change imposed was to ignore the years following a first systemic crisis. This reduced the number of observations to 884 but the number of groups remained constant. With the new specification, all models in Table 4 have smaller AIC coefficients as shown in Table 7 of the appendices. Ignoring the observations after the first systemic crisis also changed, on average, the significance of two control variables. Whilst the change in the terms of trade became significant at 10% for Models I, IV, VII and VIII, the M2/reserves variable became significant at only a superior level of confidence[3]. All the models remain jointly significant at the 1% level as per the Wald Chi-square statistic.

Finally, I used a conditional logit model in light of Arellano and Hahn (2007) who argue that fixed effects are not well modeled by a probit estimator. I faced a drop in observations from 945 to 567 but the main results do not get altered.

8. Conclusion

With this study I found that financial liberalization tends to decrease the likelihood of systemic banking crisis. Also, results showed to be robust to a series of tests. Effects of liberalization measures tend to have a quick impact since decreasing the average of

[3] M2/reserves became significant at a 5% level for models I, III, V, VII and VIII and at 10% for the remaining models

liberalization from 5 years to shorter periods did not change the main conclusions. A reduction in the number of observations also maintained the crucial conclusion that, if anything, financial liberalization decreases the probability of a systemic banking crisis. Further studies on this matter might be of interest when data regarding the 2008 financial crisis and its aftermath are available for the world economies. Although this would result in a shorter sample, considering groups of countries separately (i.e. OECD, developing countries) could end up showing different impacts of the several determinants depending on the sample being considered.

9. References

Arellano, M. and Hahn, J.. 2007. "Understanding bias in nonlinear panel models: some recent developments." *Econometric Society Monographs,* 43:381.

Abiad, Abdul, Enrica Detragiache, and Thierry Tressel. 2008. "A new database of financial reforms." IMF Working Paper 08/266.

Calvo, Guillermo, Leonardo Leidermand, and Carmen M. Reinhart. 1993. "The capital inflows problem: concepts and issues." Papers on Policy Analysis and Assessment No. 93/10.

Caprio, Gerard Jr., and Daniela Klingebiel. 1996. "Bank insolvencies: cross country experience." World Bank Policy Research Working Paper 1620.

Claessens, Stijn, Asli Demirgüç-Kunt, and Harry Huizinga. 2001. "How does foreign entry affect domestic banking markets?" *Journal of Banking & Finance*, 25 (5): 891–911.

Demirgüç-Kunt, Asli and Enrica Detragiache. 1998a. "The determinants of banking crises in developing and developed countries." *IMF Staff Papers,* 45(1).

Demirgüç-Kunt, Asli and Enrica Detragiache. 1998b. "Financial liberalization and financial fragility." IMF Working Paper 98/83.

Diamond, Douglas W., and Philip H. Dybvig. 1993. "Bank runs, deposit insurance and liquidity." *Journal of Political Economy,* 91:401-19.

Galbis, Vicente. 1993. "High real interest rates under financial liberalization: is there a problem?" International Monetary Fund Working Paper 93/7.

Glick, Reuven, and Michael Hutchison. 2000. "Banking and currency crises: how common are the twins?" Hong Kong Institute for Monetary Research Working Paper 012000.

Kaminsky, Graciela L., Carmen M. Reinhart. 1999. "The twin crises: the causes of banking and balance-of-payments problems." *The American Economic Review,* 89(3): 473-500.

Klein, Michael W., Kristin J. Forbes, and Iván Wernin. 2012. "Capital controls: gates versus walls." *Brookings Papers on Economic Activity*, Fall 2012: 317-367.

Laeven Luc, and Fabián Valencia. 2012. "Systemic banking crises database: an update." International Monetary Fund, Working Paper 12/163.

Levine, Ross. 1996. "Foreign banks, financial development, and economic growth", in *International Financial Markets,* ed., Claude E. Barfield. Washington, D.C.

