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Financial Structure, Financial Development and Banking Fragility: International Evidence

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Abstract

In this work the effects of financial structure and financial development on banking fragility are examined. The study is developed using fixed-effects panel-data regressions and by controlling the effects of certain banking indicators. We use individual and principal-components indicators of the activity, size and efficiency of intermediaries and markets are also used. The indicators include data for 211 countries between 1990 and 2003. The main results suggest that banking stability is enhanced in market-based financial systems, whilst financial development reduces it. However, this fragility-enhancing effect can be discovered only when the financial structure is taken into account. Therfore, financial structure and development jointly matter to assess banking fragility.

Keywords: banks, fragility, financial structure, financial development.
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Introduction

One of the main concerns among economists relates to the study of the determinants of banking crises. Particularly, financial structure determinants have been considered important to understand them (Demirguc-Kunt and Detragiache, 1998). In this work the effects of financial determinants on banking fragility are studied, and the article is developed by using panel-data techniques and by controlling for banking activity, size and concentration. Indicators of the activity, size and efficiency of intermediaries and markets for 211 countries during the period 1990-2003 are used.

The study is motivated by the necessity to understand the determinants of banking crises. In particular, our attention to the financial determinants relates to an old concern in economics about the effects that financial systems may have on the performance of the agents within an economy and the economy itself.[1] This concern has encouraged the development of theories and empirical research to assess the relative merits of different financial systems. However there is little consensus about which financial systems may contribute to achieve specific goals, like financial stability.

However, I do believe that the understanding of financial determinants is particularly relevant to avoid the economic costs of banking crises. Solely the costs of the recent global financial crisis of 2007-2008 have been estimated in excess of 1.4 trillion US dollars (IMF, 2008: xiii).[2] This crisis, the worst since World War II, has been considered as "a modern form of a traditional banking crisis" (Vives, 2008: 99). Moreover, according to several authors, its origins can be traced to issues related to financial structure and financial development.[3] Thus, the study of these determinants might contribute to avoid further costly crises.

The need to develop further investigations on the determinants of banking fragility cannot be minimized. The literature on the impacts of financial structure on banking crises is relatively scarce and in an early stage of development. Until recently, issues regarding data availability, accounting, regulatory and economic methods have inhibited the development of such studies. Indeed, existing studies on the relationship between financial structure and banking fragility are mainly descriptive.[4] Thus there is no reliable guide regarding how to avoid financial crises in national or global contexts.

[1] Such concern can be traced back to the writings of Bagehot (1873). See Levine (2002) and Allen and Gale (2004) for reviews on the relationships between financial structure and economic performance.

[2] See Barrel and Davies (2008) for a summary of the evolution of the financial crisis of 2007-2008.

[3] See Felton and Reinhart (2008) for a compilation of essays among academic economists and policymakers about the origins, evolution and policy responses to the global financial crisis.

[4] To our knowledge the first study on this relationship is the one of Allen (2001).

I aim at clarifying how financial structure and financial development determinants may relate to banking fragility by suggesting answers to the following questions: Does financial structure matter to assess banking performance? What are the effects, if any, of financial structure and development on banking crises? Can we analyze these two determinants independently one of another? Which type of implications may be derived from these findings? Here I analyze these questions by using a variation of the failure-determinant methodology that includes panel-data regressions.

I develop this study in three stages. First I build the financial indicators based on measures of activity, size and efficiency of intermediaries and markets. Laters I estimate the individual and joint effects of financial development and structure on banking fragility with three sets of fixed-effects logit regressions for panel-data. Finally we use omitted-variable tests to evaluate the pertinence of the joint study of the effects of financial structure and development. We use individual and principal-components indicators for the empirical assessments.

Methodologically, our study has some specific features that differentiate it with respect to others: A first feature is that I use internationally comparable data from the most extensive sets publicly available for 211 economies during the period 1990-2003.[5] The second one is that we use panel-data techniques that allow us to control the effects of time-constant unobserved heterogeneity among countries. Finally the last distinctive feature of our study is that I analyze the effects of individual and aggregate indicators of financial structure and development on banking fragility.

