

Financial reforms and banking system vulnerability: The role of regulatory frameworks

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ARTICLE INFO

Article history:

Received 19 July 2018

Revised 25 October 2019

Accepted 28 October 2019

Available online 9 November 2019

Keywords:

Banking crisis

Prudential regulation

Financial liberalization

Developed and developing economies

ABSTRACT

This paper aims at bringing new insights concerning the effect of financial reforms on banking system vulnerability. We show that the link between financial liberalization and banking crisis depends on the number of years since last regulatory reforms. Similarly, we show that updating regulations indirectly affect banking crisis according to the financial liberalization level. Then, we show that banking crisis can be largely explained by a gap between financial innovations and regulation update on a sample of 49 developed and developing countries from 1980 to 2010. Our empirical evidence supports that the regulatory environment is more important in developed countries as it reduces banking fragility perhaps because of highly-risky exchanged financial products. The effect of financial liberalization depends largely on the number of years since last reform. However, destabilizing effect of financial liberalization in developing countries cannot be neutralized by updating regulations and gets more obvious as regulations become older.

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1. Introduction

There is a large literature on the consequences of financial liberalization and financial regulation, as well as on the interaction between these institutional characteristics, on the likelihood of banking crisis in a given country. However, very little has been said about the impact on the duration of crises and even less about the timing of regulatory reform relative to liberalization. There are strong reasons to suspect that a specific regulatory structure loses effectiveness over time and, therefore, that financial liberalization may have a stronger impact on the probability of crisis and crisis duration if a regulatory structure has been unchanged for many years.

So, trying to remove some shortcomings related to previous literature, this work takes into account regulatory timing and political choices that can affect the countries' vulnerability to banking crises in the aftermath of financial liberalization. In particular, we assess the contribution of delays in updating regulations to explain banking system vulnerability. Our objective is to find out whether it is necessary to update regulations to accommodate for financial innovation or to give time for agents to become familiar with the new rules which can reduce the likelihood of banking crises. In

other words, the idea is that while regulation tends to follow financial developments, after a certain period of time it becomes more likely that new developments in the banking sector occur without being covered by regulations, which can increase financial instability. For example, banks can develop new products that are not taken into account at the time when regulations are drawn up. However, delays in updating the regulations may not have the same effect in different institutional and macroeconomic environments.

The main objective of this paper is so to analyze how the probability and the duration of banking crisis depends on the timing of liberalization relative to regulatory reform taking into account that this relationship may depend on the levels of these institutional factors as well as on other institutional characteristics of the countries. In other words, our purpose is to determine the factors that are at the origin of the banking system crisis¹ highlighting the dynamic effect of regulatory reforms and draw lessons in terms of policy monitoring and also prevention of bank difficulties.²

¹ We chose banking crises because they are the most frequent and costly in last decades (Laeven and Valencia, 2012).

² Since most of indicators cited in the previous literature as contributing to financial crises are directly or indirectly related to financial liberalization processes, often leading to excessive risk-taking which depends on the degree of regulation and supervision, we are interested in studying the effect of the regulatory environment in controlling this relationship. Our aim is mainly to show that the ability of liberalization in explaining the banking vulnerabilities depends on the regulatory environment.

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To achieve this objective we define a variable called “regulatory delay” to capture dynamic effect of regulatory reforms on banking sector vulnerability. Also we distinguish between periods of fragility before the onset of a crisis, the actual period when a crisis erupts, and years of ongoing crisis in a multinomial logit analysis. After analyzing how these three stages of crisis depend on financial liberalization, regulatory strictness, the interaction between these variables and the interaction with regulatory delays, we estimate the probability of each crisis stage and analyze in more details the dynamic relationship between liberalization and regulatory delay. Throughout the analysis, we control for a set of factors affecting the probability of crisis according to the previous literature for 49 emergent and developed countries during the period 1980–2010. A fundamental difference of such approach lies in its ability to identify not only the factors causing a crisis but also its characteristics in terms of duration and fragility. We found critical value for financial liberalization beyond which the relation between updating regulation and banking crisis probability changes sign (form). Similarly, we determine critical values for the number of years since last reforms conditioning the nature of the link between financial liberalization and banking system stability.

This paper is organized as follow: in [Section 2](#) we introduce the theoretical and empirical background of the relationship between financial liberalization and banking crises highlighting the dynamic effect of regulation in stabilizing banking system. Then, we deepened the debate concerning interactions between financial liberalization, regulatory delays as well as the vulnerability of banking crises and formulated our hypothesis. In [Section 3](#), an empirical test is presented about the hypotheses derived from the theory such as increased financial liberalization, years since last regulatory and financial reforms which are not accompanied by regulatory updating can be sources of banking crisis. In [Section 4](#), we show on one hand that the link between banking system vulnerability and financial liberalization depends on the number of years since last reforms. On the other hand, we confirmed that the impact of regulatory updating on the banking sector stability depends on the market structure and on the level of financial liberalization. Therefore, we computed the critical threshold or the turning point for financial liberalization and regulatory delays above which the curve changes its form. [Section 5](#) concludes.

2. Literature³ review

2.1. Origins of banking crises

Literature on banking crises is extensive and includes many studies based on different methodologies and perspectives. Some studies focus on the influence of macroeconomic factors, business cycles and economic growth on banks' failure ([Demirguc-Kunt and Detragiache, 2000](#); [Cihak and Schaeck, 2010](#)). Others consider the role of banking crises on a variety of factors such as: depositors' expectations of banks' financial health; bank specific characteristics; regulatory and supervisory boards; and the socioeconomic context ([Diamond and Dybvig, 1983](#); [Hutchinson and McDill, 1999](#)). Banking crises may also spread from one region to neighboring and other economically linked countries due to cross-border banking linkages: countries' borrowing and lending positions in other

countries clearly promote crises events' spillover through interconnections ([Tonzer, 2015](#)).

Empirically, the focus has been on the general determinants of banking crises and the specific issues such as banking capital requirements, regulation and contagion. In fact, in this paper we are more interested in studying the effect of delays in updating regulations on the interaction between financial liberalization and banking crisis probability which is part of a vast set of theories, hypotheses and stories. For example, [Ostrup et al. \(2009\)](#) presented five categorizations for this issue: 1) macroeconomic developments and leverage, 2) behavioral factors, speculation and optimism, 3) shift to liquidity and safety, 4) management failure, and 5) institutional weaknesses.

In the analysis of the relationship between financial liberalization and banking crises, most of the existing literature focuses on macroeconomic factors. They also take into account banks' leverage and the strength of capital regulation as well as supervision.

Concerning behavioral explanations, previous studies suggested that financial liberalization may be responsible for the speculative behavior that causes crises which cannot be possible with restrictions on bank lending and without risk taking opportunities. Moreover, they supported that capital mobility increases financial crises in emerging markets such as high capital inflows can create an asset price bubble and also cause capital flows ([McKinnon and Pill, 1997](#)). Despite its positive effects in terms of access to a larger capital inflow, capital account liberalization is sometimes accompanied by huge social and economic effects. Actually, it may expose countries to high risks of experiencing banking crises such as excessive capital inflows that can promote boom-bust cycles and reduce the effectiveness of domestic economic policy.

Financial crises can be caused by sudden shifts to safe and liquid assets both by depositors and investors which can result from a sudden sentiment of fear. For example, the demand shift raised from sudden concerns about the solvency of banks may trigger bank runs. This explanation requires implicitly that the financial system is relatively free from restrictions on risk-taking since portfolio shifts assume that investors have been able to obtain risky portfolios in accordance with their preferences. However, portfolio shifts may also be the result of liberalization ([Angkinand et al., 2010](#)). Since financial reforms affect the structure of the market, the share of agents and therefore their profits, changes in incentives and risk-taking decisions not constrained by legal and judicial restrictions (as in the state of repression) results in the modification of the portfolio .

The fourth and the most important explanation of crises refers to management failures to evaluate and control risk-taking in financial institutions as the case in the last financial crisis in the United States. In this context, a banking crisis is explained by institutional weaknesses leading to systematic governance and managerial failures.

Institutional weaknesses are important determinants of a banking crisis onset for many reasons. For example, “a weak political structure may cause budgetary deficits reducing financial ability of governments and confidence of agents in the effectiveness of public authorities” ([Angkinand et al., 2010](#)). This environment of inconsistency and uncertainty can lead to mistrust and also increase in the likelihood of banking crises.

In the presence of deposit insurance guarantees, banks shift risks to deposit insurance funds and tax payers. This “*moral hazard problem*” can explain insufficient attention to risk management and insufficient bank capital relative to credit risk. It can be so expected that this moral hazard behavior is particularly relevant if the protection of banks' liabilities is extensive and if there are few restrictions on banks' risk-taking opportunities. Thus, it is expected that financial liberalization in interaction with protection of banks' liabilities can be an interesting explanation of banking crises. The

³ We are interested in systemic banking crises and large amplitude banking failure. Banking crises have been defined as panic or serious waves of bank failures ([Calomiris, 2010](#)). A bank run occurs “when the debt holders in all or in a significant number of banks require suddenly converting their debts in liquidity”. This behavior requires banks to suspend the convertibility of their debt in cash or to act collectively to avoid suspension of convertibility. Bank failures waves are considered serious if they result in negative net worth of all failed banks by more than 1% of GDP”.

effectiveness of capital regulation and supervision should also be considered among institutional factors affecting the likelihood of banking crises. In our empirical part, we wonder whether the impact of financial liberalization on banking crises (instability) depends on the delays of updating regulation and supervision. This brief review of crises' potential causes indicates that arguments can be made for an important relationship between financial liberalization as well as the likelihood of banking crises. Thus that regulatory framework can play a crucial role in determining the nature of this link.

Barth et al. (2014) showed that the financial crisis-regulation debate has been theoretical for a long time because of limited data availability. The theoretical reasons for the regulation of the banking sector lie in its main function of transforming maturity and liquidity which expose banks to massive withdrawals fueled by waves of trust and mistrust of depositors. Previous literature showed that the same mechanism through which finance helps growth, makes financial systems exposed to shocks and fragility (Beck, 2012). The activity of maturity and liquidity transformation from short-run deposits into long term investment, in particular, is the main channel through which finance affects positively growth but at the cost of a high probability of shocks and liquidity runs in new financial liberalized markets. Information asymmetries between depositors and investors may be a source of fragility due to agency conflicts.⁴ The opacity characterizing the majority of intermediary balance sheets and strong competition pushes financial institutions to excessive risk-taking in liberalized and less controlled markets undermining discipline and resulting in financial fragility (Carletti, 2008). In other words, the latter considers that banking sector competition in the presence of market imperfections leads to fragility and systemic risks. He insists particularly on the roles that play asymmetric information, switching costs and network externalities in worsening agency problems leading to excessive risk taking which needs regulation and supervision. Similarly, Keeley (1990) supported that the decline of banks' margins and charter values in the aftermath of liberalization worsened the agency problem between banks and depositors. Thus, inducing banks to take excessive risks and increasing the probability of banking runs dramatically.

In the early 2000s, the debate became empirical through the publication of Bank data on regulation and supervision by the World Bank and mixed results emerged from this literature according to the regulatory channel. Barth et al. (2004) showed that only stronger restriction on bank assets, more barriers to foreign bank entry and deposit insurance systems increase financial instability. However, Lee and Lu (2015) supported that tighter capital regulations and higher entry requirements reduce the ratio of non-performing loans to gross loans and lead to a stable financial sector. Tchana (2014) indicated that, although entry restrictions, deposit insurance and capital requirements reduce the likelihood and duration of a banking crisis in Indonesia, higher reserve requirements increase banking sector instability. Similarly, by focusing on non-industrial economies, Klomp and de Haan (2014) showed that tighter regulation reduces banks' risk, thereby positively influencing financial stability.

In summary, the effect of regulation on bank stability seems to be ambiguous and the results open new horizons for further

research, focus on the use of specific measures of the regulatory environment and take into account the interaction with financial market structure. Most of the literature discussed above is not specific to the time dimension of financial liberalization, institutional and regulatory frameworks.

2.2. Financial liberalization, regulatory⁵ framework and banking crises: theoretical debate and hypothesis formulation

The most crucial explanation of a banking crisis focused on the importance of non-economic factors such as institutional environment quality. Indeed, most researches are based on 'lax supervisory' and monopoly hypotheses. The first explanatory channel adopts a microeconomic analysis. It insists on the inherent individual imperfections that agents face on the banking system such as adverse selection, moral hazard, problems of principal agents and other imperfections due to information asymmetries and uncertainties motivated by lax supervisory environment. The second channel is based on the market structure that changes from monopoly situation (in repressed economy) to increased competition (in liberalized markets). Conversely, a repressed economy is typically characterized by only one or a limited number of banks that operate or are licensed to operate and have exclusivity contracts. Under these conditions, barriers to entry are established against foreign banks (and even new national banks) and there is usually a ceiling on the deposit interest rate. Protected by barriers to entry and with an attractive price (maximum deposit rate), existing banks enjoy considerable monopoly power. The liberalization of domestic interest rates pushes banks to compete for deposits by increasing depositary rates thus reducing profit margins and the entry of foreign banks (Freixas and Rochet, 1997). Over time when competition becomes more intense, inefficient institutions will fail (Boyd et al., 2004). The decline in profit margins also places banks in a more instable position with respect to fluctuations in the environment in which they operate. Given that financial liberalization implies a change in the "rules of the game" and that bankers are not yet aware of their consequences, they may take excessive risks trying to benefit from a more flexible and open operating environment. For these reasons, financial liberalization may increase banking crisis probability and duration for any regulatory and economic environment (Beck, 2012). So, we support the following hypothesis:

H1.a. Financial liberalization is associated with an increase in the probability of banking (instability) crisis at given regulatory and institutional structures, time since last regulatory reform and macroeconomic conditions.

H1.b. Financial Liberalization is associated with longer duration of banking crises⁶ at given regulatory and institutional structures, time since last regulatory reform and macroeconomic conditions.

In addition, there are reasons to believe that regulatory framework strengthening is important in the aftermath of financial liberalization. On the one hand, in a repressed economy, bank managers and staff are used to work within a controlled non-competitive environment. On the other hand, domestic and external financial lib-

⁵ Regulatory framework includes regulation and supervision: The regulation of banks has been defined by Llewellyn (1986) as: 'a body of specific rules or agreed behavior either imposed by some government or other external agency or self-imposed by explicit or implicit agreement within the industry that limits the activities and business operation of financial institutions'. In other words, it is the codification of public policy towards banks. Supervision on the other hand, is the process of monitoring banks to ensure that they are carrying out their activities in accordance with laws, rules and regulations and in a safe and sound manner. It is a means of ensuring compliance with laid down rules and regulations and to determine their financial condition at any given time.

⁶ For simplicity of the analysis, we consider that banking crisis occurrence and duration have the same determinants that we will confirm empirically.

⁴ Financial markets without adequate regulation are known to be prone to failure because of the public goods characteristics of information that agents must acquire and proceed to make decision. Individual shareholders tend not to invest money and time in information collection about management in the hope that others will do so instead. They know that all shareholders, including themselves benefit from the acquired information. Financial firms wishing to reduce or avoid monitoring costs may just follow others, possibly larger financial institutions to make their investments, leading to what has been observed as the "herd behavior", a characteristic of financial agents.

eralization process can lead to increased lending and greater competition in banking sector. While increased competition may be desirable in the long run, it may induce banks to adopt risky short-term investment strategies because of the erosion in their franchise values. In this case, banks may become fragile because of the lack of a regulatory and supervisory framework that can adequately monitor them (Alba et al., 2000). In other words, financial liberalization increases excessive risk taking and imprudent behavior if it is done without updating regulatory and supervisory techniques suitable for the new competitive environment (Noy, 2004). So, without updated and tighter regulations, financial liberalization can make banking sector more fragile (because of new products and procedures not covered by old regulation pre-reformed before financial reform) increasing the probability and duration of crisis. Thus, we test the following hypothesis:

H2. *If financial liberalization is not accompanied by increased strictness of regulation, the liberalization causes an increase in:*

- a The probability of banking (instability) crisis.
- b The duration of banking crisis

Moreover, probability of banking crisis is largely explained by the asymmetry between the evolution of financial markets (speed and timing of financial reforms) and regulatory framework updating. This idea is drawn from the work of Garriga (2017)⁷ assuming that a prudential regulation may become outdated compared to bank behavior evolution towards high risk taking. She supported that a delay in revising a banking regulatory framework increases the likelihood of banks to adopt risky behaviors and, consequently, the vulnerability of countries to banking crises. This explanation is formulated based on the regulatory dialectic of Kane (1977), a process dealing with the interactions between political institutions and controlled agents. This reasoning considers “the policy process of control and economic process of regulation removal as opposing forces that are scalable in a continuous manner. This alternating adaptation evolves as a series of delayed responses, with regulators and regulated seeking to maximize their own objectives, according to the behavior of their counterpart” (Kane, 1981).

