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Assessing the robustness of the relationship between financial reforms and banking crises

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ABSTRACT

This paper provides a novel approach for assessing the robustness of the relationship between different types of financial reforms and banking crises for the period 1973–2005. We document the following facts for emerging economies: (i) liberalizations of capital accounts, securities markets, interest rates, removal of credit controls, barriers to entry, and reduction of state ownership in the banking sector, all are positively associated with a higher frequency of banking crises; (ii) the increase in financial turbulence is mainly concentrated within a time-window of five years after the reforms: If a country does not experience a banking crisis within that period, the probability of experiencing a crisis afterwards becomes insignificant; and (iii) the results are robust to the inclusion of all control variables that have been found in the literature as significant determinants of banking crises.

1. Introduction

Episodes of financial liberalizations have been common during the 1980 s and 1990 s. The influential work of McKinnon (1973) and Shaw (1973) states that financial repression prevents an efficient allocation of capital, and that financial liberalization, by unifying domestic capital markets, would boost financial development and economic growth. By the time, institutions with influence in the determination of national economic policies had been claiming that financial liberalization would lead to increases in efficiency and stability.

A wealth of econometric studies has disputed these claims (Demirgüç-Kunt and Detragiache (1998), Eichengreen and Arteta (2002), Kaminsky and Reinhart (1999), Loayza and Ranciere (2006), Noy (2004), Weller (2001), Williamson and Mahar (1998), Angkinand et al. (2010), among others). There is solid theory that explains why we should not have expected those claims to be correct (as summarized in Stiglitz (2000, 2004), Caprio et al. (2006), Stiglitz et al. (2006), as well as in the various chapters in Ocampo and Stiglitz (2008); see also Greenwald and Stiglitz (1986)).

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The term financial liberalization is applied to different types of reforms. In most of these studies, liberalizations versus non-liberalizations are classified according to dummy variables, which implies little variability in the independent variable. Furthermore, those analyses do not address the issue of when the effects of reforms on instability are manifested, i.e. whether they are concentrated in shorter or longer terms.

Some common presumptions on the relationship between financial liberalizations and financial instability have been challenged in occasions (see for example Shehzad and DeHaan (2009), that find opposite results). This problem is not specific of the literature on financial liberalization, but it is general: Assessing the robustness of an economic relationship may be a complicated task when there are many other variables that also determine the dependent variable of interest. This is a well-recognized problem in the literature of cross-country growth regressions (Levine and Renelt (1992), Sala-i-Martin (1997)). Adding many control variables to the regression may turn the coefficients of interest statistically insignificant when they are economically significant.[1]

The literature has offered different approaches to circumvent this problem. The first approach attempts to identify the most important control variables by using a variety of variable selection techniques (as backward, forward, stepwise selection models, or the use of principal component analysis (PCA) to obtain a set of control variables that are linearly independent).[2] But under any of the strategies of this approach, comparison across specifications to select the *best* model requires observations for the same periods for all control variables. In many occasions (as in this paper), the analyst does not have all that information; and if this is the case, restricting the comparison to those models that only consider control variables for which the analyst has observations for the same periods may not lead to the *best* selection.

Another approach consists in taking subsets of combinations of all the potential control variables, running the regressions with these subsets, and checking whether the coefficient of interest remains significant under the different regressions. This approach can also face problems when the available observations for the control variables are not the same as for the variables of interest. In this case, the size of the sample will depend on the subset of controls that is chosen.

An alternative to deal with this problem could be to use PCA (or any of the strategies of the first approach) to extend the sample for those variables for which we only have short samples. But in occasions this solution can be impractical. Completing the sample by PCA (or any other technique) may require data for the determinants of each control variable, whose availability may also be limited. This would lead to other rounds of PCA, that may require new data that is also unavailable, and so forth.

We consider another practical alternative, and we apply it to the analysis of the relationship between financial reforms and banking crises. Our paper confirms previous presumptions in the field using new and more refined data, sheds light over the timing of the effects of episodes of liberalization on financial instability, and offers a simple method for conducting robustness analysis, that can account for a large number of control variables.

We study the relationship between six different types of financial reforms and financial instability, measured as the frequency of banking crises, for the period 1973–2005. We use data on financial reforms introduced by Abiad et al. (2010). They classify seven different dimensions of reforms, six of which refer to liberalizations: elimination of credit allocation controls, interest rate controls, capital account controls, equity market controls, entry barriers, and privatization. The seventh dimension refers to the degree of regulation and supervision in the banking system. We document the following facts:

Liberalizations of capital accounts, securities markets, interest rates, removal of credit controls, barriers to entry, and reduction of state ownership in the banking sector, are all positively associated with the frequency of banking crises.

The increase in financial turbulence is mainly concentrated within a time-window of five years after the reforms. If a country does not experience a banking crisis within that period, the probability of experiencing a crisis afterwards becomes significantly smaller.

Consistent with previous literature, when we aggregate the different dimensions of reforms, we find that this aggregate measure of financial liberalizations is associated with a higher frequency of banking crises. As in the cases of individual reforms, the effects on instability are mainly concentrated within a time-window of five years, and they vanish afterwards.

These regularities are stronger in emerging economies than in advanced economies.

We show that the effects of reforms on instability are robust to the inclusion of a large set of variables identified in the literature as significant determinants of banking crises. The analysis of robustness presents two challenges. First, when we include other variables we create imbalances in the sample, due to the different data availability for different variables. Including all the controls together would imply a loss of many observations. Second, the number of control variables is large, hence including them all together implies a loss of statistical significance in our coefficients of interest.

We perform a robustness analysis that combines elements of both Levine and Renelt (1992) and Sala-i-Martin (1997). We first select all the variables that have been found as significant determinants of banking crises in the literature. Then, we choose all combinations of three variables in that set, and run the regressions with each of those subsets as control variables. We show that our coefficients of interest remain significant to the inclusion of almost any subset of control variables. The few cases where significance is lost are associated with the subsets with smaller number of observations. We then claim and show that the loss of significance is indeed due to the small number of observations and not to the inclusion of variables with short time-series that significantly alter the relationship between liberalizations and instability. For that purpose, we

[1] The addition of many control variables can lead to multicollinearity among the regressors, what in turn creates *variance inflation*.

[2] See Derksen and Keselman (1992), Jolliffe (2002), Gatu and Kontoghiorghes (2012), Lindsey and Sheather (2010).

run what we define as a set of *sister-regressions*: we take the original sample that excludes all the control variables, but in each regression we eliminate observations in order to replicate the sample of every controlled regression – hence, each regression with control variables has a *sister-regression* with observations for the same periods but no control variables. We show that the t-statistics and the coefficients associated with the variable of interest are similar in the controlled regressions and their *sister-regressions*. Our method can deal with a large number of control variables by using the global search regression instrument developed in Gluzmann and Panigo (2015).

The rest of paper is organized as follows. Section 2 describes the data used for the basic regressions. Section 3 describes the empirical analysis of the relationship between the different types of financial reforms and the frequency of banking crises, differentiating the effects over time. Section 4 describes the robustness analysis. Section 5 concludes.

2. Description of the data

We use data on banking crises from Laeven and Valencia (2008),[3] who extend the database from Caprio et al. (2005).

The database covers the universe of systemic banking crises for the period 1970–2007. The definition of a banking crisis is broad: there is a banking crisis if 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. Unlike prior work (Caprio and Klingebiel, 1996; Caprio et al., 2005), they exclude banking system distress events that affected isolated banks but were not systemic in nature. As a cross-check on the timing of each crisis, they examine whether the crisis year coincides with deposit runs, the introduction of a deposit freeze or blanket guarantee, or extensive liquidity support or bank interventions. They identify 124 systemic banking crises over the period 1970–2007.

To measure financial liberalizations, we use Abiad et al. (2010) database on financial reforms, covering 91 economies over the period 1973–2005. They distinguish between seven different dimensions of financial sector policy, as follows:

Credit controls and excessively high reserve requirements

The questions used to guide the coding of this dimension are the following: Are there minimum amounts of credit that must be channeled to certain sectors, or are there ceilings on credit to other sectors? Are directed credits required to carry subsidized rates? Is there a ceiling on the overall rate of expansion of credit? How high are reserve requirements?

Interest rate controls

Interest rates are considered fully liberalized when all ceilings, floors or bands are eliminated. To guide the coding of this dimension, they judge, for deposit and lending rates separately, whether interest rates are administratively set, including whether the government directly controls interest rates, or whether floors, ceilings, or interest rate bands exist.