The econometric results have implications for theoretical and practical purposes. Specifically, the assessments suggest that financial structure and financial development *jointly* matter to assess the stability of banking systems. Banking stability is *enhanced* in economies with market-based financial systems. Financial development *reduces it.* However the latter fragility-enhancing effect can be discovered only when we account for financial structure. Furthermore, the findings suggest that the size of the banking sector seems to *reduce* banking stability and that lending activities *enhance* it.

This study complements and extends the ones of Demirguc-Kunt and Detragiache (1998) and the ones of Ruiz-Porras (2006) and (2008). The first study

[5] We use panel-data extracted from the database on financial development and structure (Beck, Demirguc-Kunt and Levine, 2006), and from the datasets on episodes of systemic and borderline banking crises (Caprio and Klingebiel, 2003). The datasets are available at the World Bank´s website: (http://econ.worldbank.org).

shows that economies with low growth rates, high rates of inflation and interest rates and BOP problems are likely to experience crises. The second study describes the "stylized facts", between financial systems and banking crises. Concretely, it shows that crises are more likely in bank-based financial systems and that financial development enhances banking stability. Finally, the third study analyses the relationship between banking competition and banking crises.

This article is organised in seven sections. Section 1 reviews the literature. Section 2 describes the data. Section 3 discusses methodological issues. Section 4 shows the outcomes of the individual assessments of the effects of financial structure and development. Section 5 focuses on the joint analysis of such effects and its econometric justification. Section 6 summarises and discusses the main findings. The appendixes include further econometric estimations and indicate the countries and data of recognised banking crises used in the study.

1. Financial structure, financial development and banking fragility

Theory suggests that the opportunities to deal with financial risks and to engage in risk sharing activities depend on the particular properties of financial systems (see Allen and Gale, 2000 and 2004). Financial competition among financial markets and banks, which is reflected in the financial structure of an economy, provides different incentives and opportunities for risk management. The management of risks is the main activity of banks. Therefore, it is very likely that banking performance, and the likelihood of crises, may depend on the structure and degree of development of the financial systems.

When can financial structure be related to the likelihood of banking crises? According to the theory on comparative financial systems, such relationship can be explained in terms of financial competition. Competition between markets and banks erodes the opportunities to engage in inter-temporal risk smoothing activities (See Allen and Gale, 2000 and 2004). Such erosion is particularly relevant because banking crises have been defined as equilibrium outcomes in a context of inter-temporal risk sharing (See Diamond and Dybvig, 1983).[6]

However, we must emphasize that the relationship between financial systems and banking crises may not be a straightforward one. Theoretical works have not dealt enough with issues regarding how risks may influence intermediaries´

[6] See De Bandt and Hartmann (2002) for a survey on systemic risk in banking.

behaviour (See Allen and Santomero, 1997 and Scholtens and Van Wensveen, 2000). We cannot dismiss the possibility of bidirectional effects between financial development and banking crises. Historically, banking crises have had a significant impact on the development of financial systems.

Empirical studies that assess how different financial structures may affect the performance of banks in an international context are scarce. The first study that analyses the relationship between financial structure and banking performance is the one of Demirguc-Kunt and Huizinga (2001). Among their findings, they show that in emerging economies, financial systems tend to be bank-based and relatively underdeveloped. However they do not find any conclusive evidence to support the hypothesis that financial structure has a significant, independent influence on bank margins and profits.

The hypothesis that financial structure matters to explain banking fragility has been explicitly stated by Demirguc-Kunt and Detragiache (1998).[7] Such hypothesis has support on the study of Ruiz-Porras (2006). This article finds that financial development is associated with market-based financial systems and that such association is magnified during episodes of banking crises. Thus, he concludes that financial structure, development and banking crises are interrelated. His conclusion is reached by analyzing data for 47 economies during the period 1990-1997.

Further studies provide indirect evidence to support the idea that financial determinants might explain banking crises. Among these studies, I include the ones of Loayza and Ranciere (2006) and Evrensel (2008). The first study shows that financial liberalization, as a mean of financial development and change in financial structures, can generate short-run financial instability and long-run growth. The second one suggests that financial and economic development and banking concentration might delay banking crises. In both studies, financial development seems to be a significant determinant.