Given these adaptive dynamics and adjustment of both regulatory authorities (seeking to prevent crisis) and regulated agents (seeking profit), the variable regulatory delays is defined as the time since the last regulatory reform (Garriga, 2017). This indicator permits to see if the effect of regulation can vary with time and helps rule out the learning hypothesis. Similar to previous works, we assume that the delay in updating regulations gives the banking sector more opportunities to find ways to avoid constraints and to exploit regulations to engage in more profitable operations. This assumption is supported by the view that “financial systems’ vulnerability to crises results from “the underlying incentives faced by banks, regulators, and other financial market participants meaning that bankers decisions and incentives are affected by regulation levels and regulatory delays as well” (Ergungor and Thomson, 2005). In this context, McIlroy and Straus (2009) showed that financial markets participants always seek to get around the re-

strictions by devising different products or altering their reporting practices to avoid regulatory constraints. Furthermore, credit institutions adopt new sophisticated practices which require continuous updating of rules. Indeed, some banks move the riskiest assets off their balances to avoid capital adequacy standards (Deeg and O’Sullivan, 2009), use derivatives and other devices, develop “shadow” banking systems, generate new products, or trade complex instruments. So the development of risky activities not anticipated by the previous legislation increases the probability of a banking crisis which makes us suggest the following hypothesis as did Garriga (2017):

H3.a. *Since a given regulatory structure loses effectiveness over time, the probability of banking (instability) crisis increases with the time since the last reform at a given level of financial liberalization and macroeconomic conditions.*

H3.b. *Since a given regulatory structure loses effectiveness over time, the duration of a banking (instability) crisis increases with the time since the last reform at a given level of financial liberalization and macroeconomic conditions.*

In addition, we find that expected future profits decline in the aftermath of financial liberalization, reducing the cost of bankruptcy and leading banks to take more risky investments as long as regulatory constraints are not yet binding. As a result of liberalization, previous prudential supervision practices, even if strengthened, are often no longer viable. Also, since supervisors are not yet accustomed to the new “rules”, their effectiveness diminishes (Nier and Baumann, 2006). The weaker the underlying supervisory regime is, the stronger the destabilizing effect of financial liberalization will be. In this context, financial liberalization may cause systemic problems in the banking sector which can last for a long periods if the regulatory framework is not updated to meet new challenges making intervention policies hard and inefficient.

For these reasons, we think that by reducing monopoly power and in the absence of adequate regulatory constraints, liberalization will increase the risk taking and subsequently enhance the probability of a banking crisis. As a result, the probability of a banking crisis in the aftermath of financial liberalization can be largely explained by the asymmetry between the evolution of financial markets and regulatory framework updating. In this context, Garriga (2017) supported that a delay in revising a banking regulatory framework increases the likelihood of banks to adopt risky behaviors and, consequently, the vulnerability of countries to banking crises. She also found an inverted U-Shaped relationship between regulatory delays and a banking crisis probability conditioned by the level of financial liberalization. She explained this link by strong incentives to escape regulation constraints and taking advantage of regulatory lags in less liberalized markets and also by improved discipline in highly liberalized markets.

In addition, regulatory delays may have different effects depending on the financial market structure. In particular, we suppose that this effect depends on the level of financial market liberalization as in hypothesis (2). This suggestion is important because financial reforms affect both available profit opportunities and financial market structure. So, *contrary to hypothesis 3* we assume that regulatory delays increase the probability of banking system vulnerability in less liberalized countries for the following reasons:

Firstly, new profit opportunities are generally limited in a highly regulated banking system which pushes agents to find other ways to avoid regulatory constraints. For example, when regulators impose restrictions like low levels of interest and benefits, regulatory delays can have a stronger impact and make the country more vulnerable to crises.

Secondly, contrary to the monopolistic situation (in the case of a repressed economy), the competitive market characterizing financial liberalization allows the entry and participation of several banks in the system. Despite liberalization stimulates competition

⁷ Note that we aim to test the effect of financial liberalization on banking crisis depending on the number of years since the last reform in addition to the effect of regulatory lags on banking crisis according to financial liberalization level. The second assumption was tested by Garriga (2017) using a sample of developed and developing during the period 1974–2005. Our work differs from this work in many directions: first we keep all observations (not excluding years of banking crisis occurrence) using a multinomial logit model instead of binary model to correct for post-crisis-bias (Bussiere and Fratzscher, 2006). Then, we test the relation between financial liberalization and banking crisis following regulatory setting which is not studied. Furthermore, we study banking crisis duration in addition to banking instability and banking crisis onset properly said that are previously done. Finally, we determine the threshold values for our variables of interest improving prevention policies of banking crisis.

that encourages banks to take more risks, riskier banks will be rejected by the market discipline (Garriga, 2017). As a result, market discipline through strong competition between banks in a highly liberalized financial market reduces excessive risk-taking behavior (Martinez Peria and Schmukler, 2001) and decreases the importance of regulatory delays in explaining crises' occurrence. For these reasons, we seek hereafter to test the following hypothesis which was partially proposed by Garriga, 2017 for a different sample:

H4. The decline of the effectiveness of a regulatory structure is more pronounced in repressed financial markets than in a financially liberalized environment.⁸ Thus, Hypotheses H3.a and H3.b should be more strongly supported in repressed financial markets.

3. Anatomy of the banking crisis : effect of financial liberalization and regulatory delays

3.1. Data and variables choice

For the choice of variables, the paper relies on Arteta and Eichengreen's (2002) work which provides an extensive survey of empirical macroeconomic research on banking crises. They identify a list of macro-economic and financial variables that are found to be significant in the determination of banking crises. They focus on financial liberalization as a determinant of crises and find that it is positively and significantly related to a banking crisis' likelihood, confirming that it heightens a crisis' risk through facilitating risk taking by intermediaries as other studies suggested.⁹

The dependent variable is a "dummy" indicating the situation of the banking system in a given year. We rely on the data extracted from Laeven and Valencia (2012)¹⁰ to establish this variable. Our base contains 434 year-crisis observations. There are 145 episodes coded as crisis onset, with the following breakdown by income groups: 30 low income countries, 34 lower middle income country, 39 upper middle income countries, and 42 high income countries. The data set for this analysis includes 22 developed countries and 27 emerging markets over the period 1980–2010. We chose this period because it contains the majority of banking crises that affected both developed and emerging economies. More precisely, our choice is mainly guided by the availability of data on financial liberalization measures and banking crises. We focus on the intersection between these two main databases. In other words, we chose countries whose data can be collected on both bases while excluding countries that are too underdeveloped, considered as having different characteristics in terms of economic and institutional development. We have sought to keep the sample as homogeneous as possible and we have introduced most of the countries that are powerful at the international scale to get closer to the reality and to add value to the economic implications of our study.¹¹ This sample and period allow us to conduct an analysis of

the interconnection between the world's major financial centers in an increasingly globalized environment and a more unified global market by assessing the importance of liberalization and regulatory frameworks in banking system instability. The classification of banking crises and their dates are presented for each country of our sample in Table A1. The description of the data is presented in Table A2.

In this work, we introduce several factors that can influence the 'crisis' probability¹² and 'duration' which constitute an important part of a broad consensus in the banking crises literature. Our dependent variable corresponds, in one hand, to the likelihood of knowing systemic banking crisis that affect the majority or all the credit institutions leading to high level of losses and significant intervention of the public authorities to rescue banking system. In the other hand, we use variable duration corresponding to the number of years when a crisis is ongoing to identify potential indicator delaying the return of the banking system to its calm situation before the crisis. The main independent variables of our analysis, mainly the variables financial liberalization and prudential regulation, are taken from the database of Abiad et al. (2010) (ADT).¹³ The potentially important advantage of this database is that it provides time series measures for intensity and nature of reforms in seven dimensions: Elimination of credit controls and high reserves requirements; Elimination of interest rate controls; Elimination of entry barriers and restrictions on the scope of a bank's activity; market securities policy; Elimination of capital account restrictions; Reduction of state ownership in the banking sector and enhancement of capital regulation and prudential supervision (CRS) of the banking sector. A score between 0 and 3 is attributed for each dimension, and scores are combined into a total index that ranges between 0 and 21. The sum of the first six indices represents the 'total level of liberalization' and ranges between 0 and 18 where the high level implies fully liberalization. The seventh sub-indicator, the supervisory and regulatory measure (CRS), is used as a proxy for the 'strictness of regulation' and ranges between 0 and 3 where the high level indicates highly regulated and supervised.¹⁴ This is a categorical variable that takes into account both de facto and de jure indicators of the effectiveness of banking supervision and regulation. It is coded 0 (unregulated banking system and unsupervised), 1 (less regulated and monitored), 2 (largely regulated and monitored), or 3 (highly regulated and supervised). In addition we use the variable 'Year since reform' measuring the time or the number of years since the last capital regulation and supervision reform to assess dynamic effect or effectiveness of regulation over time. While this database contains information about financial reforms for 91 countries only for the period 1973–2005,

individuals who have not experienced the phenomenon to be studied known as "testimony observations".

¹² For the logit regression we used a discrete variable taking the value 1 when a country is experiencing banking fragility (period of two years preceding banking crisis onset), 2 when experiencing systemic banking crisis properly said, 3 when banking crisis is ongoing (duration) and 0 otherwise. For the second type of regression we are based on a continuous measure by computing banking crisis probability based on our result by logit model regression from the best model specification.

¹³ See Hamdaoui et al., (2016) for more description of this database.

¹⁴ Thus, examining the impact of bank regulatory and supervisory policies in countries is a critical area of inquiry. The problem, however, is that measuring bank regulation and supervision around the world is hard. In this context, Bart et al. (2013) provided new data concerning measures of bank regulatory and supervisory policies in 180 countries from 1999 to 2011. The data include information on permissible bank activities, capital requirements, powers of official supervisory agencies, information disclosure requirements, external governance mechanisms, deposit insurance, barriers to entry, and loan provisioning. The dataset also provides information on the organization of regulatory agencies and the size, structure, and performance of banking systems. Nevertheless, since the underlying database starts only in 1999 and do not contain yearly and necessary information permitting to obtain the variable "number of years since last reform" we referred to the database of Abiad et al., (2010) which best meets our purpose.

⁸ Our idea is that since liberalization implies reduction or removes of restrictions on interest rates and credit ceiling favoring competition, it may exercise discipline effect as a substitute for more regulation and supervision needs.

⁹ Previous works focus on the level of regulations (static effect) but not the speed of updating regulations (dynamic effect) to track financial innovations in the aftermath of financial liberalization that can matter in explaining banking crises.

¹⁰ They define a systemic banking crisis as a situation that must meet the following two conditions: (1) "significant signs of financial distress in the banking system (as indicated by significant bank runs, losses and bank liquidations) (2) "significant intervention measures in banking policies in response to significant losses in the banking system".

¹¹ We keep most emerging markets in addition to a small number of developing countries which are getting closer to being emerging. From the sample of ADT containing 91 countries we excluded underdeveloped ones, then, we looked for the countries that experienced crisis according to the study of Laeven and Valencia (2012). Countries that have not experienced crises but are included in the ADT database have been selected for multinomial Logit model specification reasons that require

we assume that financial liberalization index do not change during the last five years of this period for the following reasons: firstly, most countries have not made any changes in terms of financial reforms during the 5 years from 2000 to 2005. Secondly, only 9 countries have been affected by changes in the level of liberalization during this last period, i.e. a rate of 18%, but these countries are not concerned by the subprime crisis for which we are seeking to extend the period of study (except for the Greece). In addition, 19 countries of the sample reached full liberalization levels, so we considered the liberalization indices as constant during that period based on the characteristics of the data presented in this database assuming that the majority of countries have achieved critical values of financial liberalization and kept financial reforms unchanged since 2005. Similarly, for the variable years since reforms, we found that the studied countries experienced 141 regulatory rectifications with an average frequency of 9 years. So, we assumed that the regulations did not evolve during the last five years of our sample period.

International capital flows may affect the volatility of domestic deposits, interest rates and, consequently the financial stability (Hahm et al., 2013). To test the effect of capital account liberalization, we introduce the capital openness variable, measuring the extent of capital controls based on the information extracted from the IMF's Annual Report on Arrangements and Exchange Restrictions (Chinn and Ito, 2008).

Literature suggests that inflation can play an important role in explaining banking crises. Duttagupta and Cashin (2008) suggested that a high level of inflation implies greater macroeconomic instability in the sense that an inflationary environment may attract poor quality of borrowers (Boyd and Champ, 2003). However, other studies conclude that the impact of inflation on crises triggering was not significant (Beck et al., 2003). The level of inflation is important in making expectations and, if it is high or unstable, it becomes difficult to make decisions or predict risks correctly. Inflation is, thus, detrimental to investment and solvency analysis as it falsifies the basis on which bankers rely to make expectations. While inflation is detrimental, it should be noted that a sudden reduction in inflation reduces nominal income and cash flows of financial institutions, which can increase the risk of liquidity and solvency. For this reason, the variable inflation can be a useful leading indicator of a financial crisis (Angkinand and Willett, 2011).

The exchange rate is a key variable in studying banking crises (Goldstein and Turner, 1996; Gavin and Hausmann, 1996; Domac and Martinez Peria, 2003). Duttagupta and Cashin (2011) found that the nominal depreciation of the national currency is a regular determinant of banking crises. Nominal exchange rate depreciation can accompany or follow banking crisis in many cases. This result is mainly explained by the fact that resolution of banking system' difficulties requires the use of the international reserves which can trigger attacks on the national currency. Our interest here is to find the sources of banking crisis and so to treat instability in the exchange market as a source of banking crisis. The overvaluation of the currency leads to a financial crisis (von Hagen and Ho, 2007). It may lead to an excessive exchange risk when the exchange rate depreciates such as the financial burden of domestic borrowers who have borrowed in a foreign currency increases. Thus, to reflect the impact of the exchange rate on the probability of a financial crisis, we introduce the variable changes in the real exchange rate.

Currency crises can lead to banking crises especially in developing countries as banks tend to raise funds with liabilities denominated in foreign currencies. Therefore, devaluation may affect the bank's balance sheet and consequently increase the probability of failures or panic (Mishkin, 1995). In addition to weak fundamentals, economic volatility is also associated with vulnerability to crises as it can change the ratio of banks' assets and lia-

bilities. Volatility can be caused by a large fluctuation of foreign trade (Kaminsky and Reinhart, 1999), or real interest rates variation (Goldstein and Turner, 1996).

The degree of financial market development¹⁵ can also affect the country's vulnerability to banking crises. Size and liquidity of financial markets, ability of individuals and companies to access financial services, efficiency of financial intermediaries and markets in intermediating resources and facilitating financial transactions, as well as the stability of financial institutions affect banking crisis probability (Cihak et al., 2012). A rise in the M2/foreign reserves ratio implies a decline in the foreign currency backing of the short-term domestic currency liabilities of the banking system. This would make it difficult to stabilize the currency if sentiment shifts against it. Therefore, we introduce the ratio of money supply M2 to international reserves to measure vulnerability to sudden capital outflows or to a run on the currency. Furthermore, the real interest rate provides an idea about financial market liquidity, access, efficiency and stability such as a lower real interest rate that can induce excessive credits and lead to financial bubbles. For example, in the US real estate market households are over-indebted at variable rates and when the interest rate increased, they found themselves unable to meet their commitments leading to a generalized problem of trust. For that reason, we consider the variables real interest and credit to the private sector on the banking crisis regression. To account for possible fluctuations that may cause financial instability, we use trade volatility, domestic credit growth, current account and capital flows. These variables are generally included in financial crises models (Angkinand et al., 2010).

Other institutional, macroeconomic and political variables are supposed to affect the vulnerability of the banking sector. Per capita GDP and GDP growth are important to monitor activity and potential economic recessions. In one hand, high levels of these indicators reflect healthy economic situation and can be seen as a good signal for investors and depositors. On the other hand, optimism behavior characterizing the upward part of the economic cycle, hides a significant fragility linked to high risk taking which can be translated into a risk of reversal of feelings (recessions) and panic as well as banking crises when the peak is reached (Angkinand et al., 2010; Demirgüç-Kunt and Detragiache, 2005). We also use political variables that are hypothesized to affect the vulnerability of the financial sector namely Polity2 variable indicating the country's democratic level (Marshall and Jaggers, 2007; Garriga, 2017). In addition, we use the supervisory diffusion variable representing the average banking supervision in the world for a given year. This variable is taken into consideration since it affects the ability of agents in difficulty to find counterparties if they are strictly controlled and supervised (Garriga, 2017). Other institutional factors may affect the likelihood of banking crises such as the strength of creditor rights and the ability of creditors to enforce contracts. For example, Laporta et al. (1998) showed that countries with weak enforcement of property rights are more exposed to a larger risk of crisis. In addition, rule of law and lack of corruption, strictness of capital regulation and supervision are used as proxies for general institutional system and for the quality of the legal and political system. However, most of these measures are not potential determinant of the relationship between financial liberalization and banking crisis (Angkinand et al., 2010), but are

¹⁵ A vast body of the empirical literature estimates financial development with either of the two measures of financial depth: the ratio of private credit to GDP or stock market capitalization to GDP. However, these indicators do not take into account the complex multidimensional nature of financial development. To correct this omission, another financial development index was developed to summarize how developed financial institutions and financial markets are in terms of their depth, access, efficiency, and stability (Cihak; Demirgüç-Kunt; Feyen; and Levine, 2012).

often significant when testing for financial liberalization-economic growth link. So, similarly to previous works in the field (Demirgüç-Kunt and Detragiache, 2005) that confirmed a significant positive effect of deposit insurance scheme in risk taking and banking crisis probably, we choose a dummy variable capturing explicit deposit insurance taking the value 1 when the country adopts explicit guarantees of creditors and 0 otherwise.

Thus, we use a set of variables that concern financial links since complex connections between financial institutions can be a source of systemic risk and may accentuate the fall of the economic cycle (Yellen, 2013). The cross-border stocks of liabilities and assets, which capture the inter-country expositions, can be good potential exposure indicators (Hale et al., 2013; Minoiu et al., 2015). Similarly to these works, we used two variables that measure financial link with the outside using data from the BIS bilateral location statistics.¹⁶ The first variable exposure is a proxy for the degree of the domestic banking industry openness to the outside measured by the sum of assets and liabilities. The second variable is constructed on the basis of the financial exposure variable accounting for the effect of contagion and exchange pressure (Hamdaoui, 2016). These two variables, constructed using data from the Bank of International Settlements (2009, 2011), are included in financial analyses and have recently become important in banking crises models (Garratt et al., 2011; Minoiu and Reytes, 2013; Minoiu et al., 2015).