Entry barriers

To guide the coding of this dimension, they assess how the government restricts the entry into the financial system of new domestic banks or of other potential competitors, for example foreign banks or non-bank financial intermediaries.

State ownership in the banking sector

In coding the database, they look at the share of banking sector assets controlled by state-owned banks. Thresholds of 50 percent, 25 percent and 10 percent are used to delineate the grades between full repression and full liberalization.

Capital account restrictions

They use several existing measures of capital account openness that already exist, and that have a wide country coverage, which are surveyed in Edison et al. (2004).

Prudential regulations and supervision of the banking sector

Of the seven dimensions, this is the only one where a greater degree of government intervention is coded as a reform. To code this dimension, they ask the following questions: Does a country adopt risk-based capital adequacy ratios based on the Basle I capital accord? Is the banking supervisory agency independent from the executive's influence and does it have sufficient legal power? Are certain financial institutions exempt from supervisory oversight? How effective are on-site and off-site examinations of banks?

Securities market policy

They code the different policies governments use to either restrict or encourage development of securities markets. These include the auctioning of government securities, establishment of debt and equity markets, and policies to encourage development of these markets, such as tax incentives or development of depository and settlement systems. They also include policies on the openness of securities markets to foreign investors.

Along each dimension, a country is given a final score on a graded scale from zero to three, with zero corresponding to the highest degree of repression and three indicating full liberalization. Reversals, such as the imposition of capital controls or interest rate controls, are recorded as shifts from a higher to a lower score. The seven dimensions of financial liberalization are aggregated to obtain a single liberalization index for each economy in each year. Since each of the seven components can take values between 0 and 3, the sum takes values between 0 and 21, ranging from full repression to full liberalization.

The index shows that financial reforms advanced substantially through much of the sample. Countries in all income groups and in all regions liberalized. Considering averages of group of countries, trends look smooth, but at the individual

[3] See Laeven and Valencia (2013) for the latest update.

country level the reform process was typically characterized by long periods of no change in policy. That is, at the individual country level financial reforms are non-ordinary events.

3. Hypotheses and results

3.1. Financial liberalization and banking crises

We first analyze the relationship between the aggregate score of financial liberalization and the occurrence of banking crises.

Eqs. (1) to (3) describe the basic regressions. The dependent variable $BC_{i;t+1,t+h}$ is a dummy that takes value 1 if a banking crisis started in country i between years $t+1$ and $t+h$, and 0 otherwise. We regress that variable in the level of the financial reforms index for country i in year t ($FRI_{i,t}$) and on its change between years $t-x$ and t ($\Delta FRI_{i;t-x,t}$). Eq. (2) includes country-fixed effects, and Eq. (3) includes annual dummies.

$$BC_{i;t+1,t+h} = a_0 + a_1 FRI_{i,t} + a_2 \Delta FRI_{i;t-x,t} + u_{i,t} \quad (1)$$

$$BC_{i;t+1,t+h} = a_0 + a_1 FRI_{i,t} + a_2 \Delta FRI_{i;t-x,t} + f_i + u_{i,t} \quad (2)$$

$$BC_{i;t+1,t+h} = a_0 + a_1 FRI_{i,t} + a_2 \Delta FRI_{i;t-x,t} + f_i + f_t + u_{i,t} \quad (3)$$

Note that the dependent variable is dated after t while the regressors are dated before t. As far as crises cannot be anticipated, or as far as its anticipation precipitates its occurrence to period t, the endogeneity problem would be addressed.

Table 1 shows the results from the regressions of the specifications (1) to (3) for two models: the logit model and the linear regression model. The results are for $h = 5$ and $x = 1$. We later analyze the consequences of modifying h to any other integer from 6 to 10, and of modifying x to any other integer from 2 to 5. The table contains three panels. The top panel shows the results of the regressions that include all the countries in the sample. The mid panel includes only the advanced economies. The bottom panel includes only the emerging Asian, transition, and Latin American and Caribbean economies (*emerging economies* henceforth).

Table 1
Effects of financial reforms on banking crises, alternative specifications.

Dependent variable: $BC_{t+1,t+5}$	(1)	(2)	(3)	(4)	(5)	(6)
All countries						
FRI_t	−0.010	−0.011	−0.000	−0.010	−0.006	−0.004
	(−7.30)***	(−2.00)**	(−0.04)	(−7.65)***	(−3.35)***	(−1.06)
$\Delta FRI_{t-1,t}$	0.033	0.048	0.011	0.035	0.028	0.014
	(4.94)** *	(3.85)***	(0.78)	(4.36)***	(3.75)***	(1.83)*
Observations	2089	1475	1475	2089	2089	2089
R^2/Pseudo R2	0.033	0.014	0.099	0.030	0.163	0.207
Avanced economies						
FRI_t	0.001	0.013	0.000	0.001	0.003	0.018
	(0.99)	(1.22)	(0.00)	(1.02)	(1.65)	(4.81)***
$\Delta FRI_{t-1,t}$	−0.006	−0.034	−0.000	−0.005	−0.006	−0.021
	(−0.62)	(−0.67)	(0.00)	(−0.70)	(−0.80)	(−2.46)**
Observations	594	189	189	594	594	594
R2/ Pseudo R2	0.004	0.016	0.613	0.030	0.163	0.207
Emerging Asia, Latin America and transition economies						
FRI_t	−0.007	−0.004	−0.021	−0.007	−0.003	−0.009
	(−2.87)***	(−0.49)	(−1.22)	(−2.93)***	(−0.81)	(−1.33)
$\Delta FRI_{t-1,t}$	0.052	0.068	0.049	0.055	0.052	0.039
	(4.93)***	(4.45)***	(2.71)***	(4.76)***	(4.61)***	(3.27)***
Observations	928	800	800	928	928	928
R^2/Pseudo R2	0.026	0.027	0.159	0.029	0.157	0.248

(1) Logit Regression, marginal effects.
(2) Logit Regression with country fixed effects (conditional logit), marginal effects.
(3) Logit Regression with country fixed effects and year dummies (conditional logit), marginal effects.
(4) Linear Regression (ols).
(5) Linear Regression (ols) with country fixed effects.
(6) Linear Regression (ols) with country fixed effects and year dummies.
For Conditional logit (columns 2 and 3), the marginal effects are computed assuming no fixed effects.
Robust t/z statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

In the pooled data regressions for the whole sample or the emerging economies sample, the level of financial freedom is negatively associated with the frequency of banking crises. This result indicates that less repressed economies have a lower likelihood of suffering a banking crisis.

The coefficient of main interest is a_2, the one associated with the change in the index of financial reforms, that measures the depth of the financial liberalization. In all the regressions that do not include annual dummies, the coefficient is positive and significant. These results support the hypothesis that financial liberalization increases financial instability within a period of five years post-reforms. The effect is stronger for the sample of emerging economies. In fact, the coefficient is not statistically significantly different from zero for the sample of advanced economies.

The estimation of a conditional logit model with country-fixed effects has two limitations: it requires the exclusion of countries with no variability in the dependent variable (i.e. countries that did not experience crises over the sample), what can create a selection bias; (ii) the marginal effects can only be computed if we assume that the coefficients associated with the fixed effects are zero, as the conditional logit model does not estimate intercepts. However, Table 1 shows that the results from the linear regression model are similar to those from the logit model. This equivalence can be demonstrated calculating the marginal effects for an average year/country using the coefficients of column (1), that do not suffer from the above limitations. In the sample of emerging economies, for example, the marginal effect associated with the level of *FRI* is −0.007, and the associated with the change in *FRI* is 0.052, similar to the coefficients estimated by ordinary least squares (0.007 and 0.055, respectively).

3.2. Introducing the first controls: testing the presence of non-linear effects and the importance of previous crises

This section deals with two concerns. The first one is whether financial liberalizations affect the probability of banking crises non-linearly. The second one is whether the relationship between financial liberalization and banking crises still holds when we consider the effects of a recent crisis on the probability of a future banking crisis. A recent banking crisis could decrease the probability of a subsequent crisis, and at the same time it could revert a process of financial liberalization. Therefore, we could observe a positive association between financial liberalization and the probability of a banking crisis when it is the existence of a previous recent crisis what leads to this association.