Maimbo, Samuel Munzele, and Claudia Alejandra Henriquez Gallegos. 2014. "Interest rate caps around the world: still popular, but a blunt instrument." Finance and Markets Global Practice Group, Policy Research Working Paper 7070.

Mehrez, Gil, and Daniel Kaufman. 2000. "Transparency, liberalization and banking crises." World Bank Policy Research Working Paper 2268.

Miller, Howard. 2013. “Interest rate caps and their impact on financial inclusion.” Economic and Private Sector, Professional Evidence and Applied Knowledge Services. February 2013.

Noy, Ilan. 2004. “Financial liberalization, prudential supervision, and the onset of banking crises.” *Emerging Markets Review*, 5: 341-359.

Ranciere, Romain, Aaron Tornell, and Frank Westermann. 2006. “Decomposing the effects of financial liberalization: crises vs. growth.” *Journal of Banking & Finance*, 30: 3331-3348.

Shehzad, Choudhry Tanveer, and Jakob De Haan. 2008. “Financial liberalization and banking crises.” CESifo Working Paper 2870.

Tornell, Aaron, Frank Westermann, and Lorenza Martinez. 2004. “The positive link between financial liberalization growth and crises.” NBER Working Paper Series Working Paper 10293.

Weller, Christian E. 1999. “Financial crises after financial liberalization: exceptional circumstances or structural weakness?” Center for European Integration Studies Working Paper B15 1999.

10. Appendices

Table 5 - Correlation matrix for the control variables

	Systemic Crisis	Real GDP growth (t-1)	Real GDP per capita growth	Real Interest Rate	Inflation	M2/ Reserves	Terms of Trade	Credit to Private Sector (t-2)
Systemic crisis	1.00							
Real GDP growth (t-1)	-0.19	1.00						
Real GDP per capita growth	-0.13	-0.05	1.00					
Real Interest Rate	0.06	-0.10	-0.10	1.00				
Inflation	-0.01	-0.16	-0.05	-0.20	1.00			
M2/ Reserves	0.09	-0.12	0.25	-0.01	-0.02	1.00		
Terms of Trade	-0.05	0.08	0.03	-0.02	-0.02	0.00	1.00	
Credit to Private Sector (t-2)	-0.03	0.02	0.60	-0.05	-0.07	0.14	0.02	1.00

Table 6 - List of countries considered for the analysis

Albania	Canada	Ethiopia	Ireland	Morocco	Poland	Tunisia
Algeria	China	Finland	Israel	Mozambique	Romania	Uganda
Azerbaijan	Colombia	France	Italy	Nepal	Russia	Ukraine
Bangladesh	Costa Rica	Georgia	Japan	Netherlands	Senegal	United States
Belarus	Cote d Ivoire	Germany	Jordan	New Zealand	Singapore	Uruguay
Belgium	Czech Rep	Ghana	Kenya	Nicaragua	South Africa	Vietnam
Bolivia	Denmark	Greece	Kyrgyz Rep	Nigeria	Spain	Zimbabwe
Brazil	Dominican Rep	Guatemala	Latvia	Norway	Sri Lanka	
Britain	Ecuador	Hong Kong	Lithuania	Pakistan	Sweden	
Bulgaria	Egypt	Hungary	Madagascar	Paraguay	Switzerland	
Burkina-Faso	El Salvador	India	Malaysia	Peru	Tanzania	
Cameroon	Estonia	Indonesia	Mexico	Philippines	Thailand	

Table 7 - Estimation results ignoring the crises happening after the first systemic crisis for each country