Methodologically, I should point out that none of the previous empirical studies is a failure-determinant one. This type of studies attempts to explain recognised insolvency situations among intermediaries or troubled banking systems. They seek to identify, ex-post, the factors that may affect the likelihood of banking problems. Currently, there are no failure-determinant studies that have focused on

[7] Demirguc-Kunt and Detragiache (1998: 105) indicate that "variables that capture the structure of the banking system and, more generally, the structure of financial markets (…), are likely to play an important role in breeding banking crises, but they are neglected here because of lack of data. A study limited to a smaller set of countries that includes more structural variables might yield to more interesting results".

how financial structure determinants may affect banking crises.[8] So, the development of such studies may to be particularly necessary to improve our understanding of banking fragility.

We are far from a consensus regarding the effects of financial determinants on banking crises. The theoretical and empirical literature on comparative financial systems is rather limited and inconclusive to deal with this issue. In particular, I believe that further failure-determinant studies may be useful at clarifying the relationships between financial systems and banking fragility.

2. Banking and financial indicators

Here I describe the financial and banking indicators used in our study. Such indicators are built according to the guidelines proposed by Demirguc-Kunt and Detragiache (1998) and Levine (2002). Thus, I consider as a stable banking system one that does not experience a *recognised* episode of borderline or systemic banking crisis. In addition, I follow the convention that financial development depends to the level of development of *both* intermediaries and markets. Finally, I consider that financial structure depends on the degree to which a financial system is based on intermediaries *or* markets.

We construct the financial structure and development indicators with panel-data extracted from the revised dataset of Beck, Demirguc-Kunt and Levine (2006). We captured the main features of the financial and banking environment. We use the datasets of Caprio and Klingebiel (2003) to build the qualitative indicators of fragility. Datasets allow us to build our sample of financial and banking indicators. The main advantage of using these datasets is that they provide us with consistent data across countries and across time.

We combine the three datasets to develop our failure-determinant study for the period 1990-2003 (See Table 1).[9] Here it is important to indicate that the dataset of Beck, Demirguc-Kunt and Levine (2006) includes panel-data for 211 countries for the period 1960-2004. Specifically, the dataset includes data for 58 low-income, 54 lower-middle, 40 upper-middle, 32 high-income-non-OECD and 26 high-income-OECD countries. The datasets of Caprio and Klingebiel (2003) include

[8] Ruiz-Porras (2008) includes aggregate financial structure and development determinants as control variables to assess the relationship between banking competition and banking fragility for 47 economies during the period 1990-1997. His findings suggest that the orientation toward marked-based financial systems might enhance banking stability.

[9] The countries and episodes of banking crises considered in our study are contained in Appendix B.

data on recognized borderline and systemic episodes of banking crises for several countries during the period 1974-2003.[10]

Table 1
Financial and Banking Data

Definition	*Variable*	*Period*	*Countries (Crises)*	
Banking fragility variables				
Dummy variable on borderline episodes of banking fragility (Banking crisis=1, otherwise=0)	BORDER	1974-2003	211 (44)	6,330 (278)
Dummy variable on systemic episodes of banking fragility (Banking crisis=1, otherwise=0)	SYSTEMIC	1974-2003	211 (92)	6,330 (697)
Financial structure and development variables				
Private credit by deposit money banks and other financial institutions to GDP (Private credit ratio)	PCRDBOFGDP	1960-2004	161	4,597
Stock market capitalization to GDP (Market capitalisation ratio)	STMKTCAP	1976-2004	111	1,541
Stock market total value traded to GDP (Total value traded ratio)	STVALTRADED	1975-2004	111	1,588
Banking system variables				
Concentration (Ratio of the 3 largest banks to total banking assets	CONCENTRATION	1990-2004	160	1,790
Deposit money bank assets to GDP (Bank size ratio)	DBAGDP	1960-2004	161	4,606
Overhead costs of the banking system relative to banking system assets	OVERHEAD	1990-2004	158	1,738
Private credit by deposit money banks to GDP (Bank credit ratio)	PCRDBGDP	1960-2004	161	4,582

Notes: 1) The database on banking crises includes the two qualitative variables included here. A banking crisis is defined as systemic if most or all banking system capital is eroded by loan losses (5% of assets in eveloping countries). A non systemic banking crisis includes borderline and smaller banking crises. 2) Annual observations associated to episodes of recognized banking crises are given in parenthesis. 3) The complete financial development and structure database includes statistics on the size, activity and efficiency of various intermediaries (commercial banks, insurance companies, pension funds and non-deposit money banks) and markets (primary equity and primary and secondary bond markets).