The regression model described in Eq. (4) addresses these issues. Non-linear effects are tested by introducing the square of the change in *FRI*. The variable $PC_{i,t-j}$ stands for previous crisis, and it takes value one if country i experienced a banking crisis in year $t-j$, and zero otherwise.

$$BC_{i;t+1,t+h} = a_0 + a_1 FRI_{i,t} + a_2 \Delta \mathrm{FRI}_{i;t-x,t} + a_3 (\Delta \mathrm{FRI}_{i;t-x,t})^2 + \sum_{j=0}^{k} b_j PC_{i,t-j} + u_{i,t} \quad (4)$$

Table 2 summarizes the results of the logit model and Table 3 those of the linear regression, in both cases with country-fixed effects, for the sample of emerging economies, $h = 5$, $x = 1$, and $k = 1$. Note that we only show the results for emerging economies. The rest of the paper focuses on this sample.

Table 2
Logit regressions with country-fixed-effects.

Logit Regression with fixed effects by country						
Emerging Asia, Latin America and transition economies						
	(1)	(2)	(3)	(4)	(5)	(6)
FRI_t	−0.004	0.003	−0.004	0.003	−0.004	0.003
	(−0.49)	(0.41)	(−0.56)	(0.35)	(−0.53)	(0.39)
$\Delta FRI_{t-1,t}$	0.068	0.055	0.096	0.083		
	(4.45)***	(2.98)***	(4.13)***	(2.93)***		
Square $\Delta FRI_{t-1,t}$			−0.009	−0.009		
			(−1.60)	(−1.31)		
$\Delta FRI_{t-1,t}$ (+ changes)					0.058	0.051
					(3.07)***	(2.39)**
$\Delta FRI_{t-1,t}$ (− changes)					0.141	0.092
					(2.27)**	(1.50)
Crisis in t		−0.391		−0.389		−0.388
		(−3.40)***		(−3.35)***		(−3.35)***
Crisis in $t-1$		−0.264		−0.266		−0.264
		(−3.10)***		(−3.13)***		(−3.08)***
Observations	800	800	800	800	800	800
Pseudo R2	0.027	0.122	0.030	0.125	0.029	0.123
p-value of differences+					0.235	0.554

Logit Regression with country fixed effects (conditional logit), marginal effects. The marginal effects are computed assuming no fixed effects.
+ Refers to differences in coefficients of positive and negative changes in FRI.
Robust z statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 3
Linear regressions with country-fixed-effects.

Lineal Regression (ols) with fixed effects by country						
Emerging Asia, Latin America and transition economies						
	(1)	(2)	(3)	(4)	(5)	(6)
FRI_t	−0.003	0.000	−0.003	0.000	−0.003	0.000
	(−0.81)	(0.08)	(−0.90)	(0.04)	(−0.86)	(0.08)
$\Delta FRI_{t-1,t}$	0.052	0.045	0.063	0.049		
	(4.61)***	(4.23)***	(5.28)***	(4.04)***		
Square $\Delta FRI_{t-1,t}$			−0.004	−0.002		
			(−1.43)	(−0.51)		
$\Delta FRI_{t-1,t}$ (+ changes)					0.046	0.045
					(3.37)***	(3.52)***
$\Delta FRI_{t-1,t}$ (− changes)					0.080	0.045
					(3.80)***	(2.05)**
Crisis in t		−0.217		−0.215		−0.217
		(−6.01)***		(−5.93)***		(−5.96)***
Crisis in $t-1$		−0.159		−0.158		−0.159
		(−4.35)***		(−4.33)***		(−4.35)***
Observations	928	928	928	928	928	928
R2	0.157	0.222	0.159	0.223	0.158	0.222
p-value of differences+					0.196	0.997

Linear Regression with country fixed effects.
+ Refers to differences in coefficients of positive and negative changes in FRI.
Robust t statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

The introduction of the variable "previous crisis" as a control does not alter the sign of the coefficients associated with the change in *FRI* in any of the cases (columns (2) and (4) in Tables 2 and 3). The sign of the $PC_{i,t-j}$ coefficients for $j = 1, 2$ are both negative and significant, what suggests that a banking crisis is less likely when another crisis occurred recently. Furthermore, tables 2 and 3 reveal that there are no non-linear effects associated with financial liberalizations.

In columns (5) and (6) of tables 2 and 3, we separate the changes in *FRI* into positive (liberalizations) and negative (reversions). Our suspicion is that the coefficient associated with negative changes could be higher than the one associated with positive changes (meaning that a decrease in the degree of financial freedom would diminish financial instability by more than financial liberalization would increase it), due to the fact that crises tend to cause reversions (Abiad and Mody, 2005), and that the occurrence of a recent crisis makes the occurrence of a new crisis less likely. However, in all specifications the p-value of the differences between these two coefficients is large enough to dismiss such concern.

3.3. The increase in financial instability is mainly concentrated in the short-run

We previously showed results for $h = 5$, i.e. we reported the effect of financial reforms on the frequency of banking crises within a period of five years post-reforms. This section analyzes these effects for an extended time horizon. The figures show the results for the linear regression model with country-fixed effects. The pattern of results is similar for the other specifications and for different choices of x (Table 6 shows the results for different values of x from 1 to 5 for the logit regression model and linear regression model, in both cases with country-fixed effects).

Table 4 and Table 5 show the regressions for every h from 5 to 10 for each sample, in the logit and linear model with country-fixed effects, respectively. The coefficient on financial liberalization remains positive and significant for every $h > 5$ in the sample of emerging economies. However, the estimated coefficients are not directly comparable. When h increases, we lose observations. The loss of observations tends to decrease the value of the marginal effects for larger h. To overcome this issue, we replicate the estimations for every h using a fixed sample size, with ending date in 1995. This sample is called *fixed-size sample* henceforth, while the sample that includes all the possible years is called *original sample*.

Fig. 1 shows the evolution of the estimated coefficients for different horizons, for the original (panel a) and the fixed-size sample (panel b). In panel b of Fig. 1 we observe that the coefficient is increasingly positive until $h = 5$, when it reaches a steady value (in the original sample case the coefficient diminishes after $h = 5$ due to the loss of crises episodes). These results indicate that the effects of liberalizations on financial instability are especially concentrated in the short-run. The marginal increase in the frequency of banking crises is virtually zero more than five years after the reforms.

3.4. Types of financial reforms and banking crises

The previous analysis aggregated the different types of financial reforms. This section analyzes the effects of every individual type of reform, for the seven dimensions available in the Abiad et al. (2010). The goal is to assess whether different types of reforms have different effects on the probability of a banking crisis.

Table 4
Short-term and long-term effects – logit regressions with country-fixed-effects.

	Dependent variable					
	$BC_{t+1,t+5}$	$BC_{t+1,t+6}$	$BC_{t+1,t+7}$	$BC_{t+1,t+8}$	$BC_{t+1,t+9}$	$BC_{t+1,t+10}$
All countries						
FRI_t	−0.006	−0.006	−0.006	−0.004	−0.001	0.002
	(−0.91)	(−0.85)	(−0.79)	(−0.50)	(−0.06)	(0.20)
$\Delta FRI_{t-1,t}$	0.037	0.035	0.030	0.022	0.012	0.013
	(2.69)***	(2.39)**	(2.18)**	(1.57)	(0.66)	(0.64)
Observations	1475	1412	1349	1276	1186	1118
Pseudo R2	0.093	0.100	0.100	0.100	0.107	0.117
Avanced economies						
FRI_t	0.015	0.015	0.015	0.015	0.016	0.016
	(3.52)***	(16.06)***	(30.20)***	(10.57)***	(4.21)***	(3.64)***
$\Delta FRI_{t-1,t}$	−0.032	0.016	0.016	0.015	0.002	−0.001
	(−0.80)	(0.89)	(1.50)	(1.26)	(0.23)	(−0.09)
Observations	189	182	175	168	161	154
Pseudo R2	0.123	0.150	0.173	0.204	0.242	0.255
Emerging Asia, Latin America and transition economies						
FRI_t	0.003	0.004	0.004	0.006	0.009	0.011
	(0.41)	(0.41)	(0.38)	(0.47)	(0.59)	(0.62)
$\Delta FRI_{t-1,t}$	0.055	0.049	0.045	0.041	0.036	0.042
	(2.98)***	(2.45)**	(2.34)**	(2.10)**	(1.42)	(1.46)
Observations	800	762	724	676	611	568
Pseudo R2	0.122	0.133	0.129	0.120	0.116	0.115

Logit Regression with country fixed effects (conditional logit), marginal effects. The marginal effects are computed assuming no fixed effects.
Robust z statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 5
Short-term and long-term effects – linear regressions with country-fixed-effects.