Other specifications control important factors that could affect the systemic banking crisis probability using the variable crisis diffusion, i.e. the number of banking crises in the world during a given year, to take into account both potential vulnerability of the world over time and contagion effects in interconnected financial markets (Allen et al., 2009; Garriga, 2017). We also control for the variable diffusion supervision representing the average level of banking supervision in the sample during a given year. This variable takes into account the international origin of important prudential regulations and the possibility that stricter banking activity is a result of international standards' evolution and domestic adaptation to the global scale.

The last set of variables includes sensitivity of banking sector to previous crisis and to the other types of crises. In order to control the underlying vulnerability, we have used two variables: Currency crisis, a dichotomous variable coded 1 if the country is experiencing a currency crisis in a given year and 0 otherwise (Laeven and Valencia, 2008) and also a crisis count that measures the number of previous banking crises that the country experienced during the study period.

3.2. Econometric model¹⁷

As indicated previously our purpose in this part is to explain banking system vulnerability and duration, highlighting the importance of reinforcing regulatory strictness, especially in liberalized markets. For this reason, we focus on the number of years since the last regulatory reforms as a proxy for the quality of regulatory and supervisory framework whereas financial liberalization index as our variables of interest. To do this we refer to the qualitative variable econometric as suggested by the literature dealing with banking crises that considers several estimation techniques such as the signals approach, binary response models or binary

classification tree (Duttgupta and Cashin, 2011). In the first approach, analysts compare the behavior of selected indicators before and after banking crises events to identify the variables that better signal the probability of a crisis occurrence (Kaminsky and Reinhart, 1999). In the second approach which consists in using a binary response model (for example Logit model), it is possible to estimate banking crisis probability through a maximum likelihood technique (Demirgüç-Kunt and Detragiache, 2005). The last method is based on a binary classification tree to identify the most important variables explaining increased banking crisis instability (Duttgupta and Cashin, 2008). In this study we perform multinomial logistic regressions (second approach) since we are more interested in capturing the impact of financial liberalization and regulatory delays on the banking sector stability.¹⁸

Most of the previous works dealing with banking crisis are based on binary model excluding observations that follow the onset of the crisis. We show that using multinomial model is more appropriate than binomial models keeping all possible informative observations and increasing powerful of the specification. Table 1 shows the existence of a post-crisis bias for all the fundamentals of our model which explains our choice of a multinomial model.¹⁹ As in the previous works Bussiere and Fratzcher, 2006; Hamdaoui, 2016), the proper comparison should be between column (3), which shows the average of these indicators during the pre-crisis period, and column (4), which corresponds to what we define as "normal or quiet period" by the exclusion of the period during and immediately after the crisis. But, what the traditional binary logit model does, is to estimate the relationship between the pre-crisis periods of column (3) with observations of quiet periods combined with crisis/post-crisis episodes (column (6)). There are at least two ways to approach the post-crisis bias. The first and most common consists in abandoning all crisis/post-crisis observations and then estimates the standard binary Logit model as done by Demirgüç-Kunt and Detragiache (1998a) and Garriga (2017). Absolutely, this method consists in including only the onset year of the crisis which is a standard practice in the literature of banking crises. The disadvantage of this method is that it ignores data that could provide valuable information, particularly the behavior of the fundamentals during the recovery period and when /or if the studied variables return to normal levels. The second and our preferred alternative is a discrete dependent variable approach with more than two regimes, in our case, a multinomial logit model with four occurrences:

$$y_{i,t} = \begin{cases} 1 & \text{during the two years preceding the banking crisis} \\ 2 & \text{during the first year of the crisis} \\ 3 & \text{during the years of development of the crisis} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

The probability P (i,t) that an event will occur at a particular time in a particular country is hypothesized to be a function of a vector of n variables X (i,t) including financial liberalization and regulatory delays variables. In this case, we can define the occurrence probability of the regime "calm" (reference) and other plans (r = 1, 2 and 3), respectively by the following equations:

$$pr(Y_{it} = 0 | X, \beta, \alpha) = \frac{1}{1 + \sum_{r=1}^3 e^{\alpha_r + \sum_{j=1}^J \beta_{rj} X_{j,it}}} \quad (2)$$

¹⁸ Our study is based on the common definition of banking crises which is assumed to coincide with "depositor runs leading to the closure or takeover of one or more banks, or with large scale government intervention to assist, take over, merge, or close one or more financial institutions leading to more intervention elsewhere in the financial system" (Laeven and Valencia, 2008, 2010, 2012).

¹⁹ See Hamdaoui, 2016.

¹⁶ The data provide statistics on the stocks of cross-border assets held by banking systems in 210 countries during the period 1978–2010. This data captures the exposure of banks in a given location (BIS, 2009; 2011).As such; the BIS location statistics are useful for measuring financial connections across countries and territories that report financial data.

¹⁷ For a more detailed literature on crisis prevention models see also Babecky et al. (2014).

Table 1
Mean values of key indicators.

Variables	All period	Pre-crisis period (Y = 1)	Normal period (Y = 0)	Crisis/ post crisisperiod (Y = 2) or (y = 3)	(Y = 0), (Y = 2) or (y = 3)
GDPG	3.215	3.347	3.566	0.561	3.204
CACCT	-0.302	-1.959	-0.070	-0.978	-0.179
DCG	0.175	0.285	0.157	0.242	0.164
CPS	89.23	95.38	86.58	104.8	88.61
TOTCH	0.032	-0.132	0.006	0.320	0.043
KFLOW	4.707	6.790	4.575	4.384	4.553
M2RES	2.018	1.127	2.135	1.710	2.095
INF	3.390	2.733	3.510	2.915	3.453
RER	4.615	4.643	4.612	4.624	4.614
RIR	2.084	2.330	2.045	2.216	2.058
DS	1.287	1.418	1.251	1.462	1.281
DC	13.80	12.53	13.09	19.76	13.93
POL	6.129	6.457	6.096	6.164	6.109
FL	12.35	12.57	12.29	12.65	12.35
FEXP	3.371	6.807	2.351	8.708	3.109
FCONT	-0.265	18.00	1.965	-27.87	-1.537
CRS	1.287	1.295	1.277	1.352	1.290
GCAP	9.052	9.041	9.055	9.036	9.053
CCOUNT	1.158	0.971	1.056	2.023	1.188
YSR	8.633	10.161	8.353	9.735	8.519
KOP	0.660	0.684	0.679	0.509	0.662
DI	0.617	0.695	0.590	0.770	0.614
CUC	0.022	0.019	0.012	0.1	0.022

Notes:GDPG: GDP Growth; CACCT: Current account; DCG: Domestic Credit Growth; CPS: Credit to the Private Sector; TOTCH: terms of trade change; KFLOW: Capital flow; M2RES: M2 to reserves ratio; INF: Inflation; RER: real exchange rate; RIR: real interest rate; DS: Diffusion supervisory (International average level of supervision); DC: Diffusion crisis (world's number of crisis); POL: political regime; FL: financial liberalization; FEXP: Financial exposition; FCONT: Financial connectivity; CRS: capital regulation and supervision; GCAP: per capita GDP; CCOUNT: crisis count (number of previous crisis); YSR: Years since last reforms; KOP: Capital openness; DI: Deposit insurance (explicit); CUC: Currency crisis (dummy variable indicating currency crisis occurrence).

$$pr(Y_{it} = r|X, \beta, \alpha) = \frac{e^{\alpha_r + \sum_{j=1}^3 \beta_{rj} X_{j,it}}}{1 + \sum_{r=1}^3 e^{\alpha_r + \sum_{j=1}^3 \beta_{rj} X_{j,it}}} \tag{3}$$

Where $X_{j,it}$, is the j^{th} indicators for explaining Y_{it} . The coefficients β_3 associated with indicators j of the model are estimated using maximum likelihood.

The logic of the definition of crisis/post-crisis regime is as follows. Once a crisis erupts in any country, it takes time before it returns to normal situation. In fact, this period of time may vary considerably from one country to another. Although the introduction of a regime ($y_{i,t} = 2$ and 3) supports that post-crisis observations can affect the model's ability to predict or to explain the crisis, it also provides interesting insights about the crisis progress and its resolution. For some countries of the sample, the crisis was sudden and violent, while for others, it was longer. Thus, the current model seeks not only to determine whether a set of core fundamentals can predict banking crises, but also if the same indicators can predict its end.

As stated above, the same as for the binomial Logit model, we choose the quiet regime ($y_{i,t} = 0$) as a reference to provide identification for the logit model. This implies that β_r measures the effect of a change in the independent variable $x_{i,t}$ on the probability of being in a regime (r) with respect to the probability of being in the quiet regime. For example, β_1 measures the effect of a change in the independent variable $x_{j,it}$ on the probability of being in a pre-crisis regime relative to the probability of being in the tranquil situation.

$$\frac{pr(Y_{it} = r|X, \beta, \alpha)}{pr(Y_{it} = 0|X, \beta, \alpha)} = e^{\alpha_r + \sum_{j=1}^3 \beta_{rj} X_{j,it}} \tag{4}$$

The main advantage of a multinomial Logit model is that it allows an explicit modeling and it distinguishes between three plans, thus it permits the distinction between different effects. In partic-

ular, β_1 reveals whether an economy is still in a tranquil state, in which fundamentals are sustainable or whether it is in a state of pre-crisis facing a crisis within the next two years. So, our sample must contain a number of non-crisis countries with the same characteristics as those finding themselves in crisis at a later date.²⁰ β_1 reveals whether an economy is still in a tranquil situation or it will be in a crisis regime. β_3 provides information about whether an economy will still be in a recovery state(crisis is ongoing) or will return to a tranquil state.

Before beginning the interpretation of the results, we discuss the implication of our hypotheses and the expected signs. First, according to (H.1) liberalization is expected to be positively correlated with the probability of instability, triggering and duration of crises, so the coefficient associated with the variable financial liberalization is expected to be positive and significant for the three regimes of model (2). For Hypothesis 2, we assume that financial liberalization not accompanied by updated regulations increases the probability of instability, onset and duration of banking crises. Thus, the coefficient associated with the interaction term between financial liberalization and regulatory delays is expected to be positive and significant for all schemes and models from 4 to 8. For hypothesis 3, we argue that the delay in updating the regulations increases the probability of instability, occurrence and duration of the banking crisis. Then, the coefficient associated with the variable years since reforms is expected to be positive and significant for all regimes of model (3). In hypothesis 4, we assume that the destabilizing effect engendered by the decline of effectiveness of a regulatory structure weakens with increased financial liberalization through increased completion and market discipline. So, based on this assumption and contrary to hypothesis (3) the interaction

²⁰ In panel data logit estimation, including fixed effects requires that countries in which there was no crisis during the period under consideration be excluded from the panel (Demirgüç-Kunt and Detragiache, 1998a). This excludes a large amount of information which may induce a sample bias but this problem does not arise in the second part of the analysis since the dependent variable becomes continuous (not dummy).

term is expected to be significant and negative for all models from 4 to 8.

3.3. Results and interpretations²¹

Models 1–4 show the different specifications at the end to clarify the effect of financial liberalization and regulatory variables on the banking sector stability (Table 2).²²

Model 1 includes all the candidate variables considered by the previous banking crisis literature. Capital flows (KFLOW), financial exposure (FEXP) and depository insurance (DI) significantly increase the likelihood of instability ($y_{i,t=1}$) and banking crisis onset ($y_{i,t=2}$). The coefficients associated to these variables are positive and strongly significant (columns 2 and 3). Similarly, financial exposition, deposit insurance and credit to private sector ratio (CPS) significantly extend the necessary time to return to tranquil situation ($y_{i,t=3}$) (column 4). A current account surplus (CACT) significantly reduces the likelihood of banking system instability (coef=-0.090 and p-value=0.000) as well as the triggering of banking crisis (coef=-0.135 and p-value=0.000). An important level of economic growth (GDPG) contributes significantly to decreasing the probability of banking crisis onset (column 2). If the crisis is already ongoing, rapid economic growth, high per capita GDP (GCAP) and high level of financial connectivity (FCONT) accelerate the return to a stable regime (column 4).

Model 2 includes the control variables that capture the degree of financial market liberalization (FL) and capital regulation and supervision (CRS): Financial liberalization is positively and significantly associated with the likelihood of a pre-crisis regime, triggering crisis and period of crisis as suggested by literature (H1.a and H1.b verified). A high level of prudential supervision (strictness of regulation) is significantly associated with a low probability of bank instability and less significantly reduces the probability of a banking crisis and its duration. The opening of the capital account (KOP) reduces the likelihood of vulnerability, occurrence and duration of a banking crisis although it is not significant at the conventional threshold of 10% to explain banking fragility.

Model 3 shows that the number of years since the last regulatory reform (YSR) has no direct effect on the banking crisis probability and its duration unless the indirect effect of liberalization is taken into account but it increases the likelihood of banking instability (H3.a and H3.b not verified). Model 4 shows that the coefficient associated to the interaction term (YSR*FL) is positive and significant meaning that financial liberalization not accompanied by regulatory updates increases the probability of banking vulnerability and duration according to H.2. However, contrary to H.4 the positive (destabilizing) effect of the variable number of years elapsed since the last prudential reform is associated with high levels of financial liberalization and the negative effect with low levels as indicated by the direction of the interaction term (positive and statistically significant at the conventional level for all regimes).

Models 5–8 show different specifications to explore the robustness of the relationship of interest and improve the model specification (Table 2).²³ Through models, the coefficient associated with the variable years since reform is negative and statistically significant at the 10% threshold explaining banking crises occurrence and

duration but contradicting hypothesis 3. All things being equal, the probability of banking crises declines gradually as the time since a banking reform is important supporting the learning hypothesis. However, the substantive impact of time is conditioned by the degree of financial liberalization. The positive and statistically significant coefficient associated with the interaction term (YSR*FL) gives support against hypothesis ((4) and support (H.2). Our results imply that the importance of regulatory updating is more needed in more liberalized (not in repressed) markets and that a high financial liberalization not accompanied by an update of regulatory reforms increases the likelihood of a banking crisis and extends the necessary time to resolve it. This finding implicitly contradicts the results of Garriga (2017) who argued that updating prudential rules is not necessary and can be replaced by market discipline in a more competitive environment. This result can be supported in the absence of deposit insurance schemes (DI) which increase positively and significantly excessive risk taking and contribute to banking crisis occurrence and also extend the necessary time to return to a stable situation (Table 2).

The joint effect of the variables years since reform and financial liberalization is positive and statistically significant at a conventional threshold. When the level of financial liberalization is weak, an additional year since the last reform reduces the likelihood of a banking crisis and its severity in terms of necessary time to return to a tranquil banking system. From certain threshold of financial liberalization, any regulatory reform delays increase the likelihood of a banking crisis and its duration as shown by the positive and significant sign of the interaction term. This result implies, on the one hand, that delays in regulation do not automatically lead to an increased vulnerability to banking crises since incentives on risk taking are not important in a less competitive or a more monopolistic market structure. A tranquil situation gives agents in banking market an opportunity to learn about regulations and make more effective decisions. On the other hand, the negative effect of regulatory delays in terms of increasing vulnerability to banking crises is greater in highly liberalized countries. Contrary to Garriga 2017, we find a U-Shaped relationship between regulatory delays and a banking crisis probability conditioned by the financial liberalization level. This conclusion is also confirmed by Hamdaoui et al. (2016) who argued that the relationship between financial liberalization and the probability of a banking crisis is not linear but depends on the level of the institutional framework. In other words, they find an inverted-U-shaped curve between these two variables and that the likelihood of a crisis declines in highly liberalized countries if regulatory and institutional frameworks are strong and adequate. So, contrary to hypothesis H4, if the regulatory framework is not updated to cope with innovations and newly created financial products (*in more liberalized markets*), the country is more exposed to a banking crisis.

Regarding other variables, the opening of the capital account is negatively associated with banking instability, initiation and duration of a banking crisis. However, corresponding coefficients are statistically significant only when the variable 'previous banking crises' is introduced into the model (model 8). Prudential regulation reduces the likelihood of banks' vulnerability but not significantly. Very few economic and institutional variables reach acceptable levels of statistical significance in these models (Table 2). Capital flows, financial exposure and depository insurance are good predictors of instability and triggering of a banking crisis, suggesting that high levels of these indicators increase the probability of a crisis. Similarly, a current account surplus significantly reduces the likelihood of a banking crisis. An important economic growth rate reduces the probability of occurrence and the duration of a banking crisis. Financial exposure and explicit insurance increase the probability of a banking crisis triggering and slow the return to a calm state. Connectivity or financial interconnection increases

²¹ The first value is the coefficient associated with the explanatory variable and the second value is the corresponding p-value in all the tables.

²² We can see that the probability of banking crisis and its duration have the same determinants in the majority of cases. In particular, financial liberalization and regulatory delays affect similarly banking crisis probability and duration (Table 2).

²³ Comparing measures of adjustment quality, we suggest that models incorporating all variables are characterized by better quality and explanatory power than those without all interest variables. Model 4 is used as a reference model for robustness testing.

Table 2
Banking crisis probability (full sample).