[10] A limitation of the datasets of Caprio and Klingebiel (2003) refers to the characterization and coverage of banking crises. In many countries, banking problems are underestimated as also the size of their costs. Moreover, the time span of banking crises is not easy to determine. Even at a mere qualitative level, the characterization of crises may be difficult to establish for certain countries because they are not officially recognized. Thus, I cannot dismiss the possibility that certain "periods of banking stability", in our database, may occur in reality due to missing, or non reported data, on banking crisis episodes.

Methodologically, we define nine individual indicators to describe the financial and banking environments prevailing in every country every year according to data availability. I organized these indicators into three types. The *structural assortment* contains measures of the activity, size and efficiency of stock markets *relative to* that of banks. The *development assortment* contains measures of the activity, size and efficiency of stock markets *and* banks. Finally the *banking assortment* contains measures of activity, size and concentration of banking systems.

I use the ideas of Levine (2002) to build the financial assortments that capture the specific features of the financial system in a country. The structural assortment is integrated by the Structure-Activity, Structure-Size and Structure-Efficiency indicators. Here, market-based financial systems are associated to large values of the indicators, and bank-based ones to small values. The development assortment is integrated by the Finance-Activity, Finance-Size and Finance-Efficiency indicators. Financial development is associated to large values of the indicators and underdevelopment to small ones.[11]

I summarize the information content of these assortments by using two aggregate indicators of financial structure and development. We follow the approach of Levine (2002) to define them. Such indicators are built with principal-component methods. Specifically they are the Structure-Aggregate and the Finance-Aggregate ones. We use the aggregate indicators as indexes of scale for the level of development and of the relative prominence of markets in the financial system. These two indicators complement the previous ones included in the structure and development assortments.

Finally, I describe the main features of the banking sector with the third assortment. The banking assortment is integrated by the Banking-Activity, Banking-Size and Banking-Concentration indicators. Large values of the first two indicators are associated with high levels of credit activity and with a large amount of banking assets (See Demirguc-Kunt and Huizinga, 2001). High values of the last indicator are associated with concentrated banking systems. We use these three indicators as control variables in the panel-data models. They are included here on the basis of data availability.[12]

[11] The financial indicators may have limitations for describing the main features of financial systems. Particularly, Levine (2002) indicates that the Finance-Size and the Structure-Efficiency indicators have some problems to be considered as good measures of financial development and financial structure. Here we include these indicators for completeness and consistency with other studies.

[12] We are aware that important control variables are missing. We do not include them due to the lack of data. These omissions include economic indicators and variables to describe different regulatory regimes.

Table 2
Banking and Financial Indicators

Name	*Definition*	*Measurement*
	Banking Fragility Indicators	
Crises	Binary variable for fragility: Banking crisis=1 Non banking crisis=0	Recognized episodes of systemic and/or borderline banking crises
	Financial Structure Indicators	
Structure Activity	$STCACT=\ln\left(\frac{\text{STVALTRADED}}{\text{PCRDBGDP}}\right)$	Activity of stock markets relative to that of banks
Structure Size	$STCSIZ=\ln\left(\frac{\text{STMKTCAP}}{\text{PCRDBGDP}}\right)$	Size of stock markets relative to that of banks
Structure Efficiency	*STCCEFF* = 1n(STVALTRADED*OVER_HEAD)	Efficiency of stock markets relative to that of banks
Structure Aggregate	First principal component of the set of individual financial structure indicators.	Scale index of financial structure.
	Financial Development Indicators	
Finance Activity	*FINACT*= 1n(STVALTRADED*PCRDBOFGDP)	Activity of stock markets and intermediaries
Finance Size	*FINSIZ*= 1n(STMKTCAP*PCRDBOFGDP)	Size of stock markets and intermediaries
Finance Efficiency	$FINEFF=\ln\left(\frac{\text{STVALTRADED}}{\text{OVERHEAD}}\right)$	Financial sector efficiency
Finance Aggregate	First principal component of the set of individual financial development indicators.	Scale index of financial development.
	Banking System Indicators	
Banking Activity	*BNKACT*=1n(PCRDBGDP)	Credit activity of the banking system
Banking Size	*BNKSIZ*=1n(DBAGDP)	Overall size of the banking sector
Banking Concentration	*BNKCON*=1n(CONCENTRATION)	Banking system concentration

Notes: The characterization of the financial and banking systems depends on the indicators´ relative value (with respect to the sample medians). Large values of the financial structure indicators are associated to market-based financial systems; small ones to bank-based ones. Large values of the financial development indicators relate to high levels of financial development.