	Dependent variable					
	$BC_{t+1,t+5}$	$BC_{t+1,t+6}$	$BC_{t+1,t+7}$	$BC_{t+1,t+8}$	$BC_{t+1,t+9}$	$BC_{t+1,t+10}$
All countries						
FRI_t	−0.004	−0.004	−0.004	−0.003	−0.001	0.000
	(−2.37)**	(−2.36)**	(−2.23)**	(−1.61)	(−0.50)	(0.19)
$\Delta FRI_{t-1,t}$	0.025	0.024	0.020	0.015	0.007	0.008
	(3.55)***	(3.25)***	(2.81)***	(1.99)**	(0.97)	(0.98)
Observations	2089	2000	1911	1822	1733	1644
R^2	0.213	0.263	0.301	0.344	0.384	0.424
Avanced economies						
FRI_t	0.004	0.005	0.005	0.006	0.008	0.008
	(2.34)**	(2.69)***	(2.80)***	(2.89)***	(3.16)***	(3.11)***
$\Delta FRI_{t-1,t}$	−0.008	0.007	0.009	0.010	0.005	0.004
	(−1.05)	(0.70)	(0.86)	(0.97)	(0.54)	(0.44)
Observations	594	572	550	528	506	484
R^2	0.163	0.206	0.253	0.306	0.366	0.421
Emerging Asia, Latin America and transition economies						
FRI_t	0.000	0.000	0.001	0.003	0.006	0.008
	(0.08)	(0.15)	(0.26)	(0.69)	(1.28)	(1.51)
$\Delta FRI_{t-1,t}$	0.045	0.041	0.036	0.031	0.023	0.025
	(4.23)***	(3.72)***	(3.38)***	(2.80)***	(1.96)*	(1.99)**
Observations	928	882	836	790	744	698
R2	0.222	0.270	0.297	0.327	0.351	0.373

Linear Regression with country fixed effects.
Robust t statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Although the different dimensions of the *FRI* are positively correlated, there is a considerable variance in those correlations. Table 7 shows the pairwise correlations among the seven dimensions.

Table 8 and Table 9 show the results of the logit and linear models (respectively) for the sample of emerging economies with country fixed-effects. We control for the existence of previous crises in the two years before the reforms, and we use the

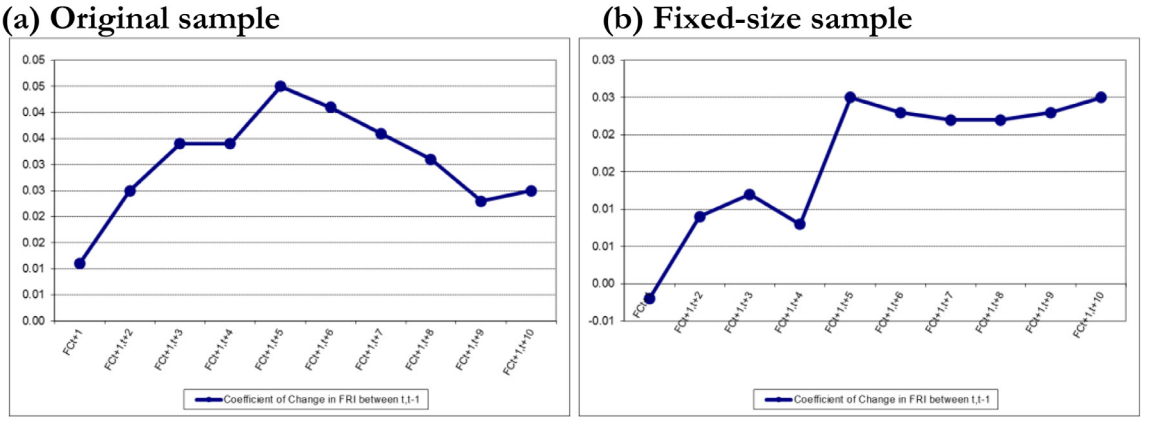

Fig. 1. Effects of financial reforms on financial instability for different horizons.

Table 6
Logit and linear regressions for different time ranges for reforms.

Panel A	*Logit regressions with country-fixed-effects*				
FRI_t	−0.006	−0.008	−0.009	−0.010	−0.011
	(−0.91)	(−1.26)	(−1.41)	(−1.49)	(−1.47)
$\Delta FRI_{x,t}$	$x = t-1$	$x = t-2$	$x = t-3$	$x = t-4$	$x = t-5$
	0.037	0.029	0.022	0.019	0.018
	(2.69)***	(2.35)**	(1.98)**	(1.87)*	(1.75)*
Observations	1475	1403	1316	1198	1136
Pseudo R2	0.093	0.111	0.123	0.143	0.165
Panel B	*Linear regressions with country-fixed-effects*				
FRI_t	−0.004	−0.005	−0.006	−0.006	−0.006
	(−2.37)**	(−3.05)***	(−3.30)***	(−3.32)***	(−3.03)***
$\Delta FRI_{x,t}$	$x = t-1$	$x = t-2$	$x = t-3$	$x = t-4$	$x = t-5$
	0.025	0.018	0.013	0.010	0.009
	(3.55)***	(3.82)***	(3.54)***	(2.99)***	(2.61)***
Observations	2089	2000	1911	1822	1733
R^2	0.213	0.230	0.243	0.260	0.279

Panel A: Logit Regression with country fixed effects (conditional logit), marginal effects. The marginal effects are computed assuming no fixed effects.
Panel B: Linear Regression with fixed effects by country.
Robust t/z statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 7
Correlations.

	CC	*IRC*	*EB*	*SO*	*CAR*	*SMP*	*BRS*
CC	1						
IRC	0.65	1					
EB	0.57	0.55	1				
SO	0.49	0.43	0.44	1			
CAR	0.59	0.60	0.51	0.52	1		
SMP	0.63	0.63	0.54	0.49	0.68	1	
BRS	0.61	0.59	0.56	0.49	0.58	0.64	1

CC: Credit controls.
IRC: Interest rate controls.
EB: Entry barriers.
SO: State ownership in the banking sector.
CAR: Capital account restrictions.
SMP: Securities market policies.
BRS: Prudential Banking regulation and supervision.

dimension of banking regulation and supervision as a control variable. Column (1) includes all together the seven dimensions of financial reforms, namely credit controls, interest rate controls, entry barriers, state ownership in the banking sector, capital account restrictions, prudential regulation and supervision of the banking sector, and securities market policy.

Table 8
Logit regression with country-fixed effects.

	Emerging Asia, Latin America and transition economies						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CC_t	−0.087	0.036					
	(−1.28)	(0.96)					
IRC_t	0.101		0.101				
	(1.89)*		(3.66)***				
EB_t	0.064			0.112			
	(1.16)			(3.01)***			
SO_t	0.015				0.072		
	(0.25)				(1.36)		
CAR_t	−0.005					0.066	
	(−0.12)					(1.75)*	
SMP_t	0.034						0.115
	(0.49)						(2.51)**
BRS_t	−0.290	−0.208	−0.287	−0.288	−0.224	−0.222	−0.274
	(−3.11)***	(−2.23)**	(−3.17)***	(−3.09)***	(−2.43)**	(−2.51)**	(−2.76)***
$\Delta CC_{t-1,t}$	−0.003	0.077					
	(−0.07)	(1.90)*					
$\Delta IRC_{t-1,t}$	0.080		0.089				
	(2.49)**		(3.44)***				
$\Delta EB_{t-1,t}$	0.087			0.128			
	(1.38)			(2.82)***			
$\Delta SO_{t-1,t}$	0.015				0.091		
	(0.28)				(1.63)		
$\Delta CAR_{t-1,t}$	0.006					0.072	
	(0.15)					(2.24)**	
$\Delta SMP_{t-1,t}$	0.105						0.176
	(1.73)*						(3.68)***
$\Delta BRS_{t-1,t}$	−0.075	0.034	−0.047	−0.030	0.013	0.014	0.001
	(−0.73)	(0.37)	(−0.53)	(−0.31)	(0.14)	(0.15)	(0.01)
Crisis in t	−0.434	−0.403	−0.439	−0.415	−0.394	−0.420	−0.420
	(−4.45)***	(−3.74)***	(−4.40)***	(−4.50)***	(−3.68)***	(−3.70)***	(−4.10)***
Crisis in t − 1	−0.243	−0.238	−0.250	−0.221	−0.214	−0.224	−0.252
	(−2.82)***	(−2.57)**	(−2.79)***	(−2.66)***	(−2.32)**	(−2.54)**	(−2.81)***
Observations	800	800	800	800	800	800	800
Pseudo R2	0.189	0.129	0.166	0.149	0.132	0.134	0.151

Logit Regression with country fixed effects (conditional logit), marginal effects. The marginal effects are computed assuming no fixed effects.
Robust z statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Columns 2–7 show the results associated with each reform individually, with the variable banking regulation and supervision is included as a control.