	Model1			Model 2			Model3			Model 4			Model 5			Model 6			Model 7			Model 8		
	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$
CRS				-0.307	-0.347	-0.110	-0.156	-0.219	-0.081	-0.156	-0.215	-0.117	-0.171	-	-0.079	-0.688	-0.637	-0.328	-0.154	-0.191	-0.090	-0.171	-0.237	-0.145
				(0.046)	(0.133)	(0.491)	(0.359)	(0.393)	(0.634)	(0.354)	(0.398)	(0.491)	(0.317)	-(0.149)	(0.049)	(0.003)	(0.066)	(0.121)	(0.361)	(0.455)	(0.597)	(0.309)	(0.349)	(0.426)
FL				.075	.115	.107	.072	.112	.107	-0.023	-0.060	-0.010	-0.192	-1.26	-0.531	-0.788	-0.990	-0.368	-0.214	-0.575	-0.066	-0.032	-0.008	-0.340
				(0.050)	(0.026)	(0.005)	(0.060)	(0.029)	(0.005)	(0.700)	(0.484)	(0.858)	(0.763)	(0.132)	(0.381)	(0.217)	(0.262)	(0.558)	(0.729)	(0.503)	(0.913)	(0.959)	(0.993)	(0.586)
KOP				-0.115	-0.284	-0.370	-0.125	-0.298	-0.372	-0.097	-0.244	-0.336	-0.102	-0.221	-0.319	-0.035	-0.207	-0.316	-0.096	-0.232	-0.318	-0.153	-0.428	-0.220
				(0.292)	(0.073)	(0.001)	(0.255)	(0.062)	(0.001)	(0.385)	(0.132)	(0.004)	(0.364)	(0.176)	(0.007)	(0.759)	(0.211)	(0.007)	(0.385)	(0.155)	(0.007)	(0.184)	(0.014)	(0.074)
YSR							.042	.034	.009	-0.070	-0.171	-0.138	-0.068	-0.166	-0.130	-0.078	-0.172	-0.140	-0.068	-0.169	-0.129	-0.071	-0.179	-0.113
							(0.044)	(0.250)	(0.639)	(0.261)	(0.064)	(0.033)	(0.288)	(0.040)	(0.029)	(0.197)	(0.057)	(0.029)	(0.272)	(0.070)	(0.049)	(0.252)	(0.055)	(0.094)
YSR*FL										.008	.015	.011	.087	.149	.102	.075	.144	.105	.085	.155	.106	.087	.167	.097
										(0.052)	(0.017)	(0.015)	(0.057)	(0.011)	(0.016)	(0.085)	(0.025)	(0.020)	(0.054)	(0.018)	(0.020)	(0.050)	(0.012)	(0.039)
GDPG	-0.015	-0.148	-0.202	-0.026	-0.163	-0.219	-0.022	-0.160	-0.218	-0.020	-0.153	-0.214	-0.026	-0.122	-0.182	-0.010	-0.142	-0.206	-0.021	-0.146	-0.202	-0.020	-0.163	-0.201
	(0.620)	(0.000)	(0.000)	(0.409)	(0.000)	(0.000)	(0.486)	(0.000)	(0.000)	(0.518)	(0.000)	(0.000)	(0.424)	(0.003)	(0.000)	(0.735)	(0.001)	(0.000)	(0.513)	(0.001)	(0.000)	(0.534)	(0.000)	(0.000)
CACCT	-0.090	-0.135	-0.017	-0.095	-0.146	-0.031	-0.095	-0.144	-0.030	-0.092	-0.135	-0.028	-0.090	-0.146	-0.024	-0.113	-0.150	-0.035	-0.092	-0.133	-0.029	-0.090	-0.146	-0.030
	(0.000)	(0.000)	(0.469)	(0.000)	(0.000)	(0.217)	(0.000)	(0.000)	(0.222)	(0.000)	(0.000)	(0.263)	(0.000)	(0.000)	(0.353)	(0.000)	(0.000)	(0.159)	(0.000)	(0.000)	(0.249)	(0.000)	(0.000)	(0.238)
DCG	.542	-0.622	-0.048	.493	-0.677	-0.127	.357	-0.780	-0.159	.430	-0.726	-0.003	.445	-0.782	-0.069	.280	-0.851	-0.119	.423	-0.778	.484	-0.017	.484	-0.522
	(0.133)	(0.358)	(0.908)	(0.174)	(0.338)	(0.769)	(0.333)	(0.268)	(0.716)	(0.249)	(0.327)	(0.994)	(0.234)	(0.277)	(0.879)	(0.457)	(0.249)	(0.793)	(0.255)	(0.309)	(0.970)	(0.195)	(0.506)	(0.582)
CPS	.022	.064	.081	.029	.070	.081	.023	.066	.081	.019	.057	.078	.019	.045	.073	.019	.060	.077	.019	.056	.075	.015	.040	.089
	(0.442)	(0.106)	(0.002)	(0.301)	(0.078)	(0.002)	(0.422)	(0.106)	(0.002)	(0.512)	(0.170)	(0.003)	(0.509)	(0.290)	(0.007)	(0.492)	(0.142)	(0.003)	(0.513)	(0.182)	(0.005)	(0.607)	(0.360)	(0.001)
TOTCH	-0.696	1.41	.543	-0.629	1.25	.340	-0.527	1.25	.353	-0.530	1.24	.395	-0.621	1.69	.826	-0.294	1.39	.496	-0.626	.820	-0.302	-0.554	1.59	.528
	(0.509)	(0.308)	(0.582)	(0.550)	(0.356)	(0.728)	(0.615)	(0.353)	(0.719)	(0.611)	(0.354)	(0.688)	(0.556)	(0.203)	(0.398)	(0.779)	(0.297)	(0.614)	(0.548)	(0.543)	(0.765)	(0.598)	(0.251)	(0.597)
KFLOW	.039	.043	-0.022	.043	.049	-0.023	.040	.047	-0.024	.040	.047	-0.022	.040	.052	-0.016	.040	.047	-0.024	.040	.046	-0.023	.040	.053	-0.014
	(0.000)	(0.002)	(0.265)	(0.000)	(0.001)	(0.282)	(0.000)	(0.001)	(0.276)	(0.000)	(0.001)	(0.301)	(0.001)	(0.001)	(0.439)	(0.000)	(0.001)	(0.263)	(0.000)	(0.001)	(0.270)	(0.000)	(0.000)	(0.472)
M2RES	-0.230	-0.005	.334	-0.243	-0.101	.134	-0.314	-0.015	.127	-0.336	-0.197	.094	-0.033	-0.022	.012	-0.058	-0.037	-0.001	-0.033	-0.020	.008	-0.027	-0.007	-0.004
	(0.407)	(0.989)	(0.164)	(0.386)	(0.785)	(0.582)	(0.271)	(0.681)	(0.603)	(0.240)	(0.603)	(0.700)	(0.248)	(0.559)	(0.610)	(0.053)	(0.353)	(0.996)	(0.236)	(0.588)	(0.740)	(0.334)	(0.861)	(0.858)
INF	-0.028	-0.022	-0.061	-0.047	-0.049	-0.087	-0.044	-0.046	-0.086	-0.033	-0.032	-0.076	-0.034	-0.052	-0.100	-0.029	-0.029	-0.073	-0.035	-0.037	-0.082	-0.032	-0.025	-0.080
	(0.482)	(0.713)	(0.190)	(0.282)	(0.431)	(0.065)	(0.312)	(0.457)	(0.068)	(0.451)	(0.610)	(0.106)	(0.441)	(0.396)	(0.036)	(0.500)	(0.634)	(0.116)	(0.430)	(0.559)	(0.085)	(0.470)	(0.695)	(0.090)
RER	.494	.781	.342	.547	.900	.385	.581	.904	.383	.475	.751	.283	.445	1.00	.347	.562	.793	.310	.484	.774	.312	.508	.859	.121
	(0.233)	(0.171)	(0.406)	(0.211)	(0.139)	(0.386)	(0.187)	(0.138)	(0.389)	(0.283)	(0.224)	(0.530)	(0.313)	(0.107)	(0.445)	(0.198)	(0.194)	(0.490)	(0.274)	(0.212)	(0.494)	(0.265)	(0.217)	(0.783)
RIR	.173	.387	.122	.133	.286	.031	.172	.322	.041	.208	.380	.047	.185	.373	.014	.252	.420	.097	.202	.358	.012	.223	.362	.162
	(0.228)	(0.070)	(0.363)	(0.366)	(0.195)	(0.821)	(0.248)	(0.149)	(0.768)	(0.167)	(0.089)	(0.738)	(0.227)	(0.095)	(0.919)	(0.087)	(0.056)	(0.501)	(0.179)	(0.109)	(0.928)	(0.149)	(0.124)	(0.258)
POL	-0.021	-0.043	-0.020	-0.025	-0.048	-0.031	-0.029	-0.051	-0.032	-0.029	-0.052	-0.032	-0.027	-0.072	-0.050	-0.035	-0.059	-0.035	-0.030	-0.053	-0.033	-0.033	-0.059	-0.033
	(0.437)	(0.232)	(0.456)	(0.354)	(0.188)	(0.262)	(0.285)	(0.158)	(0.257)	(0.283)	(0.156)	(0.250)	(0.313)	(0.059)	(0.085)	(0.204)	(0.110)	(0.212)	(0.267)	(0.152)	(0.243)	(0.232)	(0.117)	(0.255)
FEXP	.051	.056	.045	.061	.066	.053	.055	.062	.051	.058	.065	.053	.055	.074	.059	.061	.067	.055	.058	.064	.052	.061	.071	.053
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FCONT	.061	.231	-0.288	.064	.240	-0.264	.066	.239	-0.002	.071	.260	-0.286	.007	.027	-0.027	.007	.025	-0.002	.007	.028	-0.026	.007	.026	-0.023
	(0.624)	(0.098)	(0.050)	(0.616)	(0.098)	(0.070)	(0.611)	(0.102)	(0.075)	(0.591)	(0.087)	(0.058)	(0.597)	(0.069)	(0.079)	(0.573)	(0.082)	(0.066)	(0.565)	(0.071)	(0.068)	(0.583)	(0.097)	(0.107)
GCAP	-0.137	-0.293	-0.360	-0.153	-0.272	-0.321	-0.133	-0.260	-0.321	-0.153	-0.287	-0.330	-0.170	-0.080	-0.234	.076	-0.100	-0.204	-0.156	-0.295	-0.327	-0.191	-0.449	-0.102
	(0.284)	(0.121)	(0.003)	(0.296)	(0.202)	(0.024)	(0.370)	(0.225)	(0.024)	(0.297)	(0.171)	(0.019)	(0.249)	(0.721)	(0.114)	(0.638)	(0.667)	(0.204)	(0.290)	(0.160)	(0.023)	(0.197)	(0.035)	(0.519)
DI	.763	.984	1.64	.764	.916	1.53	.733	.893	1.53	.753	.914	1.56	.755	.942	1.64	.658	.851	1.50	.756	.909	1.51	.946	1.498	.799
	(0.007)	(0.014)	(0.000)	(0.008)	(0.025)	(0.000)	(0.011)	(0.029)	(0.000)	(0.009)	(0.025)	(0.000)	(0.009)	(0.025)	(0.000)	(0.025)	(0.039)	(0.000)	(0.009)	(0.027)	(0.000)	(0.000)	(0.000)	(0.029)
DC																-0.064	.961	.758						
																(0.591)	(0.000)	(0.000)						
DS																1.04	.812	.466						
																(0.001)	(0.074)	(0.107)						
CUC																			.340	1.33	1.57			
																			(0.673)	(0.062)	(0.003)			
CCOUNT																						-0.155	-0.594	.386
																						(0.082)	(0.001)	(0.000)
Pseudo R ²			0.149			0.161			0.164			0.170			0.200			0.178			0.175			0.203

Notes: Numbers in parenthesis are p-value; $y_{i,t=1}$: Pre-crisis period (two years before crisis occurrence) ; $y_{i,t=2}$: crisis onset ; $y_{i,t=3}$: crisis duration ; CRS : Capital regulation and supervision ; FL : Financial liberalization ; KOP : capital openness; YSR : Years since last reform; YSR*FL: interaction term between the number of years since the last reform and the level of financial liberalization; GDPG: GDP growth; CACCT: Current account balance; DCG: Domestic credit growth; CPS : credit to the private sector; TOTCH : terms of trade change; KFLOW: capital flow; M2RES: M2 to reserves ratio; INF: Inflation; RER: real exchange rate; RIR: Real interest rate; POL: Political regime; FEXP: Financial expositio; FCONT: Financial connectivity; GCAP: per capita GDP; DI: Deposit Insurance; DC: Diffusion crisis (Number of crisis at the international scale); DS: Diffusion Supervision (level of supervision at the international level); CUC: Currency crisis; CCOUNT: Number of previous banking crises.

the probability of a banking crisis, but once triggered, it facilitates the resolution or the passage from this situation to a more stable and sustainable one. A high level of domestic credit contributes significantly to extend the duration of the crisis.

As for the rest of variables, model (5) shows that, despite the fact that the variable diffusion crisis (DC) has no significant effect on the probability of banking instability; it significantly increases the likelihood of onset and duration of a banking crisis. Conversely, the number of banking crises around the world in a given year affects the probability of a country to be influenced by the systemic banking contagion effect. Therefore, the coefficient associated with the variable diffusion supervision (DS) (Model 6) is positive and statistically significant in relation to the likelihood of instability and banking crises indicating that stricter regulation in the rest of the world increases the probability of a certain country to be in crisis. This conclusion is explained by the fact that if a country is in a situation of funding needs, it cannot easily find its counterpart if the other party is strictly controlled. It is possible, however, that a more sophisticated diffusion measure can better capture the effect of contemporary banking crises in other countries. The presence of a currency crisis is also associated with a greater likelihood of a banking crisis (Model 7) because of the possible same origins whereas this effect is no longer significant in explaining the onset of the banking crisis but it extends too significantly the period of its occurrence. In other words, a currency crisis' occurrence affects negatively the banking crisis' resolution strategy because of the decline in foreign exchange reserves held by monetary authorities that are exhausted by intervention policies.

Model (8) includes the number of past banking crises (COUNT) (during the sample period). The introduction of this variable increases the explanatory power of the model (measured by pseudo R²).²⁴ The coefficient of this variable is negative and statistically significant suggesting that a country that has experienced more banking crises in the past becomes less exposed to. However, past crises may advocate a more vulnerable banking system and extend the period of crisis resolution.²⁵

4. Financial liberalization, regulatory delays and banking sector vulnerability

In order to confirm the U-shaped relationship previously found, we need to show that the number of years since last reforms decreases the probability of a banking crisis (Instability) when financial liberalization is low and increases vulnerability as well as banking crisis if financial liberalization is high (contrary to H.4). Similarly, we show that financial liberalization decreases banking crisis if the regulatory framework is updated but it increases a banking crisis' probability when regulatory lags become larger (as suggested by H.2). Our methodology consists in computing the probability of a banking crisis (Instability) based on the results found previously using the estimated coefficients of model (8) by a Logit model. The probability index (prob_{i,t}^{crisis} or prob_{i,t}^{instability}), which is a variable measuring the probability that a country i experiences a banking crisis (banking sector instability) in period t, is assumed to depend linearly on a set of control variables Z_{i,t}, on the financial liberalization measure FL_{i,t}, on the number of years

since last reforms and on a random component η_{i,t}.

$$\Pr(Y = r \setminus Z_1, Z_2, \dots, Z_k, FL, YSR) = \frac{e^{\beta_{0r} + \beta_{1r}Z_1 + \beta_{2r}Z_2 + \dots + \beta_{kr}Z_k + \alpha_r FL + \gamma_r YSR}}{1 + \left(\frac{1}{e^{(\beta_{02} + \beta_{12}Z_1 + \beta_{22}Z_2 + \dots + \beta_{k2}Z_k + \alpha_2 FL + \gamma_2 YSR)}} \right)} \quad (5)$$

Where r=1 corresponds to the instability and r=2 implies banking crisis onset. prob_{i,t} = β̂Z_{i,t} + α̂FL_{i,t} + γ̂YSR_{i,t} + η_{i,t}, where β̂, α̂ and γ̂ are estimated coefficients. For example, Prob (crisis) variable is constructed as follows:

$$\text{Prob(crisis)} = \Pr(Y = 2 \setminus Z_1, Z_2, \dots, Z_k, FL, YSR) = \frac{1}{1 + \left(\frac{1}{e^{(\beta_{02} + \beta_{12}Z_1 + \beta_{22}Z_2 + \dots + \beta_{k2}Z_k + \alpha_2 FL + \gamma_2 YSR)}} \right)} \quad (6)$$

After computing banking crisis probability (instability)²⁶ we used a standard panel data model to regress this variable on the explanatory variables of model (8). Our purpose is mainly to confirm nonlinear relationship between variables of interest. In addition, we tried to construct an empirical platform that permits computing change in Y in intermediate value for a change in a covariate x not a change in Y from 0 to 1 for a change in X which was previously done. The last analysis may be directly done through the calculation of marginal effects as shown in Table 3. Since the coefficients from multinomial logit can be difficult to interpret because they are relative to the base outcome, another way to evaluate the effect of covariates is to examine the marginal effect of changing their values on the probability of observing an outcome. For example, financial liberalization decreases the average probability of knowing financial instability by 0.012 in developed countries but not significantly.²⁷

4.1. Panel model specification

$$\begin{aligned} \text{Prob(instability, crisis)}_{i,t} = & \beta_0 + \beta_1 * \text{GDPG}_{i,t} + \beta_2 * \text{GCAP}_{i,t} + \beta_3 * \text{CACCT}_{i,t} + \beta_4 * \text{DCG}_{i,t} \\ & + \beta_5 * \text{CPS}_{i,t} + \beta_6 * \text{TOTCH}_{i,t} + \beta_7 * \text{INF}_{i,t} + \beta_8 * \text{M2RES}_{i,t} \\ & + \beta_9 * \text{RER}_{i,t} + \beta_{10} * \text{RIR}_{i,t} + \beta_{11} * \text{KFLOW}_{i,t} + \beta_{12} * \text{FEXP}_{i,t} \\ & + \beta_{13} * \text{FCONT}_{i,t} + \beta_{14} * \text{POL}_{i,t} + \beta_{15} * \text{DI}_{i,t} + \beta_{16} * \text{KOP}_{i,t} + \beta_{17} * \text{FL}_{i,t} \\ & + \beta_{18} * \text{CRS}_{i,t} + \beta_{19} * \text{YSR}_{i,t} + \beta_{20} * \text{YSRFL}_{i,t} + \beta_{21} * \text{CCOUNT}_{i,t} \end{aligned}$$

As indicated previously, the expected sign of β₁₇ (H.1) is ambiguous. If β₁₇ < 0, the view that financial liberalization provides more discipline in the banking system holds. Alternatively, β₁₇ > 0 implies a support for the conventional view, in that case financial liberalization is associated with increased banking turmoil. The expected sign of β₁₉, which represents the direct effect of number of years since last reforms on the banking sector stability is also ambiguous (H.3). The expected sign of the coefficient of the interaction term β₂₀(H2 and H4) is also uncertain for the reasons discussed previously, and it is ultimately an empirical question. If β₂₀ has the same sign as β₁₇, then the direct effect of financial liberalization will be reinforced at higher levels of YSR. On the other hand, if β₂₀ and β₁₇ have opposite signs, higher levels of YSR will weaken the direct effect of FL.²⁸

²⁴ Since the model 8 is preferred in terms of explanatory power it is used to analyze the U-shaped relationship.