	I		II		III		IV	
Control variables								
Real GDP growth (t-1)	-6,1453	***	-5,73872	***	-5,7114	***	-5,9802	***
	(1.5323)		(1.5506)		(1.5330)		(1.5449)	
Real GDP per capita growth	-0,0001	***	-0,0001	***	-0,0001	***	-0,0001	***
	(0.0000)		(0.000)		(0.000)		(0.0000)	
Real Interest Rate	-0,3864		-0,23693		-0,2489		-0,3244	
	(0.3538)		(0.3545)		(0.3454)		(0.3565)	
Inflation	-8,1780		-10,3437		-12,8818		-9,0861	
	(12.811)		(14.5466)		(16.1689)		(13.4318)	
M2/ Reserves	0,0062	**	0,0052	*	0,0054	***	0,0057	***
	(0.0029)		(0.0030)		(0.0029)		(0.0030)	
Terms of Trade	-0,0088	*	-0,0072		-0,0075		-0,0082	
	(0.0048)		(0.0048)		(0.0047)		(0.0048)	
Credit to Private Sector (t-2)	1,0586	***	1,2704	***	1,0307	***	1,0994	***
	(0.3516)		(0.3855)		(0.3378)		(0.3617)	
Financial Liberalization								
Liberalization Index								
			-0,04661	**				
Credit Controls			(0.0186)					
					-0,2039	**		
Interest Rate Controls					(0.0798)			
							-0,06783	
							(0.0695)	
Constant	-1,3485	***	-1,0650	***	-1,0343	***	-1,2446	***
	(0.1897)		(0.2145)		(0.2133)		(0.2167)	
Wald Chi-Square	40,88		44,37		47,79		41,24	
AIC	543,548		538,755		539,038		544,587	
Number of observations	884		884		884		884	
Number of Countries	79		79		79		79	

*** indicates significance at 1% level whereas ** indicates significance at 5% level and * indicates significance at 10%

Table 7 (continued) - Estimation results ignoring the crises happening after the first systemic crisis for each country

	V		VI		VII		VIII		IX	
Control variables										
Real GDP growth (t-1)	-6,1132	***	-5,8776	***	-5,8985	***	-5,9931	***	-5,7549	***
	(1.5384)		(1.5031)		(1.5611)		(1.546)		(1.5440)	
Real GDP per capita growth	-0,0001	***	0,0000	***	-0,0001	***	-0,0001	***	-0,0001	***
	(0.0000)		(0.0000)		(0.0000)		(0.0000)		(0.0000)	
Real Interest Rate	-0,2667		-0,2071		-0,2637		-0,3926		-0,2591	
	(0.3544)		(0.3447)		(0.3589)		(0.3551)		(0.3540)	
Inflation	-8,5768		-10,0651		-9,5706		-10,2508		-9,8138	
	(12.3132)		(13.9075)		(13.9366)		(14.7533)		(14.3315)	
M2/ Reserves	0,0063	**	0,0051	*	0,0063	*	0,0056	*	0,0050	*
	(0.0029)		(0.0028)		(0.0029)		(0.003)		(0.0030)	
Terms of Trade	-0,0078		-0,0072		-0,0083	*	-0,0084	*	-0,0073	
	(0.0048)		(0.0047)		(0.0048)		(0.0048)		(0.0048)	
Credit to Private Sector (t-2)	1,1835	***	1,1143	***	1,1468	***	1,1048	***	1,2281	***
	(0.3788)		(0.3379)		(0.3671)		(0.3620)		(0.3690)	
Financial Liberalization										
Entry Barriers	-0,1755	**								
	(0.0778)									
Banking Supervision			-0,3418	***						
			(0.1123)							
Privatization					-0,1886	**				
					(0.0894)					
Capital Account Controls							-0,0903			
							(0.0862)			
Security Markets									-0,2387	**
									(0.1066)	
Constant	-1,0983	***	-1,1555	***	-1,2073	***	-1,2305	***	-1,1349	***
	(0.2135)		(0.1822)		(0.1975)		(0.219)		'(0.204)	
Wald Chi-Square	43,26		40,88		42,96		41,29		44,43	
AIC	540,104		535,978		540,595		544,425		540,267	
Number of observations	884		884		884		884		884	
Number of Countries	79		79		79		79		79	

*** indicates significance at 1% level whereas ** indicates significance at 5% level and * indicates significance at 10%