When the reforms are included all together, only the coefficient of the variable liberalization of the interest rate remains significant at the one percent level. This result is not surprising: as Table 7 suggests, it is possible that the presence of multicolinearity implies this result.

The inclusion of each dimension separately reveals that every type of liberalization is positively and significantly associated with the probability of banking crisis. Liberalizations of interest rate controls, entry barriers, and securities market policies are still significant at the 1 percent level. The variable liberalization of capital account restrictions is significant at the 5 percent level.

4. Robustness

In this section we perform an extensive robustness analysis for the results that correspond to the sample of emerging economies. We show the results for the linear regression model with no country-fixed effects or annual dummies. The results obtained with this specification also hold under the other specifications.[4]

4.1. Description of control variables

We consider a large set of control variables that have been considered in the literature as important determinants of banking crises. This aside provides a description of those variables.

[4] All tables for the alternative specifications are available upon request to the authors.

Table 9
Linear regression with country-fixed effects.

	Emerging Asia, Latin America and transition economies						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CC_t	−0.085	0.014					
	(−3.61)***	(0.84)					
IRC_t	0.090		0.073				
	(4.50)***		(5.18)***				
EB_t	0.060			0.081			
	(2.48)**			(4.16)***			
SO_t	−0.011				0.025		
	(−0.52)				(1.27)		
CAR_t	−0.012					0.035	
	(−0.57)					(1.76)*	
SMP_t	0.020						0.069
	(0.76)						(3.33)***
BRS_t	−0.165	−0.112	−0.167	−0.165	−0.118	−0.123	−0.152
	(−6.81)***	(−5.48)***	(−7.68)***	(−7.37)***	(−5.50)***	(−5.60)***	(−6.33)***
$\Delta CC_{t-1,t}$	−0.007	0.064					
	(−0.17)	(1.69)*					
$\Delta IRC_{t-1,t}$	0.077		0.082				
	(3.05)***		(3.27)***				
$\Delta EB_{t-1,t}$	0.098			0.118			
	(2.37)**			(2.99)***			
$\Delta SO_{t-1,t}$	0.015				0.059		
	(0.52)				(2.18)**		
$\Delta CAR_{t-1,t}$	0.007					0.063	
	(0.23)					(2.28)**	
$\Delta SMP_{t-1,t}$	0.080						0.133
	(1.81)*						(2.99)***
$\Delta BRS_{t-1,t}$	−0.053	0.004	−0.042	−0.036	0.001	−0.005	−0.021
	(−1.13)	(0.10)	(−0.93)	(−0.74)	(0.02)	(−0.11)	(−0.45)
Crisis in t	−0.287	−0.246	−0.275	−0.273	−0.232	−0.248	−0.253
	(−7.62)***	(−6.85)***	(−7.60)***	(−7.48)***	(−6.37)***	(−6.94)***	(−7.09)***
Crisis in t − 1	−0.173	−0.146	−0.159	−0.151	−0.142	−0.141	−0.151
	(−4.65)***	(−3.97)***	(−4.35)***	(−4.12)***	(−3.85)***	(−3.94)***	(−4.11)***
Observations	928	928	928	928	928	928	928
R2	0.272	0.224	0.249	0.239	0.224	0.226	0.235

Linear Regression with country fixed effects.
Robust t statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Shocks that adversely affect the economic performance of bank borrowers and whose impact cannot be reduced through diversification should be positively correlated with systemic banking crises. The shocks associated with banking sector problems highlighted by the literature include cyclical output downturns that can be captured by real GDP growth, terms of trade deteriorations, real short-term interest rate, and declines in asset prices such as equity and real estate (Gorton, 1988; Caprio and Klingebiel, 1996; Lindgren et al., 1996, Kaminsky and Reinhart, 1999).

Given banks' exposure to interest rate risk, a large increase in short-term interest rates is likely to be a major source of systemic banking sector problems. The increase in short-term interest rates may be due to various factors, such as an increase in the rate of inflation, a shift toward more restrictive monetary policy that raises real rates, an increase in international interest rates, the removal of interest rate controls owing to financial liberalization (Galbis, 1993), or the need to defend the exchange rate against a speculative attack (Velasco, 1987; Kaminsky and Reinhart, 1999).

Currency mismatch is another source of banking fragility. If borrowers can borrow in external currency while receiving their income in local currency, foreign exchange risk is shifted onto borrowers, and unexpected devaluation would affect bank profitability negatively through an increase in nonperforming loans. Antecedents of banking problems derived from currency mismatches can be found in Chile in 1981 (Akerlof et al., 1993), in Mexico in 1995 (Mishkin, 1999), in the Nordic countries in the early 1990 s (Drees and Pazarbasioglu, 1998), in Turkey in 1994, and in Argentina in 2001 (Galiani et al., 2003), among others.

Deposit insurance can prevent the occurrence of bank runs. However, if the premiums do not fully reflect the riskiness of bank portfolios, then the presence of deposit insurance creates incentives for taking excessive risk, i.e., it increases moral hazard (Kane, 1989). The opportunities for taking risk are decreasing in the level of financial repression. Thus, if financial liberalization takes place in countries with deposit insurance, and it is not accompanied by a well-designed and effective system of prudential regulation and supervision, then excessive risk taking on the part of bank managers is possible, increasing the likelihood of a banking crisis. In summary, there is ambiguity in theory with respect to the sign of the correlation between existence of deposit insurance and frequency of banking crises.

In countries with liberalized banking sectors but with weak bank supervision and easy-to-circumvent legal remedies, looting behavior is more likely (Akerlof et al., 1993). Thus, a weak legal system that allows fraud to go unpunished increases the probability of a banking crisis.

Sudden withdrawals of bank deposits with similar effects to those of a bank run may also take place after periods of large inflows of foreign short-term capital. Such inflows, often driven by the combined effect of capital account liberalization and high domestic interest rates owing to inflation stabilization policies, result in an expansion of domestic credit. When foreign interest rates rise, domestic interest rates fall, or when confidence in the economy weakens, foreign investors quickly withdraw their funds, and the domestic banking system may become illiquid (Calvo et al., 2004).

The real interest rate may also be considered as a proxy for financial liberalization, as Galbis (1993) found that liberalization process tends to lead to high real rates. Another variable that can proxy the progress with financial liberalization is the change in real credit. Since case studies point to a number of episodes in which banking sector problems were preceded by strong credit growth, we include lags of this variable as controls.

Inflation is a potential explanatory variable because it is likely to be associated with high nominal interest rates and because it may proxy macroeconomic mismanagement, which adversely affects the economy and the banking system through various channels.

The rate of depreciation of the exchange rate may be used to test the hypothesis that banking crises may be driven by excessive foreign exchange risk exposure either in the banking system itself or among bank borrowers.

To test whether systemic banking sector problems are related to sudden capital outflows in countries with an exchange rate peg, we control for the ratio of M2 to foreign exchange reserves. According to Calvo (1996), this ratio is a good predictor of a country's vulnerability to balance of payment crises.

The government surplus as a percentage of GDP represents the financing needs of the central government. This variable may matter for at least two reasons. First, governments with financing difficulties often postpone measures to strengthen banks' balance sheets (Lindgren et al., 1996). Second, failure to control the budget deficit may be an obstacle to successful financial liberalization (McKinnon, 1991). Frustrated attempts of financial liberalization can create problems for the banking system.

The effect of adverse macroeconomic circumstances on the likelihood of a banking crisis should be of a less magnitude in countries where the banking system is liquid. To capture liquidity, Demirgüç-Kunt and Detragiache (1998) use the ratio of bank cash and reserves to bank assets.

GDP per capita is also used as a proxy of institutional quality. Indexes of the quality of the legal system, of contract enforcement, and of the bureaucracy do the same job, approximating opportunities for moral hazard.

Following Hardy and Pazarbasioglu (1999), we also introduce regional variables.