²⁵ Our results show that the probability of banking system vulnerability depends on the nature of the studied countries. The variable "c.type" which reflects the country's type (developed or developing) is positively and statistically significant in explaining banking system instability and banking crisis onset. This result means that emerging countries are more exposed to banking system vulnerability but there are no differences between countries in terms of crisis resolution or period of occurrence, perhaps because of increased international connections. Results are not presented for paper length purpose.

²⁶ Note that banking crisis or instability variables are not taken as a dummy variable contrarily to the specification for logit model.

²⁷ We privileged the analysis of the continuous measurement of the situation of the banking sector which takes into account the intermediate situations instead of the discrete measure describing only the passage from the calm situation (0) to the final situation (1) which can be far from reality and does not allow studying the effect of a covariate change on the variation of the probability (different from zero) at a given time.

²⁸ The same analysis holds for the effect of YSR on the banking system stability conditional on the level of financial liberalization.

Table 3
Marginal effects after M-logit regression (Model 8).

	Full sample			Developped countries			Developping countries		
	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$	$y_{i,t=1}$	$y_{i,t=2}$	$y_{i,t=3}$
CRS	-0.00842(0.403)	-0.00549(0.447)	-0.00639(0.528)	-0.01219(0.403)	-0.00380(0.729)	.04159(0.003)	-0.02415(0.194)	-0.01175(0.412)	-0.08494(0.000)
FL	-9.36e-06(0.998)	.00010(0.967)	-0.00188(0.588)	-0.01279(0.188)	-0.00446(0.583)	-0.00121(0.881)	-0.00312(0.581)	-0.00327(0.408)	-0.00222(0.655)
KOP	-0.00598(0.384)	-0.01081(0.032)	-0.01008(0.141)	.01244(0.463)	.00304(0.792)	-0.02496(0.048)	-0.00338(0.713)	-0.01082(0.121)	-0.00011(0.990)
YSR	-0.00283(0.446)	-0.00442(0.102)	-0.00535(0.154)	-0.03087(0.046)	-0.00241(0.848)	-0.00334(0.795)	-0.00588(0.224)	-0.00757(0.033)	-0.01113(0.019)
YSRFL	.00039(0.138)	.00040(0.036)	.00044(0.091)	.00202(0.030)	.00012(0.864)	.00024(0.747)	.00053(0.176)	.00070(0.022)	.00052(0.168)
GDPG	.00064(0.727)	-0.00391(0.002)	-0.01060(0.000)	.01419(0.001)	-0.00660(0.018)	-0.01714(0.000)	-0.00034(0.873)	-0.00256(0.090)	-0.00571(0.004)
CACCT	-0.00457(0.002)	-0.00365(0.001)	-0.00072(0.608)	-0.00152(0.538)	-0.00312(0.088)	-0.00177(0.413)	-0.00773(0.001)	-0.00587(0.002)	.00108(0.573)
DCG	.03296(0.135)	-0.01640(0.461)	-0.01512(0.553)	.05436(0.491)	-0.08144(0.320)	-0.12697(0.084)	.02586(0.354)	-0.02357(0.423)	-0.05065(0.126)
CPS	.00002(0.890)	.00007(0.528)	.00048(0.001)	-0.00003(0.879)	-0.00003(0.848)	-0.00012(0.424)	-0.00031(0.340)	-0.00012(0.592)	.00125(0.000)
TOTCH	-0.04375(0.482)	.04662(0.235)	.02722(0.620)	.24140(0.262)	.18273(0.235)	.18102(0.241)	.01760(0.796)	.07999(0.062)	.03124(0.590)
KFLOW	.00224(0.001)	.00140(0.000)	-0.00123(0.285)	.00219(0.016)	.00060(0.353)	-0.00083(0.521)	.00145(0.221)	.00152(0.024)	-0.00567(0.009)
M2RES	-0.00160(0.348)	-0.00005(0.960)	-0.00008(0.955)	.00080(0.800)	.00027(0.914)	.00381(0.278)	-0.00335(0.160)	.00022(0.884)	.00084(0.638)
INF	-0.00140(0.592)	-0.00029(0.866)	-0.00424(0.100)	.1005(0.209)	.10058(0.144)	-0.04511(0.095)	.00307(0.381)	.00192(0.401)	.00521(0.158)
RER	.02586(0.341)	.02180(0.270)	.00116(0.962)	.53410(0.000)	.14634(0.116)	.15111(0.072)	.01168(0.683)	.01040(0.639)	-0.02562(0.369)
RIR	.01082(0.237)	.00877(0.189)	.00665(0.399)	.01760(0.254)	.01196(0.241)	-0.01509(0.072)	.00801(0.567)	.01460(0.179)	.05641(0.000)
POL	-0.00153(0.352)	-0.00143(0.183)	-0.00151(0.357)	.00390(0.835)	-0.00320(0.762)	-0.00324(0.808)	.00102(0.609)	-0.00081(0.532)	-0.00237(0.201)
FEXP	.00308(0.000)	.00157(0.000)	.00242(0.001)	.00131(0.029)	.00085(0.021)	.00119(0.054)	.00418(0.691)	.00388(0.630)	-0.00413(0.853)
FCONT	.00004(0.544)	.00008(0.049)	-0.00014(0.062)	-0.00022(0.044)	-0.00001(0.853)	-0.00024(0.020)	.00048(0.120)	.00026(0.060)	-0.00023(0.136)
GCAP	-0.00879(0.321)	-0.01163(0.060)	-0.00320(0.716)	.04849(0.401)	.07436(0.089)	-0.00565(0.887)	.01361(0.320)	.00241(0.798)	.00565(0.677)
DI	.04546(0.013)	.03576(0.004)	.03462(0.088)	.11403(0.014)	.00384(0.890)	-0.01345(0.612)	.03595(0.194)	.04063(0.019)	.07784(0.002)
CCOUNT	-0.008620.097	-0.01757(0.000)	.02445(0.000)	-0.01648(0.058)	-0.01123(0.213)	.03916(0.000)	-0.01252(0.092)	-0.02464(0.001)	.01963(0.000)
N° obs			1519			682			837

Notes: Numbers in parenthesis are p-value; CRS: capital regulation and supervision; FL: Financial Liberalization; KOP: Capital openness; YSR: Years since last reforms; YSRFL: Interaction term between financial liberalization and regulatory delays variables; GDPG: GDP growth; CACCT: current account; DCG: domestic credit growth; CPS: credit to the private sector; TOTCH: terms of trade change; KFLOW: capital flow; M2RES: M2 to reserve ratio; INF: Inflation; RER: real exchange rate; RIR: real interest rate; POL: political regime; FEXP: financial exposition; FCONT: financial connectivity; GCAP: per capita GDP; DI: Deposit insurance; CCOUNT: crisis count (number of previous crisis).

In the previous section, we found a U-Shaped relationship between the probability of a banking crisis and delays in regulation depending on the level of financial liberalization (*The opposite of H.4*). That is to say, when financial liberalization is weak, regulatory delays may be desirable for the banking system since they reduce banking crisis likelihood. Whereas, if the level of financial reforms increases and exceeds a certain degree, the probability of banking system dysfunction becomes higher. Consequently, delays in updating the regulations imply a high risk facing banks and their counterparts at the same time. Similarly, the relationship between financial liberalization and a banking crisis' occurrence probability can be considered very important if the number of years since the last reform becomes larger (*H.2*). In this case, a U-shaped curve is confirmed between these two variables depending on the frequency of updating regulations. Throughout the present study, we try to determine the threshold value of these two variables. In order to calculate the turning points corresponding to these variables, the coefficients β_{17} , β_{19} and the coefficient β_{20} associated with the interaction term²⁹ must have opposite signs.

The turning point corresponding to financial liberalization can be found as follows:

$$\frac{dprob(crisis)}{dYSR} = 0 \Rightarrow \beta_{19} + \beta_{20} * fl = 0 \Rightarrow fl = -\frac{\beta_{19}}{\beta_{20}}$$

Similarly, the turning point corresponding to regulatory lags can be found as follows:

$$\frac{dprob(crisis)}{dfl} = 0 \Rightarrow \beta_{17} + \beta_{20} * YSR = 0 \Rightarrow YSR = -\frac{\beta_{17}}{\beta_{20}}$$

4.2. Data preliminary analysis

Before going to econometric estimation and results discussions, we present the stylized facts and a statistical description of our data based on our variables of interest such as the regulatory framework and the financial liberalization level. Table 4 illustrates the number and frequency of banking sector turmoil according to the number of years elapsed since the last regulatory reforms. Results confirm the previous findings such as that the relationship between regulation updating and banking vulnerability is not direct but conditioned by the level of financial liberalization. Although situations of fragility are less frequent in the first year following regulatory reforms (5.56) but become more numerous to form 12.73% of cases in the 15th year and that the frequency of crises increases from 2.22% to 5.45% on the average over the same period, the relationship is not clear enough Table 4A. Because the observations are not equitably distributed according to the number of years since the last reforms, we think of frequency. Results show a growing trend between the variable YSR and the frequency of bank vulnerability, whereas this relationship depends on the level of financial liberalization as suggested previously. For this reason, we present in Table 4B the statistics concerning crises distribution of our sample when financial liberalization is partial (does not exceed 6) and for the cases where financial liberalization is more important ($FL > 6$). Our results show that when financial liberalization is low and it happens in the first year following regulatory reforms, instability of the banking sector occurs in 25% of cases but disappears in the second; third, fourth, fifth and sixth years and decreases gradually until the 15th. If the number of years becomes too high, the probability of crisis increases again with the delay in updating regulation even if the level of liberalization is so weak to disappear at the end. Similarly, banking crisis onsets become less

frequent as time elapses since the last regulatory reform.³⁰ These results are reversed when financial liberalization level is higher implying an increase of banking sector instability from 4.65% in the first year after regulatory reforms to 13.6% in the 15th year and 50% in the 23th year.

Thus, if we persuade in terms of estimated probabilities of instability and banking crises, we note on the basis of Table 4A, that the relationship between regulatory delays and bank vulnerability is not clear enough. When the level of financial liberalization is low, the delay in updating regulations seems to have a stabilizing effect on the banking system. Moreover, even if the probability of instability increases during the first 3 years following financial reform it tends to go down from 7.74% in the first year to 1.88% in the 5th year. Likewise, the probability of a banking crisis drops dramatically from 3.12% in the first year of reform to less than 1% for the majority of subsequent periods.

Similarly, we present in Table 5 the average values of banking sector instability and crises' probabilities during the sample period and the corresponding number of years since the last reforms in addition to the level of financial liberalization. Table 5 and Fig. 1 give an idea about the average evolution of a banking system in our full sample.

We can notice that when the number of years since the last reform is low and does not exceed 10 in average (1980–1984), financial liberalization reduces the probability of instability and banking crisis (but from 1985, when the delay becomes important, additional financial reform is accompanied by a slight increase in the probability of instability and banking crises). This phase of stability lasted until the years 2002 with a tendency towards an increase in number of years since the last reforms accompanied, by an increase in the probabilities of instability and crisis, clearly felt during the years 2007 and 2008 (peak of the subprime crisis). Similarly, when liberalization is low, the number of years since the last reform can lower the probability of instability and banking crises (as in the first part of the chart). Yet, when the level of liberalization is high, delayed updating of regulations may be a destabilizing factor of the banking system (last part of the chart).

4.3. Results discussions³¹

Before going to regression, we compute a correlation matrix which allows a two-by-two analysis of the correlations between the explanatory variables. We found that there are no problems of multi-collinearity since the coefficients are globally weak except for the link between capital regulation and supervision and financial liberalization (0.705 for the full sample)³² However, for all samples, the values of "Variance Inflation Factors" (VIF) are lower than 10, which indicate that the problem of multi-collinearity is not disturbing and that we can preserve all variables in our regressions. Otherwise, the analysis is not "distorted" unacceptably by the existing level of multi-collinearity.

4.3.1. Full sample

- Instability

Table 6 illustrates the results of panel regressions where the dependent variable is the probability of banking instability, taking into account problems of heteroscedasticity and autocorrelation which

³⁰ Note that regulatory delay has no effect on the vulnerability of the banking sector beyond 24 years, regardless of the level of liberalization, but in the case of weakly liberalized economies it loses its validity from the 20th year.

³¹ Before beginning our analysis, we note that our data are of annual frequency and the results must be interpreted with caution.

³² The results are not presented for paper length and when considering developing and developed countries' samples, results are similar and there is no problem of collinearity.

²⁹ This condition is necessary to have a U-Shaped or inverted U-Shaped relationship which we like to defend.

Table 4

Regulatory framework and banking sector stability.

4.A. Effect of regulatory updating on banking sector fragility									4.B. Effect of regulatory delays on banking sector fragility conditional on financial liberalization level										
Banking sector situations									Banking sector situations										
YSR Calm (Y=0)	Instable(Y=1)	Crisis onset(Y=2)	Crisisongoing(Y=3)	Total	Prinst (%)	Prcrisis (%)	Y=0	Y=1	Y=2	Y=3	Prinst (%)	Prcrisis (%)	FL<6	Y=0	Y=1	Y=2	Y=3	Prinst (%)	Prcrisis (%)
0	75(82.42)	4(4.40)	3(3.30)	9(9.89)	91(5.99)	4.93	2.70	3(75.00)	1(25.00)	0	0	7.74	3.12	72(82.76)	3(3.45)	3(3.45)	9(10.34)	4.80	2.68
1	72(80.00)	5(5.56)	2(2.22)	11(12.22)	90(5.92)	4.86	2.35	2(50.00)	1(25.00)	1(25.00)	0	9.75	4.19	70(81.40)	4(4.65)	1(1.16)	11(12.79)	4.63	2.27
2	68(80.95)	6(7.14)	2(2.38)	8(9.52)	84(5.53)	5.09	2.29	3(100.)	0	0	0	10.56	3.97	66(80.49)	6(7.32)	2(2.44)	8(9.76)	4.93	2.26
3	67(82.72)	6(7.41)	2(2.47)	6(7.41)	81(5.33)	5.08	2.25	2(100.)	0	0	0	10.37	3.23	65(82.28)	6(7.59)	2(2.53)	6(7.59)	4.95	2.23
4	63(81.82)	5(6.49)	4(5.19)	5(6.49)	77(5.07)	4.98	2.64	2(100.)	0	0	0	4.50	1.05	61(81.33)	5(6.67)	4(5.33)	5(6.67)	5.00	2.68
5	64(87.67)	3(4.11)	1(1.37)	5(6.85)	73(4.81)	4.87	1.81	1(100.)	0	0	0	1.88	0.42	63(87.50)	3(4.17)	1(1.39)	5(6.94)	4.91	1.83
6	62(88.57)	2(2.86)	3(4.29)	3(4.29)	70(4.61)	5.48	1.90	0	0	0	0	0	0	63(88.57)	2(2.86)	3(4.29)	3(4.29)	5.48	1.90
7	98(87.50)	8(7.14)	3(2.68)	3(2.68)	112(7.37)	7.07	3.02	21(84.00)	2(8.00)	2(8.00)	0	8.25	4.94	79(88.76)	6(6.74)	1(1.12)	3(3.37)	6.70	2.46
8	85(81.73)	10(9.62)	3(2.88)	6(5.77)	104(6.85)	7.07	3.99	18(75.00)	5(20.83)	0	1(4.17)	7.46	6.35	69(84.15)	5(6.10)	3(3.66)	5(6.10)	6.90	3.28
9	80(84.21)	6(6.32)	4(4.21)	5(5.26)	95(6.25)	6.95	4.49	17(68.00)	3(12.00)	2(8.00)	3(12.00)	7.99	5.86	64(90.14)	3(4.23)	2(2.82)	2(2.82)	6.53	3.95
10	79(86.81)	1(1.10)	4(4.40)	7(7.69)	91(5.99)	6.73	4.10	18(75.00)	0	3(12.50)	3(12.50)	6.41	4.87	61(91.04)	1(1.49)	1(1.49)	4(5.97)	6.85	3.82
11	75(89.29)	1(1.19)	1(1.19)	7(8.33)	84(5.53)	6.54	3.00	19(86.36)	0	0	3(13.64)	6.56	2.13	57(90.48)	1(1.59)	1(1.59)	4(6.35)	6.52	3.29
12	71(88.75)	4(5.00)		5(6.25)	80(5.27)	6.90	2.37	20(95.24)	0	0	1(4.76)	7.33	1.90	51(86.44)	4(6.78)	0	4(6.78)	6.75	2.54
13	62(88.57)	5(7.14)		3(4.29)	70(4.61)	7.34	2.65	19(100.)	0	0	0	6.21	2.26	43(84.31)	5(9.80)	0	3(5.88)	7.76	2.79
14	52(85.25)	7(11.48)	2(3.28)		61(4.02)	8.23	3.51	18(94.74)	1(5.26)	0	0	5.90	1.91	34(80.95)	6(14.29)	2(4.76)	0	9.29	4.24
15	43(78.18)	7(12.73)	3(5.45)	2(3.64)	55(3.62)	8.98	4.85	15(88.24)	2(11.76)	0	0	7.81	1.49	28(73.68)	5(13.16)	3(7.89)	2(5.26)	9.49	6.35
16	32(66.67)	7(14.58)	4(8.33)	5(10.42)	48(3.16)	10.21	6.42	10(66.67)	4(26.67)	1(6.67)	0	9.46	4.41	22(64.71)	4(11.76)	3(8.82)	5(14.71)	11.88	8.05
17	29(65.91)	5(11.36)	3(6.82)	7(15.91)	44(2.90)	9.86	7.85	9(64.29)	2(14.29)	2(14.29)	1(7.14)	8.16	13.21	20(62.50)	3(9.38)	3(9.38)	6(18.75)	10.82	10.37
18	22(64.71)	3(8.82)	2(5.88)	7(20.59)	34(2.24)	9.86	5.79	5(55.56)	1(11.11)	1(11.11)	2(22.22)	3.72	1.79	19(67.86)	2(7.14)	1(3.57)	6(21.43)	10.99	6.62
19	17(62.96)	4(14.81)	1(3.70)	5(18.52)	27(1.78)	12.16	4.84	5(71.43)	1(14.29)	0	1(14.29)	7.14	0.71	13(59.09)	3(13.64)	1(4.55)	5(22.73)	13.97	5.79
20	14(73.68)	1(5.26)	2(10.53)	2(10.53)	19(1.25)	15.14	4.30	3(60.00)	0	1(20.00)	1(20.00)	13.41	1.81	12(75.00)	1(6.25)	1(6.25)	2(12.50)	16.72	4.73
21	9(69.23)	1(7.69)	1(7.69)	2(15.38)	13(0.86)	11.78	3.93	1(100.)	0	0	0	2.76	0.20	8(66.67)	1(8.33)	1(8.33)	2(16.67)	12.53	4.24
22	2(33.33)	2(33.33)		2(33.33)	6(0.39)	10.08	4.72	0	0	0	0	0	0	2(33.33)	2(33.33)	0	2(33.33)	10.08	4.72
23	2(50.00)	2(50.00)			4(0.26)	14.79	6.50	0	0	0	0	0	0	2(50.00)	2(50.00)	0	0	14.79	6.50
24	1(33.33)		2(66.67)		3(0.20)	17.01	9.04	0	0	0	0	0	0	1(33.33)	0	2(66.67)	0	17.01	9.04
25				2(100.)	2(0.13)	8.13	14.56	0	0	0	0	0	0	0	0	0	2(100.)	8.13	14.56
26				1(100.)	1(0.07)	16.20	6.53	0	0	0	0	0	0	0	0	0	1(100.)	16.20	6.53

Sources: authors' compilation based on [Abiad et al. \(2010\)](#) and on predicted probabilities using estimated coefficients of model 8.