In summary, we include the following control variables, whose sources and statistics are described in Table 10: Initial GDP per capita (corresponding to the year 1973), real GDP growth, inflation rate, depreciation rate of real exchange rate, depreciation rate of nominal exchange rate, cash surplus/deficit of central government as a percentage of GDP, private consumption growth, private investment growth, terms of trade index, change in domestic credit to private sector as a percentage of GDP, bank liquid reserves as a percentage of bank assets, real interest rate, strength of legal rights index, number of procedures to enforce a contract, money and quasi money (M2) as a percentage of total reserves, regional dummies, dummy for previous banking crisis, lending minus deposit real spread interest, dummy for countries with explicit deposit insurance, change in foreign liabilities of the banking system as a percentage of GDP, and change in deposit liabilities as a percentage of GDP. Some other relevant variables are not included due to lack of data.

4.2. Methodology

The inclusion of control variables creates imbalances in the data samples: For different control variables the availability of observations may be different. If we run the regressions including all those variables together, the maximum length for which all variables have observations corresponding to all periods could be "too small", in the sense of impeding the estimation of the coefficients of interest. We would lose many observations of banking crises and of financial reforms; besides, adding too many control variables could lead to multicollinearity, which would create inflation variance. Our analysis is not exempt of these problems. To overcome them, we perform a robustness analysis that relies on a strategy that combines elements from Levine and Renelt (1992) and Sala-i-Martin (1997).

Levine and Renelt (1992) analyze the robustness of the conclusions from cross-country growth regressions to small changes in the conditioning information set. They take all the variables that have been significant in growth cross-country regressions. Then, they take all the possible combinations of three of those variables, and run a growth regression that includes a set of variables that are always included in growth regressions, the variable of interest (that is, the variable whose coefficient's significance is queried), and the subset of control variables. The regression is run for every possible subset formed with the combinations described, and the coefficient associated with the variable of interest is computed for every regression. Finally, they identify the highest and lowest values of that coefficient that cannot be rejected at the 0.05 significance level. Let those values be β_L and β_U, respectively. They define an interval bounded by $[\beta_L - 2\sigma, \beta_U + 2\sigma]$, where σ is the standard deviation of the coefficient. If the interval includes the zero, then that result is said to be fragile. Otherwise, it is said to be robust. Each control variable plays the role of the "variable of interest" once.

Table 10
Control variables.

Variable	Source	Variablility	Summary statistics				
			Obs.	Mean	St. dev.	Min.	Max.
Initial GDP per capita (1973)	PWT	Cross country	928	5244.5	3224.3	639.5	15,089.2
Real GDP growth	WDI	Time & Cross country	928	0.034	0.059	−0.449	0.165
Inflation rate	WDI	Time & Cross country	823	0.994	5.837	−0.085	117.5
Depreciation rate of real exchange rate	PWT	Time & Cross country	914	0.026	0.502	−0.812	13.21
Depreciation rate of nominal exchange rate	WDI	Time & Cross country	928	1.531	10.51	−0.216	174.7
Cash surplus/deficit of central government as % of GDP	IFS & WDI	Time & Cross country	562	−2.167	4.964	−41.22	16.11
Private consumption growth	PWT	Time & Cross country	928	0.034	0.068	−0.306	0.469
Private investment growth	PWT	Time & Cross country	928	0.033	0.958	−25.23	12.55
Terms of trade index (2000 = 100)	WDI	Time & Cross country	570	109.6	31.82	50.98	306.6
Change in domestic credit to private sector as % of GDP	WDI	Time & Cross country	874	0.399	9.175	−86.10	99.56
Bank liquid reserves as% of bank assets	WDI	Time & Cross country	852	16.24	13.72	0.132	135.8
Real interest rate	WDI	Time & Cross country	647	7.678	37.03	−97.81	789.8
Strength of legal rights index (0 = weak to 10 = strong)	WDI	Cross country	928	5.022	2.345	1	10
Procedures to enforce a contract (number)	WDI	Cross country	928	35.93	5.425	21	46
Money and quasi money (M2) as% of total reserves	WDI	Time & Cross country	884	6.773	50.57	0	1,459.7
Dummy for Emerging Asian countries	Abiad et al. (2010)	Cross country	928	0.341	0.474	0	1
Dummy for Latin American countries		Cross country	928	0.495	0.500	0	1
Dummy for Transition economies		Cross country	928	0.165	0.371	0	1
Dummy for previous banking crisis.	Laeven and Valencia (2008)	Time & Cross country	928	0.458	0.498	0	1
Lending minus deposit real spread interest	WDI	Time & Cross country	555	7.493	11.35	−20.48	114.0
Dummy for countries with explicit deposit insurance	Barth et al. (2004)	Cross country	746	0.641	0.480	0	1
Change in foreign liabilities of the banking system as% of GDP	IFS	Time & Cross country	783	−0.005	0.075	−0.839	0.340
Change in deposit liabilities as% of GDP	IFS	Time & Cross country	807	0.009	0.101	−1.062	1.741

Sala-I-Martin (1997) shows that the above test is too strong for any variable to pass it. Specifically, if the distribution of the estimators of the variable of interest has some positive and some negative support, then one is bound to find one regression for which the estimated coefficient changes sign if enough regressions are run. Hence, he proposes an alternative test. Instead of focusing on the extreme values of the interval and concluding that the variable of interest is fragile if zero belongs to the interval, his test pays attention to the fraction of the density function that lies to each side of zero. If the coefficient is expected to be positive, then its degree of robustness is higher when the fraction of the density function that lies above zero is higher.

Our methodology takes elements both from Levine and Renelt (1992) and Sala-i-Martin (1997). We take all the possible combinations of 3 variables out the 23 variables listed above. The number of combinations is to 1771. The number of observations for the regressions run is depends on the combinations we take. We run the regressions using the *global search regress* instrument developed in Gluzmann and Panigo (2015).

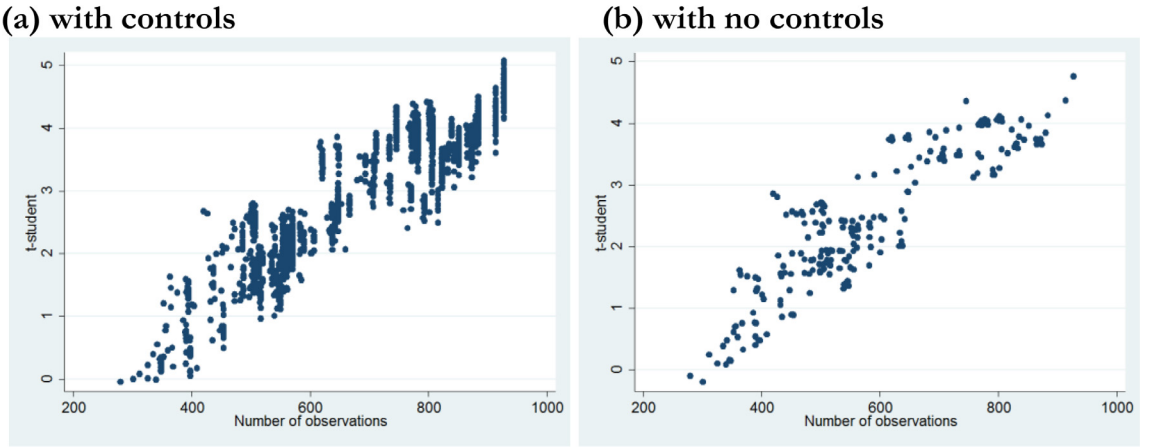

Fig. 2. t-statistic and number of observations, with and without controls – financial liberalizations.

4.3. Results

In 99.8 percent of the regressions we run, the coefficient on the ΔFRI is positive. Fig. 2 (panel a) shows that the likelihood that the coefficient of interest is significant is increasing in the number of observations. Indeed, the only two cases for which the coefficient has the "wrong" sign are cases in which the number of observations is the minimum. Furthermore, all the coefficients become significant at 5 percent level once the number of observations exceeds 600.