Notes: The first value corresponds to the number of times when the event is present while the values in parenthesis are the corresponding percentage or frequency. For example, (4) the first value in the third column indicates that, in 4 times, situation of instability is present with a percentage of 4.4 of the possible events at the same year of regulatory reforms. Prinst and prcrisis indicate estimated probability of instability and probability of crisis onset, respectively.

Table 5
Financial liberalization, regulatory delays, banking instability and crisis probabilities' average values.

Full sample					Developed countries				Developing markets			
Years	FL	YSR	Prinst	Prcrisis	fl	Ysr	Prinst	Prcrisis	fl	Ysr	Prinst	Prcrisis
1980	6.49	6.77	8.19	4.00	9.27	6.5	5.49	1.94	4.23	7	10.40	5.67
1981	6.72	7.61	7.75	5.48	9.56	7.13	5.37	2.21	4.41	8	9.70	8.15
1982	6.71	8.42	7.13	5.56	10.01	7.72	5.42	2.30	4.03	9	8.52	8.22
1983	6.81	9.44	6.43	3.82	10.09	8.72	4.99	1.80	4.14	10.03	7.60	5.47
1984	7.37	10	6.41	3.08	10.92	9.22	5.30	1.63	4.49	10.62	7.31	4.26
1985	7.80	10.75	6.03	2.46	11.85	9.681	5.19	1.55	4.5	11.62	6.72	3.20
1986	8.12	10.42	5.75	2.02	12.36	9.5	5.38	2.09	4.67	11.18	6.06	1.97
1987	8.64	10.97	6.02	1.98	13.25	9.5	6.03	2.34	4.88	12.18	6.02	1.69
1988	8.96	11.32	6.53	1.93	13.55	9.04	6.20	1.96	5.22	13.18	6.79	1.91
1989	9.64	11.02	7.63	4.87	13.79	7.86	6.78	2.35	6.25	13.59	8.32	6.92
1990	10.45	11.59	7.24	4.13	14.13	8.09	7.28	3.60	7.45	14.44	7.22	4.56
1991	11.60	10.93	7.35	3.84	14.65	7.86	6.38	4.99	9.12	13.44	8.14	2.89
1992	12.29	9.79	7.72	3.11	15.31	5.86	5.62	3.55	9.82	13	9.44	2.75
1993	13.21	8.28	7.85	2.91	16.02	4.09	4.26	2.31	10.92	11.70	10.78	3.39
1994	13.60	7.08	6.75	2.62	16.34	3.09	3.93	1.24	11.37	10.33	9.04	3.75
1995	14.01	4.79	6.09	2.25	16.47	3.77	4.37	1.42	12.00	5.62	7.50	2.93
1996	14.63	4.95	6.32	2.79	16.61	4.09	4.35	1.39	13.01	5.66	7.94	3.94
1997	14.82	4.77	6.25	3.20	16.75	4.63	4.40	1.40	13.25	4.88	7.75	4.66
1998	14.95	5.04	5.92	3.93	16.93	5.40	5.87	1.78	13.35	4.74	5.96	5.68
1999	15.15	5.36	5.71	2.52	16.97	6.18	6.59	1.76	13.67	4.70	4.99	3.13
2000	15.30	5.10	7.12	2.33	17.02	6.81	9.30	2.85	13.89	3.70	5.34	1.90
2001	15.37	5.97	5.26	2.48	17.05	7.81	7.02	3.24	14.00	4.48	3.82	1.86
2002	15.37	6.48	4.77	1.91	17.05	8	6.59	2.67	14.00	5.25	3.28	1.29
2003	15.47	7.08	4.92	1.74	17.14	9	7.05	2.76	14.12	5.51	3.19	0.91
2004	15.54	7.51	5.67	1.98	17.14	9.31	8.00	3.37	14.23	6.03	3.78	0.85
2005	15.62	8.51	7.51	2.84	17.19	10.31	11.35	5.06	14.34	7.03	4.38	1.04
2006	15.62	9.51	8.54	3.85	17.193	11.31	12.18	7.01	14.34	8.03	5.57	1.28
2007	15.62	10.51	11.09	6.23	17.19	12.31	14.89	10.45	14.34	9.03	8.00	2.79
2008	15.62	11.51	10.50	7.58	17.19	13.31	13.00	12.71	14.34	10.03	8.47	3.40
2009	15.62	12.51	6.15	5.61	17.19	14.31	7.03	8.35	14.34	11.03	5.44	3.37
2010	15.62	13.51	7.51	2.93	17.19	15.31	8.00	3.05	14.34	12.03	7.12	2.83

Notes: FL: financial liberalization; YSR: years since the last reforms; Prinst: probability of instability; Prcrisis: probability of crisis;

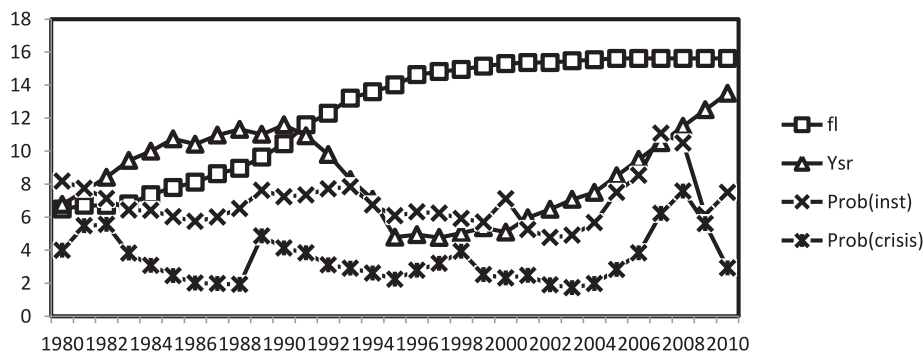


Fig. 1. Average Evolution of basic indicators in the full sample. Notes: The horizontal axis corresponds to the timing of events (year); the vertical axis refers to the annual average value of the corresponding indicator; FL: Financial liberalization; YSR: Year since last reforms; prob(inst): probability of instability; prob (crisis): probability of crisis. Sources: [Abiad et al. \(2010\)](#) for FL and YSR and author's calculation based on the M-logit estimated coefficients for the predicted probabilities of instability and crisis.

we corrected using generalized least square method. We found that the critical value of the variable YSR is 1.533. This result implies that any attempt of financial liberalization in one country of the full sample, risks creating financial fragilities if it is not done in the two years following regulations' updates as suggested by (H.2). In other words, our results show that financial liberalization can reduce the frequency of the banking sector vulnerabilities only if the regulatory framework is newly updated. However, it increases banking sector instability in case of an old regulatory framework. For example, we can see that financial liberalization decreases the probability of banking instability in the two years following regulatory reforms (Fig. 2A) but when the number of years since last reforms becomes important, banking vulnerability becomes more probable in the aftermath of financial liberalization (Fig. 2C).

Similarly, we found a critical value for financial liberalization, after resolving problems of autocorrelation and heteroscedasticity,

equal to 7.866. This result, combined with the previous findings, implies that if the level of financial liberalization is less than this value (for the full sample), the delay in regulation reduces the likelihood of instability (Fig. 3A). Yet, if liberalization exceeds this threshold, the updating of regulations becomes an emergency and any delays in updating rules and banking management instruments lead to a high risk of systemic banking difficulties (Fig. 3C). So, when financial liberalization is low, any delay in updating the regulatory framework reduces banking sector instability but when financial liberalization is important any delays in updating regulatory rules make banking sectors more vulnerable and crises more likely (contrary to H.4).

- Banking crisis onset

Table 7 shows that the determinants of the banking crisis' onset and those of the instability of the banking system differ widely. The most important result is that financial liberalization is not a

Table 6
Panel model results (dependant variable: Computed banking instability probability).

Instability	Full sample		Developed countries				Developing countries					
	FE Coef.	P> z	GLS Coef.	P> z	FE Coef.	P> z	GLS Coef.	P> z	FE Coef.	P> z	GLS Coef.	P> z
GDPG	.064	0.011	.027	0.027	.172	0.001	.087	0.001	.042	0.127	.007	0.962
GCAP	−0.623	0.215	−0.847	0.000	3.50	0.016	.318	0.449	−1.99	0.002	−0.966	0.000
CACCT	−0.425	0.000	−0.446	0.000	−0.475	0.000	−0.456	0.000	−0.398	0.000	−0.446	0.000
DCG	4.81	0.000	3.64	0.000	3.54	0.000	3.62	0.000	5.12	0.000	3.50	0.000
CPS	.015	0.000	.003	0.037	.001	0.814	.003	0.198	.036	0.000	.004	0.110
TOTCH	−6.66	0.000	−4.69	0.000	−2.65	0.214	−1.81	0.044	−7.72	0.000	−5.32	0.000
INF	−0.212	0.000	−0.247	0.000	−1.47	0.000	−0.361	0.091	−0.260	0.000	−0.296	0.000
M2RES	−0.162	0.019	−0.146	0.000	.441	0.016	−0.123	0.002	−0.228	0.006	−0.148	0.000
RER	3.80	0.000	2.46	0.000	7.18	0.000	3.06	0.000	3.65	0.000	2.10	0.000
RIR	.954	0.000	1.03	0.000	1.36	0.000	1.33	0.000	.731	0.000	.829	0.000
KFLOW	.346	0.000	.273	0.000	.253	0.000	.252	0.000	.383	0.000	.308	0.000
FEXP	.181	0.000	.325	0.000	.234	0.000	.321	0.000	.157	0.338	.246	0.048
FCONT	.004	0.000	.004	0.000	.021	0.000	.014	0.000	.002	0.000	.002	0.027
POL	−0.163	0.000	−0.142	0.000	−0.117	0.311	−0.183	0.075	−0.176	0.000	−0.145	0.000
DI	3.96	0.000	4.41	0.000	3.50	0.000	4.34	0.000	3.94	0.000	4.49	0.000
KOP	−0.717	0.000	−0.613	0.000	−0.624	0.001	−0.547	0.000	−0.730	0.000	−0.623	0.000
FL	−0.025	0.626	−0.069	0.015	.015	0.879	−0.123	0.025	−0.027	0.691	−0.071	0.078
CRS	−0.511	0.010	−0.763	0.000	−0.201	0.479	−0.466	0.000	−0.738	0.016	−0.968	0.000
YSR	−0.287	0.000	−0.354	0.000	−0.225	0.076	−0.332	0.000	−0.346	0.000	−0.377	0.000
YSRFL	.042	0.000	.045	0.000	.037	0.000	.043	0.000	.048	0.000	.048	0.000
CCOUNT	−1.04	0.000	−0.797	0.000	−0.764	0.000	−0.819	0.000	−0.829	0.000	−0.786	0.000
cons	−11.3	0.023	−1.68	0.273	−64.7	0.000	−15.8	0.141	.075	0.989	1.80	0.294
Obs		1519		1519		682		682		837		
N°ofgrps		49		49		22		22		27		
R-sq: with in		0.7423				0.7821				0.7812		
between		0.7665				0.4825				0.5385		
overall		0.7471				0.6993				0.7246		
Jointly sig test		0.000		0.000		0.0000		0.000		0.000		0.000
Hausman Test (prob > chi2)		89.86(0.000)				63.36(0.0000)				69.95(0.0000)		
Breuschpagan (prob > Chi2)		39,472.07(0.0000)				3776.50(0.0000)				34,368.48(0.0000)		
Wooldridge (prob > F)		12.821(0.0008)				24.222(0.0001)				14.578(0.0007)		
FL threshold		6.83≈7		7.866		6.081		7.72		7.208		7.854
YSR threshold		0.595		1.533		x		2.860		0.562		1.479

Notes: FE: Fixed Effect panel regression; GLS: Generalized Least Squares regression; Jointly sig test: corresponds to jointly significance of all introduced variables referring to the Fisher test for the first regression and to the Wald Chi2 test for the GLS regression; GDPG: GDP growth; GCAP : per capita GDP; CACCT: current account balance; DCG : Domestic credit growth; CPS: credit to the private sector; TOTCH: terms of trade change; INF: Inflation; M2RES: M2 to reserve ratio; RER: real exchange rate; RIR: real interest rate; KFLOW: capital flow; FEXP: Financial exposition; FCONT: financial connectivity; POL: political regime; DI: deposit insurance; KOP: capital openness; FL: Financial Liberalization; CRS: capital regulation and supervision; YSR: years since last reforms; YSRFL: interaction term between number of years since last reforms and financial liberalization variables; CCOUNT: crisis count(number of previous crisis).

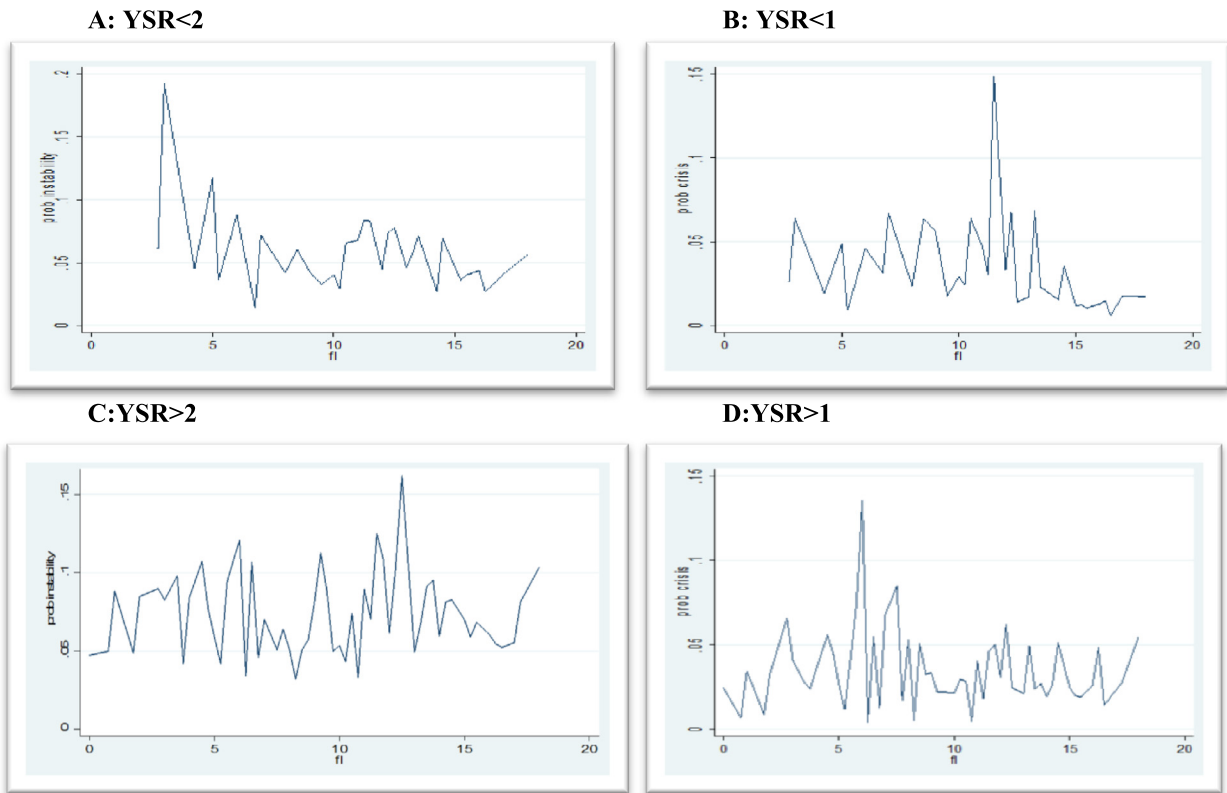


Fig. 2. Financial liberalization and banking sector stability depending on the number of years since the last reforms(Full sample) .35 Notes: Figs. 2A and 2C (2B and 2D) present the link between the probability of banking instability (crisis) and financial liberalization level according to the number of years since the last reforms (YSR) taking into consideration threshold value for the full sample; Horizontal axes correspond to the level of financial liberalization, vertical axes correspond to the probability of banking instability (crisis).