We claim that the loss of significance for our coefficient of interest is due to the low number of observations, and not because the inclusion of variables for which the available time-series is shorter are variables that indeed alter significantly

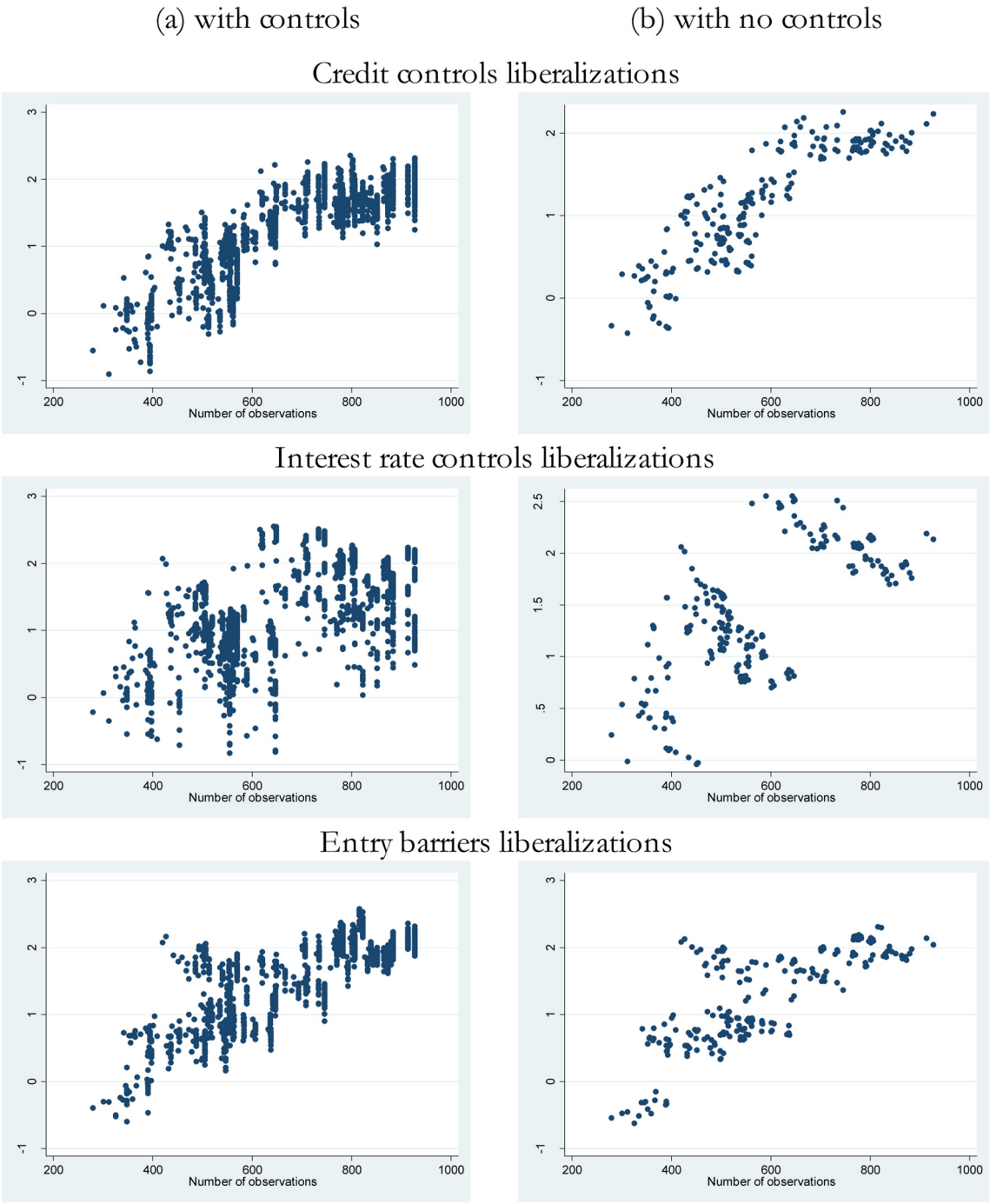

Fig. 3. t-statistic and number of observations for the different reforms.

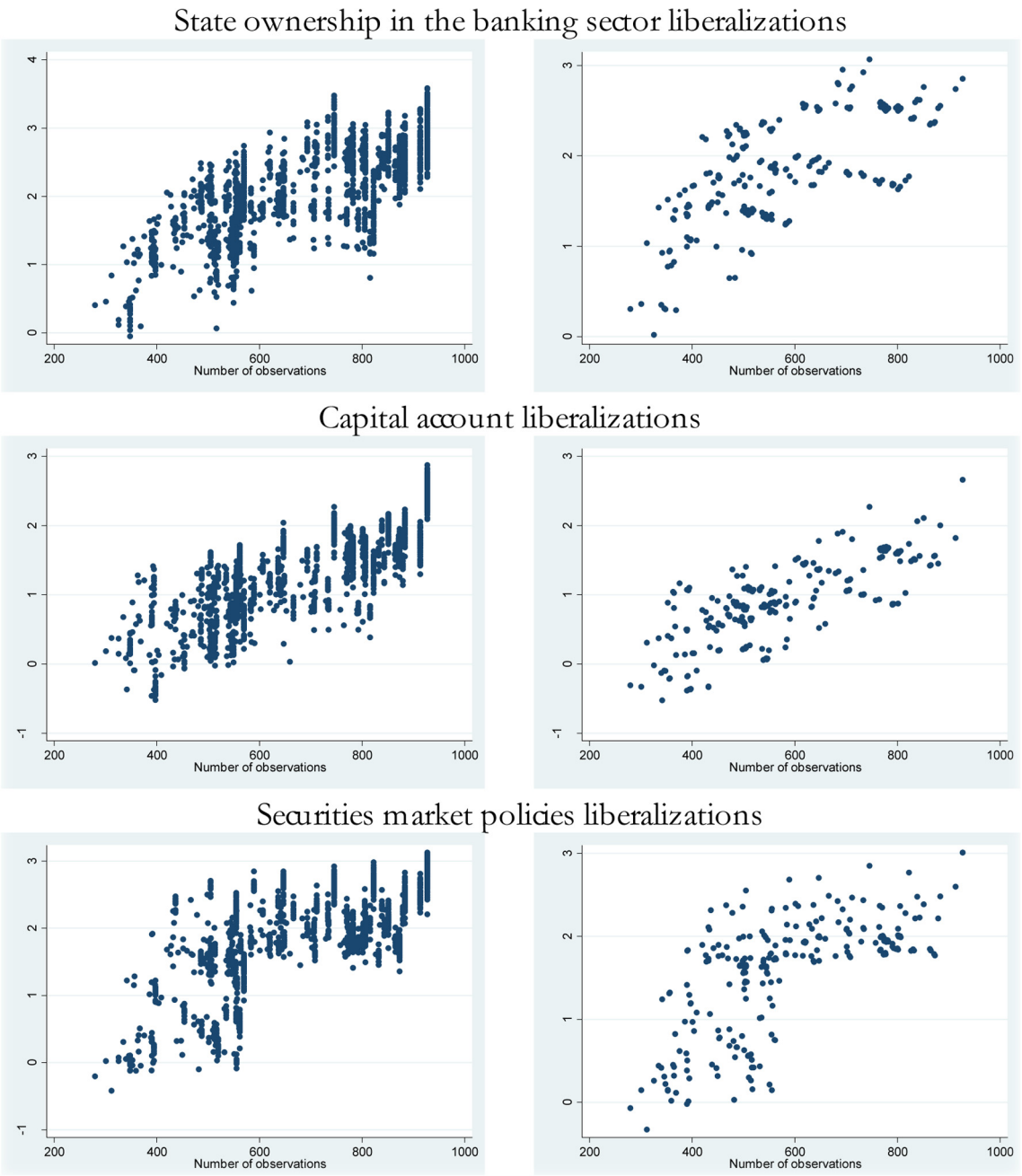

Fig. 3 (*continued*)

the relationship between financial liberalization and frequency of banking crises. To assess the validity of our assertion, we perform an additional exercise. We run a *sister-regression* for each regression with control variables. A *sister-regression* is defined as a regression that excludes all the control variables, but that eliminate the observations corresponding to the periods for which there was no data availability in the regression that did include the control variables. That is, our strategy implies a continuous disposal of observations, in order to run 1771 regressions of equal sample size as the 1771 controlled regressions.

Figure 2 (panel b) shows our findings. Unsurprisingly, the relationship between significance of coefficients and number of observations is still positive and strong, and in particular it displays the same pattern as the regressions with controls, suggesting that our results in the regressions with controls were robust.

We follow the same strategy for assessing the robustness of the regressions corresponding to each of the different dimensions of financial reforms. The results are summarized in Fig. 3. The regressions are also robust to the inclusion of controls.