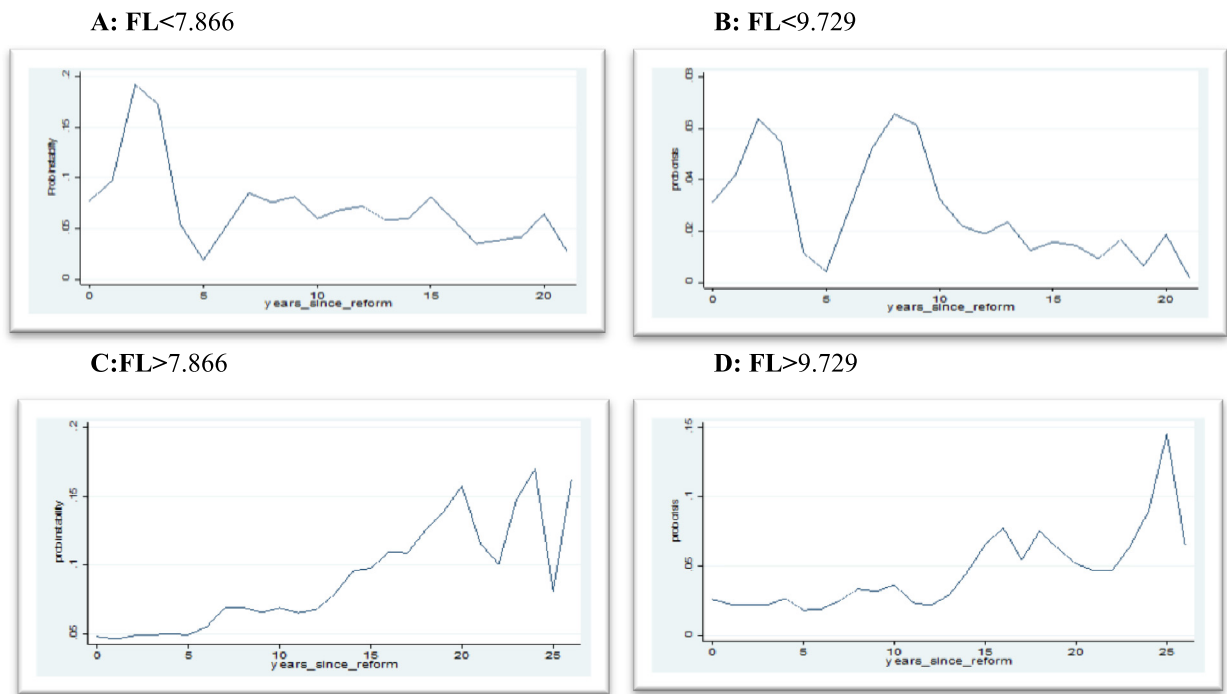


Fig. 3. Regulatory lags and banking sector stability conditional on financial liberalization (Full sample). Notes: Figs. 3A and 3C (3B and 3D) present the link between the probability of banking instability (crisis) and the number of years since last reforms conditional on financial liberalization level (FL) taking into account threshold values for the full sample; Horizontal axes correspond to the number of years since last reforms, vertical axes correspond to the probability of banking instability (crisis).

Table 7
Panel model results (dependant variable: Computed banking crisis probability).

Crisisonset	Full sample		Developed countries				Developing countries					
	FE Coef.	P> z	GLS Coef.	P> z	RE Coef.	P> z	GLS Coef.	P> z	FE Coef.	P> z	GLS Coef.	P> z
GDPG	-0.478	0.000	-0.359	0.000	-0.497	0.000	-0.343	0.000	-0.448	0.000	-0.386	0.000
GCAP	-0.581	0.391	-0.855	0.000	1.18	0.072	.499	0.378	-0.468	0.622	-1.13	0.000
CACCT	-0.336	0.000	-0.282	0.000	.403	0.000	-0.282	0.000	-0.319	0.000	-0.313	0.000
DCG	-0.329	0.520	-0.998	0.003	2.18	0.076	-1.27	0.017	.138	0.832	-0.638	0.182
CPS	.009	0.067	.007	0.002	.007	0.031	.002	0.438	.002	0.766	.014	0.001
TOTCH	3.58	0.001	3.76	0.000	5.22	0.058	3.02	0.020	3.72	0.004	3.98	0.000
INF	.067	0.359	-0.120	0.110	.126	0.728	-0.199	0.385	.172	0.043	-0.150	0.106
M2RES	-0.064	0.489	.065	0.023	.097	0.063	.151	0.015	-0.156	0.212	.044	0.198
RER	2.12	0.000	1.80	0.000	4.66	0.000	2.13	0.017	1.93	0.003	1.58	0.000
RIR	1.68	0.000	.822	0.000	1.61	0.000	1.02	0.000	1.75	0.000	.813	0.000
KFLOW	.225	0.000	.157	0.000	.260	0.000	.141	0.000	.203	0.000	.178	0.000
FEXP	.256	0.000	.182	0.000	.251	0.000	.201	0.000	.101	0.683	.356	0.010
FCONT	.013	0.000	.015	0.000	.028	0.000	.027	0.000	.011	0.000	.013	0.000
POL	-0.316	0.000	-0.132	0.000	-0.208	0.089	-0.126	0.157	-0.296	0.000	-0.147	0.000
DI	3.91	0.000	3.18	0.000	2.96	0.000	3.18	0.000	4.58	0.000	3.50	0.000
KOP	-0.918	0.000	-0.876	0.000	-0.812	0.000	-0.763	0.000	-1.01	0.000	-0.937	0.000
FL	.001	0.986	-0.029	0.461	-0.099	0.385	-0.122	0.130	.069	0.499	.062	0.292
CRS	.078	0.770	-0.400	0.001	-0.620	0.002	-0.282	0.103	.147	0.748	-0.764	0.000
YSR	-0.382	0.000	-0.360	0.000	-0.419	0.007	-0.429	0.000	-0.366	0.000	-0.355	0.000
YSRFL	.039	0.000	.037	0.000	.041	0.000	.041	0.000	.034	0.000	.033	0.000
CCOUNT	-1.56	0.000	-1.07	0.000	-0.601	0.000	-0.894	0.000	-1.96	0.000	-1.10	0.000
Cons	-4.92	0.465	.996	0.636	-33.6	0.000	-12.9	0.057	-4.12	0.617	3.43	0.202
Obs		1519		1519		682		682		837		837
N°ofgrps		49		49		22		22		27		27
R-sq: within		0.5995				0.6843				0.5885		
between		0.3766				0.7854				0.1061		
overall		0.5496				0.6919				0.5101		
Jointly sig test		0.0000		0.000		0.0000		0.000		0.0000		0.000
Hausman Test (prob > chi2)		49.11(0.0003)				14.00(0.8696)				33.33(0.0310)		
Breuschpaganest (prob > chi2)		17,161.54(0.0000)				X				7073.81(0.0000)		
Wooldridgetest (prob > F)		55.326(0.0000)				9.355(0.0060)				63.217(0.0000)		10.76
FL threshold		9.794		9.729≈10		10.219		10.463				
YSR threshold				0.783≈1		2.414		2.975≈				

Notes: FE: Fixed Effect panel regression; RE: Random Effect panel regression; GLS: Generalized Least Squares regression; Jointly sig test: corresponds to jointly significance of all introduced variables referring to the Fisher test for the first regression and to the Wald Chi2 test for the GLS regression; GDPG: GDP growth; GCAP : per capita GDP; CACCT: current account balance; DCG : Domestic credit growth; CPS: credit to the private sector; TOTCH: terms of trade change; INF: Inflation; M2RES: M2 to reserve ratio; RER: real exchange rate; RIR: real interest rate; KFLOW: capital flow; FEXP: Financial exposition; FCONT: financial connectivity; POL: political regime; DI: deposit insurance; KOP: capital openness; FL: Financial Liberalization; CRS: capital regulation and supervision; YSR: years since last reforms; YSRFL: interaction term between number of years since last reforms and financial liberalization variables; CCOUNT: crisis count(number of previous crisis).

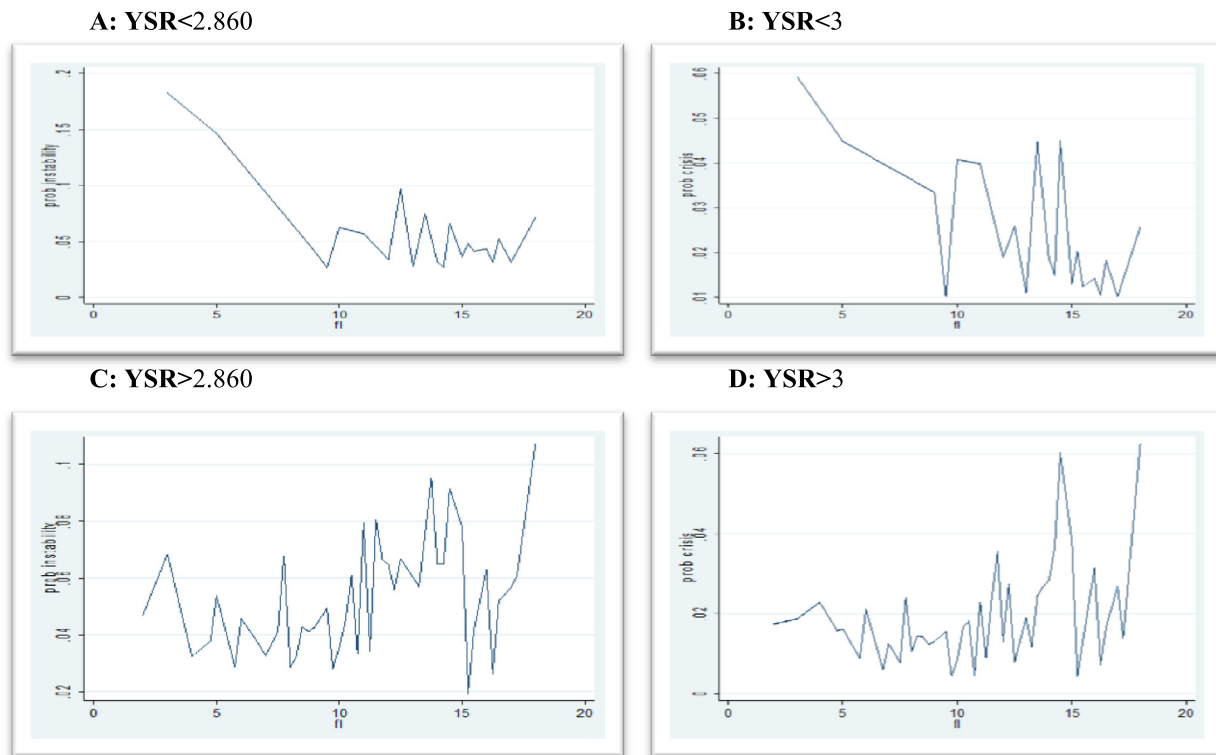


Fig. 4. Financial liberalization and banking crisis according to regulatory updating (Developed countries). Notes: Figs. 4A and 4C(4B and 4D) present the link between the probability of banking instability (crisis) and financial liberalization level according to the number of years since the last reforms (YSR) taking into consideration threshold value for developed countries; Horizontal axes correspond to the level of financial liberalization, vertical axes correspond to the probability of banking instability (crisis).

potential determinant of the likelihood of a crisis which is the case for bank fragility and that the likelihood of a banking crisis is too sensitive to the delay of updating regulations.

Our results show that financial liberalization slightly reduces banking crisis' probability (in a non-significant way) in the first year that follows the regulatory reform (Fig. 2B) but it increases the banking crisis' likelihood in the latter years (Fig. 3D). Likewise, when economies are largely repressed and FI do not exceed 9.729, delays in updating regulations make agents more familiar with the regulatory framework and reduce banking crisis probability (Fig. 3B) but this effect will be reverted in more liberalized markets (contrary to H.4) (Fig. 3D).

Given the importance of these results as far as politicians and decision-makers are concerned, we subdivide the sample into two groups of developed and developing countries. We found differences in terms of sensibility of banking sectors in each type of countries (footnote 26). We try here to test if the results differ widely or slightly as well as to find explanations for possible divergences.

4.3.2. Developed. countries

• Instability

The coefficient associated with the variable financial liberalization is negative and the variable of interaction is positive (Table 6), which means that the effect of financial liberalization on the banking sector fragility is weakened with the number of years since reforms. In other words, the stabilizing effect of financial liberalization can be achieved when YSR is smaller than 2.860 (Fig. 4A) and that destabilizing effect of financial liberalization is associated with a high level of YSR (Fig 4C). This means that updates of regulations in the countries that are sufficiently developed must be frequent in order to avoid banking vulnerabilities in the aftermath of financial liberalization, perhaps because of the sophisticated products (New

and complex derivatives) and instruments that are difficult to control in these countries. To put in another way, high levels of financial liberalization increase a banking sector instability which needs regulatory framework updating (as assumed by H.2) .³³

Then, we found that the critical value of financial liberalization is 7.72. This value implies that in developed countries, delays in regulation become important only when the level of financial liberalization is beyond this value (Fig.5A) .³⁴ From this level, any delays in updating rules concerning capital regulation and supervision can be dangerous in terms of banking instability (contrary to H.4). For example, when the level of financial liberalization in a developed country is high, any delays in updating regulations increases banking instability for the 20 years that follow the last reform (Fig 5C). This value is lower than the one found in the case of the full sample, explaining once again the nature of the exchanged financial products which are riskier and much more difficult to follow by the supervisory and rating agencies as in the case of the subprime crises. This real estate or mortgage crisis showed a failure in terms of evaluation of high credit risk encountered by credit institutions in the United States. A crisis that has been largely explained by the synthetic securitization which makes it possible to erase the traceability of risk and the development of hybrid securities whose level of risk cannot be estimated. Despite the fact that the level of regulation in this country was high, the new products were not covered or taken into consideration when establishing the old regulations. This is the reason why we have to deal with such a question, which is to take into consideration the temporal

³³ Note that the level of financial liberalization is high in developed countries and is 14.95 on average for all advanced countries of our sample.

³⁴ Note that when financial liberalization is low, regulatory updating not matters for the banking system stability in developed countries.

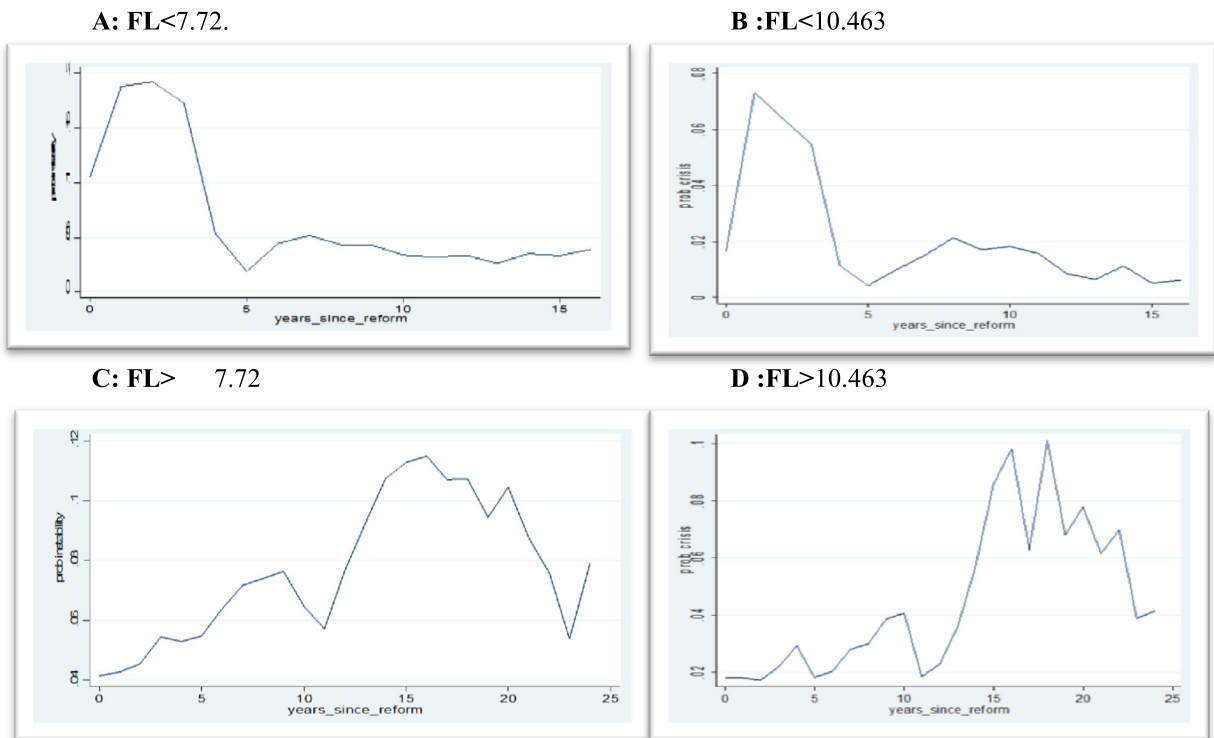


Fig. 5. Regulatory delays and banking system vulnerability conditional on the level of financial liberalization (Developed countries). Notes: Figs. 5A and 5C (5B and 5D) present the link between the probability of banking instability (crisis) and the number of years since last reforms conditional on financial liberalization level (FL) taking into accounting threshold values for developed countries; Horizontal axes correspond to the number of years since last reforms, vertical axes correspond to the probability of banking instability (crisis).

component of the regulatory environment and not to be interested just in the level of the rules in static forms.

- Banking crisis onset

Table 7 shows that the number of years since the last regulatory reforms can reduce a banking crisis onset if financial liberalization is less than 10.463 (Fig. 5B) and increases significantly banking crisis probability in more financially liberalized markets (Fig. 5D) *contrary to (H.4)*. However, the effect of financial liberalization on the banking sector is not clear (not statistically significant) even if the number of years since last reforms is too high (Fig. 4D) despite its remarkable stabilizing effect when regulatory reforms are recently updated (Fig. 4B). In addition, banking systems are more exposed to banking instability than a banking crisis onset in newly liberalized markets (FL= 7.72 in the case of instability against 10.463 in the case of crisis). On the contrary, delays in updating regulations lead to a banking crisis in developed countries only in the case of highly financial liberalization *contrary to banking vulnerability* which can be caused even by low levels of financial reforms.

4.3.3. Developing countries

- Instability

The last column of Table 6 shows that if the last update of regulations is made during the previous two years (YSR=1.479), financial liberalization in developing countries does not increase (but decreases) the probability of the banking sector's vulnerability as long as the level of liberalization is not too high (Fig. 6A). But, if such a reform is sufficiently old - more than two years ago - any attempt to financial liberalization can lead to banking sector vulnerability as shown by more frequent periods of instability *confirming H.2* (Fig. 6C).

In addition, Table 6 shows that *contrary to (H.4)* if financial liberalization in developing countries is weak and does not exceed

7.854, the old rules already in place in a less developed country increase the confidence of the participants in the banking system and reduce the likelihood of failure and instability (Fig. 7A). If the level of liberalization becomes high, the entry of new participants and great competition lead to the creation of an environment of inconsistency and uncertainty. This situation creates an atmosphere of financial speculation and disorder. If public authorities do not intervene to ensure effective control accompanied by a set of rules and laws that allow the various actors to be properly controlled and protected, the situation can worsen and lead to a default in banking institutions. Figure (7C) shows that any delay in regulatory updating increases the probability of bank instability especially for high level of financial liberalization and, to a lesser extent, contravenes the outbreak of the banking crisis itself (Fig. 7D).

- Banking crisis onset

Table 7 shows that the effect of regulatory updating on the banking crisis probability depends largely on the level of financial liberalization especially when financial liberalization does not exceed 10.76 (Fig. 7B). *Contrary to (H.4)*, in a developing country any supplementary years using old regulations contribute to stabilizing the banking sector but, beyond this threshold, regulatory delays increase the likelihood of a banking crisis (Fig. 7D). Concerning the effect of financial liberalization, we can see that it is positively and statistically not significant in explaining banking crisis occurrence. Coefficients associated to the variable financial liberalization and interaction terms are of the same sign, meaning that the destabilizing effect of financial liberalization on banking crisis probability in developing countries is reinforced with the number of years since the last reforms *as supported by (H.2)* but not significantly (Fig. 6B and D).

Finally, we can conclude that, by subdividing our sample, the results differ slightly when certain variables change signs and sig-

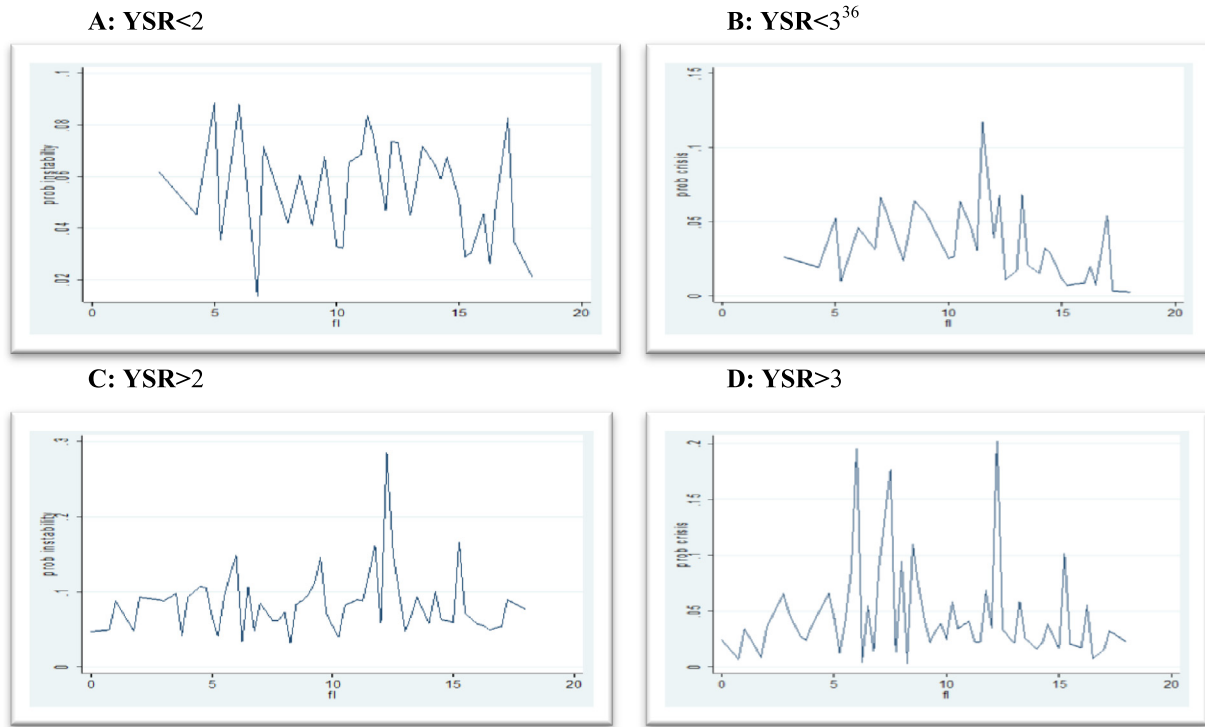


Fig. 6. Financial liberalization and banking crisis according to regulatory updating (Developing countries). Notes: Figs. 6A and 6C(6B and 6D) present the link between the probability of banking instability(crisis) and financial liberalization level according to the number of years since the last reforms(YSR) taking into consideration threshold value for developing countries; Horizontal axes correspond to the level of financial liberalization; Vertical axes correspond to the probability of banking instability (crisis).

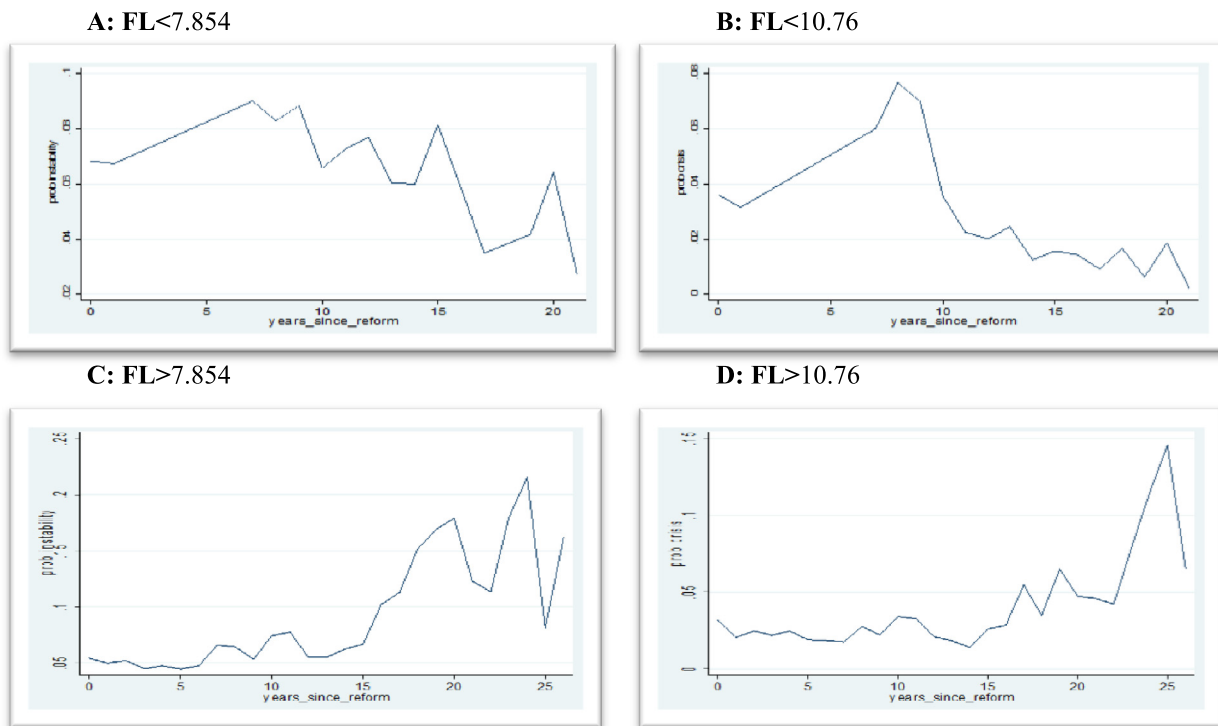


Fig. 7. Regulatory delays and banking system vulnerability conditional on the level of financial liberalization (Developing countries). Notes: Figs. 7A and 7C (7B and 7D) present the link between the probability of banking instability (crisis) and the number of years since last reforms conditional on financial liberalization level (FL) taking into accounting threshold values for developing countries; Horizontal axes correspond to the number of years since last reforms Vertical axes correspond to the probability of banking instability (crisis).

nificance but, overall, our variables of interest retain the same degree of importance. Therefore, both for developed and developing countries, when the country reaches a certain degree of liberalization, the updates of the rules become very important in order to keep up the same rate of creation of new products. Otherwise, banking crises may arise if there is a mismatch between financial development and the regulations that manage financial systems.

5. Conclusions and implications

In this work, we explored in the first part the effect of delays in updating regulatory frameworks and financial liberalization on the likelihood of banking instability, crises onset and duration. Despite the clear importance of banking crises in the global economy, this topic remains underestimated and the existing literature cannot fully explain the origins of banking sector bankruptcy and do not focus on the effect of regulatory framework in the aftermath of financial reforms. We support that delays in updating prudential regulations combined with increased financial liberalization give banks opportunity to engage in risky behaviors. Firstly, we confirmed the view that financial liberalization increases competitions reducing profitability of banks and also extend fragility. Secondly, we revealed how this effect is, nevertheless, conditioned by the number of years since the last regulatory reforms. As markets are heavily repressed, competition is weak and banks are poorly motivated to escape the constraints of regulation and take advantage of regulatory delays. When markets are highly liberalized, competition from new participants pushes bankers to take more risk which is easier without increased strictness of regulation and can lead to banking fragility and high crises probabilities. Our empirical results are robust for different model specifications and show that capital regulation and supervision can help prevent banking crises.

The results suggest that the incentives created by the institutions may vary over time. This finding provides an important contribution since a significant portion of the research takes into consideration the static effects of institutions—especially regulation and supervision – on the likelihood of a country's banking vulnerability and duration. These results are of major interest as they deal with the issue motivating this work and pave the way for new research channels. Although the basic model presented here is a Logit model like those presented in the literature, it is based on more than only two schemes in order to distinguish between the crisis and pre-crisis phases. Its parsimony and its relatively high predictive power allowed us to test other hypotheses regarding the occurrence of a banking crisis providing a basis for analysis. The empirical results also suggest reassessing the importance of many economic variables assumed to be linked to banking crises but fail to reach the conventional threshold significance of 10%. In addition, a Logit model permits computing banking crisis probability so as to find the turning point for financial liberalization and emphasizes the importance of updating the regulatory environment using a panel data. This methodology helped us to confirm results found in the first empirical part: the link between financial liberalization and a banking crisis can be represented by a U-shaped curve depending on regulatory delays. We found that, on one hand, financial liberalization can stabilize the banking sector if the regulatory framework is regularly updated and that any delays in regulatory updating may lead to a systemic banking crisis. On the other hand, a regulatory update is important only when financial liberalization reaches a critical value which is lower in developed countries meaning that they need regulatory updates because of sophisticated and complex new financial products such as exchanged assets and derivatives. Contrary to expectations, the regulatory environment is of major importance in developed countries, perhaps because of the high-risky

exchanged financial products. Therefore, we found that the critical threshold for financial liberalization is smaller in developed countries. From an overall overview, developed countries are responsible for international crisis occurrence and contagion via a more unified and interconnected economic world. So, since international cooperation is needed, attention must be paid to regulatory updating in order to reduce the negative effects of financial liberalization.

Appendices

Tables A1 and A2

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Table A1
Systemic banking crises dating.

Country	date	Country	date	Country	date
Argentina	1980, 1989, 1995, 2001	India	1993	Portugal	2008
Australia		Indonesia	1997	Russia	1998, 2008
Austria	2008	Ireland	2008	Singapore	
Belgium	2008	Israel	1997	South Africa	
Brazil	1990, 1994	Italy	2008	Spain	2008
Chile	1976, 1981	Japan	1997	Srilanka	1989
China	1998	South Korea	1997	Sweden	1991, 2008
Colombia	1982, 1998	Malaysia	1997	Switzerland	2008
Czechrepublic	1996	Mexico	1981, 1994	Thailand	1983, 1997
Denmark	2008	Morocco	1980	Tunisia	1991
Egypt	1980	Netherlands	2008	Turkey	1982, 2000
Finland	1991	New Zealand		United kingdom	2007
France	2008	Norway	1991	United states	1988, 2007
Germany	2008	Pakistan		Venezuela	1994
Greece	2008	Peru	1983		
Hong Kong		Philippines	1983, 1997		
Hungary	1991, 2008	Poland	1992		

Source: Laeven and Valencia (2012).

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Table A2
Data description^a.

Variables	obs	Std.Dev	Min	Max	Descriptions	Sources
BC	1519	0.876	0	3	Dummy equal: 1 in the two years preceding banking crisis, 2 in the first year of crisis, 3 when crisis is ongoing (only systemic), and 0 otherwise.	Laeven and Valencia (2012)
Crisis probability	1519	0.0342	0.002	0.893	It corresponds to the probability of systemic banking crisis occurrence. It is computed based on estimated parameters using logit model	
DC	1519	9.613	0	30	The number of banking crises in the world in a given year	
CCOUNT	1519	1.764	0	8	The number of previous banking crises	
Economic and Financial variables						
GDPG	1519	4.06	-14.53	18.28	Real GDP growth (annual%)	WDI (2010)
CACT	1519	5.254	-16.28	28.72	Current account balance (% of GDP)	
DCG	1519	0.323	-0.729	4.157	The natural log difference of domestic credit to the private sector	
CPS	1519	52.783	8.196	329.841	Domestic credit provided by banking sector (% of GDP)	
TOTCH	1519	0.103	-0.571	.761	Change in the terms of trade	
INF	1519	2.934	-22.37	5.252	The log difference of GDP deflator	
M2RES	1519	4.928	9.891	25.647	The natural log of the ratio of money and quasi money (M2) to gross international reserves	WDI and IFS
KFLOW	1519	8.162	48.25	101.622	The sum of capital inflows and outflows divided by GDP (current US\$)	
RER	1519	.272	2.586	6.136	The log of real exchange rate	Darvas, Zsolt (2012)
RIR	1519	1.235	4.605	9.754	The log of the nominal interest rate	IFS
FEXP	1519	9.644	0	108.376	The sum of assets and liabilities of domestic banks in a reporting country to the residents of all other countries	BIS locationalStatistics
FCONT	1519		3615	2346	The financial connectivity variable is measured as the financial exposition multiplied by the Exchange Market Pressure (EMP) of each partner country in any given year	WDI,IFS and BIS locational Statistics
FL	1519	5.399	0	18	The sum of the following six types of liberalization: Elimination of credit controls and high reserves requirements; Elimination of interest rate controls; Elimination of entry barriers and restrictions on the scope of a bank's activity; market securities policy; Elimination of capital account restrictions and Reduction of state ownership in the banking sector of the banking sector. A score between 0 and 3 is attributed for each dimension, and scores are combined into a total liberalization index that ranges between 0 and 18 where high level imply fully liberalized.	Abiad et al. (2010)
KOP	1519	1.565	1.875	2.421	An index measuring a country's degree of capital account openness based on the information from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions	Chinn and Ito, 2008,2014)
Institutional and political variables						
CRS	1519	1.084	0	3	Enhancement of prudential regulation and supervision of the banking sector; it measures the strictness of regulation (3 means highly regulated and supervised) and is coded based on 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?	Abiad et al. (2010)
DS	1519	0.791	0.142	2.183	The average level of banking supervision in the sample for given year	
YSR	1519	5.627	0	26	It refers to the time since last reforms and it corresponds to the number of years elapsed since the change in the ADT's score for banking sector supervision.	
GCAP	1519	1.360	5.401	11.124	Real GDP per capita	WDI
DI	1519	0.486	0	1	Dummy that equals one if the country has explicit deposit insurance and zero otherwise (DI)	Demirguc Kunt et al. (2014)
POL	1519	5.752	-9	10	A score indicating political regime ranging from +10 (strongly democratic) to -10 (strongly autocratic).	Marshall and Jaggers, 2007
CUC	1519	0.147	0	1	A dichotomous variable coded 1 if the country experienced a currency crisis in a given year	Laeven and Valencia (2008)
C. type	1519	1.551	1	2	A binary dummy taking the value 1 for developed countries and 2 otherwise(emerging markets)	Author' classification based on IMF

^a See Hamdaoui (2016)