In summary, the inclusion of control variables does not invalidate our previous finding of a significant and robust positive relationship between financial liberalization and financial instability, either at the aggregate or individual level of reforms.

5. Conclusions

Our study confirms established presumptions on the relationship between financial liberalization and banking crises supported by earlier literature, and shed light on the particular effect of different types of financial reforms on the likelihood of banking crises, as well as on the evolution of these effects over time.

We have documented that reforms in the direction of liberalization of a number of financial dimensions (namely, capital accounts, securities markets, interest rates, removal of credit controls, barriers to entry, and reduction of state ownership in the banking sector) in emerging economies were all positively associated with a higher frequency of banking crises for the period 1973–2005. We also showed that the increase in financial turbulence was mainly concentrated within a time-window of five years after the reforms. Finally, we presented a novel, tractable method for robustness analysis, that could be applied to analyze the relationship between any two or more variables in which the dependent variable is at the same time determined by many other variables. Applying this method, we showed that our results are robust to the inclusion of all control variables that have been found in the literature as significant determinants of banking crises.

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References

Abiad, Abdul, Detragiache, Enrica, Tressel, Thierry, 2010. A new database of financial reforms. IMF Staff Papers 57, 281–302.
Abiad, A., Mody, A., 2005. Financial reform: What shakes it? What shapes it? Am. Econ. Rev. 95 (1), 66–88.
Akerlof, George A., Romer, Paul M., Hall, Robert E., Mankiw, Gregory N., 1993. Looting: the economic underworld of bankruptcy for profit. Brook. Papers Econ. Activity 24, 1–73.
Angkinand, Apanard P., Sawangngoenyuang, Wanvimol, Wihlborg, Clas, 2010. Financial liberalization and banking crises: a cross-country analysis. Int. Rev. Finan. 10, 263–292.
Barth, J.R., Gerard, C., Ross, L., 2004. Bank regulation and supervision: what works best? J. Financ. Intermed. 13 (2), 205–248.
Calvo, Guillermo A., Izquierdo, Alejandro, Mejia, Luis F., 2004. On the Empirics of Sudden Stops: The Relevance of Balance-sheet Effects. NBER Working Papers: 10520.
Calvo, Guillermo A., 1996. Capital flows and macroeconomic management: tequila lessons. Int. J. Finan. Econ. 1, 207–223.
Caprio, Gerard, Honohan, Patrick, Stiglitz, Joseph E., 2006. Financial Liberalization: How Far, How Fast? Cambridge University Press, Cambridge.
Caprio, Gerard, Klingebiel, Daniela, 1996. Bank Insolvencies: Cross-country Experience. World Bank Policy Research Working Paper No. 1620.
Caprio, Gerard, Klingebiel, Daniela, Laeven, Luc, Noguera, Guillermo, 2005. Appendix: banking crisis database. In: Honohan, Patrick, Laeven, Luc (Eds.), Systemic Financial Crises: Containment and Resolution. Cambridge University Press, Cambridge, pp. 307–340.
Demirgüç-Kunt, Asli, Detragiache, Enrica, 1998. Financial Liberalization and Financial Fragility. IMF Working Paper No. 98/83.
Derksen, Shelley, Keselman, Harvey J., 1992. Backward, forward and stepwise automated subset selection algorithms: frequency of obtaining authentic and noise variables. British J. Math. Stat. Psychol. 45, 265–282.
Drees, Burkhard, Pazarbasioglu, Ceyla, 1998. The Nordic Banking Crises: Pitfalls in Financial Liberalization?. IMF Occasional Paper No. 161.
Edison, Hali J., Klein, Michael W., Ricci, Luca Antonio, Sl{o}k, Torsten, 2004. Capital account liberalization and economic performance: survey and synthesis. IMF Staff Papers 51, 220–256.
Eichengreen, Barry, Arteta, Carlos, 2002. Banking crises in emerging markets: presumptions and evidence. In: Mario, Blejer I., Skreb, Marko (Eds.), Financial Policies in Emerging Markets. The MIT Press, Cambridge, MA, pp. 47–94.
Galbis, Vicente, 1993. High Real Interest Rates Under Financial Liberalization Is There a Problem?. IMF Working Paper No. 93/7.
Galiani, Sebastián, Heymann, Daniel, Tommasi, Mariano, Servén, Luis, Terra, María Cristina, 2003. Great expectations and hard times: the argentine convertibility plan. Economía 3, 109–160.
Gatu, Cristian, Kontoghiorghes, Erricos John, 2012. Branch-and-bound algorithms for computing the best-subset regression models. J. Comput. Graph. Stat. 15, 139–156.
Gluzmann, Pablo, Panigo, Demian, 2015. Global search regression: a new automatic model-selection technique for cross-section, time-series, and panel-data regressions. Stata J. 15, 325–349.
Gorton, Gary, 1988. Banking panics and business cycles. Oxford Econ. Papers 40, 751–781.
Greenwald, Bruce C., Stiglitz, Joseph E., 1986. Externalities in economies with imperfect information and incomplete markets. Quart. J. Econ. 101, 229–264.
Hardy, Daniel C., Pazarbasioglu, Ceyla, 1999. Determinants and leading indicators of banking crises: further evidence. IMF Staff Papers 46, 247–258.
Jolliffe, Ian, 2002. Principal Component Analysis. John Wiley & Sons, New York.
Kaminsky, Graciela L., Reinhart, Carmen M., 1999. The twin crises: the causes of banking and balance-of-payments problems. Am. Econ. Rev. 89, 473–500.
Kane, Edward J., 1989. How incentive-incompatible deposit-insurance funds fail. NBER Working Paper No. 2836.
Laeven, Luc, Valencia, Fabian, 2008. Systemic Banking Crises: a new Database. IMF Working Paper No. 08/224.
Laeven, Luc, Valencia, Fabian, 2013. Systemic banking crises database. IMF Econ. Rev. 61, 225–270.
Levine, Ross, Renelt, David, 1992. A sensitivity analysis of cross-country growth regressions. Am. Econ. Rev. 84, 942–963.
Lindgren, Carl-Johan, Garcia, Gillian G., Saal, Matthew I., 1996. Bank Soundness and Macroeconomic Policy. International Monetary Fund, Washington, DC.
Lindsey, Charles, Sheather, Simon, 2010. Variable selection in linear regression. Stata J. 10, 650.
Loayza, Norman V., Ranciere, Romain, 2006. Financial development, financial fragility, and growth. J. Money Credit Banking 38, 1051–1076.
McKinnon, Ronald I., 1973. Money and Capital in Economic Development. Brookings Institution Press, Washington, DC.
McKinnon, Ronald I., 1991. Financial control in the transition from classical socialism to a market economy. J. Econ. Perspect. 5 (1991), 107–122.
Mishkin, Frederic S., 1999. Lessons from the tequila crisis. J. Banking Finan. 23, 1521–1533.
Noy, Ilan., 2004. Financial liberalization, prudential supervision, and the onset of banking crises. Emerg. Markets Rev. 5, 341–359.

Ocampo, José Antonio, Stiglitz, Joseph E., 2008. Capital Market Liberalization and Development. Oxford University Press, New York.
Sala-i-Martin, Xavier X., 1997. I just ran two million regressions. Am. Econ. Rev. 87, 178–183.
Shaw, Edward, 1973. Financial Deepening in Economic Development. Oxford University Press, New York.
Shehzad, Choudhry T., DeHaan, Jakob, 2009. Financial Reform and Banking Crises. CESifo Working Paper Series No. 2870.
Stiglitz, Joseph, Ocampo, José Antonio, Spiegel, Shari, Ffrench-Davis, Ricardo, Nayyar, Deepak, 2006. Stability with Growth: Macroeconomics, Liberalization and Development: Macroeconomics, Liberalization and Development. Oxford University Press, New York.
Stiglitz, Joseph E., 2000. Capital market liberalization, economic growth, and instability. World Develop. 28 (2000), 1075–1086.
Stiglitz, Joseph E., 2004. Capital-market Liberalization, globalization, and the IMF. Oxford Rev. Econ. Policy 20 (2004), 57–71.
Velasco, Andres, 1987. Financial crises and balance of payments crises: a simple model of the southern cone experience. J. Develop. Econ. 27, 263–283.
Weller, Christian E., 2001. Financial crises after financial liberalisation: exceptional circumstances or structural weakness? J. Develop. Stud. 38, 98–127.
Williamson, John, Mahar, Molly, 1998. Essays. Int. Finan. 1–70, 211.