3. Methodological issues in relation with the econometric assessment

In this section I discuss some methodological issues regarding our assessment of the effects of financial determinants on banking fragility. In particular, we define the scope and limits of our research. From an empirical perspective, its main distinctive feature is that the failure-determinant framework relies on fixed-effects logit models for panel-data. I combine the properties of time-series and cross-sectional data for estimation purposes. The assessment is based on estimations of three functional form specifications.

I assess the effects of financial structure and development by estimating the probabilities of occurrence of banking crises according to the conventions of the failure-determinant literature. Specifically, given cross-country annual data for n economies, we have that, for each period t, the i-country is either experiencing a banking crisis, or it is not. The probability that a crisis may occur is hypothesized to be a function of a matrix of K vector-variables $x_{it} = x_{it1}, x_{it2},...,x_{itk}$. Such matrix describes the financial environment through the inclusion of failure-determinant and control variables.

I study the specific and joint effects of financial determinants with three subunits of the independent-variable matrix x_{it}. We differentiate each specification by using a superscript. The first design x_{it}^{S} focuses on the effects of the financial structure indicators. The second one x_{it}^{F} focuses on the effects of the financial development. The last x_{it}^{SF} focuses on the joint effects of both indicators. Thus the set of designs of the matrix x_{it} is:

$$x_{it}^{F} = [0, F_{it}, B_{it}] \quad (1)$$
$$x_{it}^{S} = [S_{it}, 0, B_{it}] \quad (2)$$
$$x_{it}^{SF} = [S_{it}, F_{it}, B_{it}] \quad (3)$$

Where:

S_{it} =vector of financial structure indicators;
F_{it} =vector of financial development indicators; and
B_{it} =vector of banking indicators;

The analysis is based on estimations of linear functional forms that relate the coefficient vector â with the matrix x_{it}. Linearity is a convention in the failure-determinant literature. Here denominate the specification that relates x_{it}^{S} and $\hat{a}^{S} = [ß_{S}, 0, ß_{B}]$ as the *financial-structure specification (FS specification)*. I denominate the one that relates x_{it}^{F} and $\hat{a}^{F} = [0, ß_{F}, ß_{B}]$ as the *financial-development specifica-*

tion (FD specification). Finally we denominate the joint specification that relates x_{it}^{SF} and $\hat{a}^{F} = [ß_S, ß_F, \beta_B]$ as the *financial-structure-and-development specification (FSD specification)*.

The analysis of how financial structure and development may affect the stability of banking systems depends on several estimations of the coefficient vector â. We use these estimations to clarify the effects of the financial system determinants. The assessment of each specification depends on four estimations; three estimations for the individual indicators and one for the aggregate indicators. I do not combine indicators of the same type due to the potential multicollinearity that may exist among them.

Econometrically, it can be argued that endogeneity may arise in our assessment framework. Endogeneity can arise due to the omission of relevant variables or or because of simultaneity. Here we deal with endogeneity issues with likelihood-ratio (LR) tests for omitted variable bias. Such tests assume that x_{it}^{SF} includes irrelevant variables and that the x_{it}^{S}, and x_{it}^{F} may be correctly specified. Thus the hypothesis that financial structure and development effects must to be analysed *jointly* predicts that the null hypothesis of correct specification of x_{it}^{S}, or x_{it}^{F} will be *rejected*.

Furthermore, endogeneity and causality problems may be related. Here we use lags of the independent variables to avoid potential simultaneity and endogeneity problems arising from potential two-way relationships. In addition, we deal with causality issues postulating certain hypotheses about the signs for the estimated coefficients. Specifically, the hypothesis that market-based financial systems *enhance* banking stability, predicts that the estimated signs of $ß_S$ will be *negative*. The hypothesis that financial development also *enhances* stability, predicts that the signs of $ß_F$ will be *negative* too.[13]

4. Econometric assessment of the effects of the individual determinants[14]

Here we report the outcomes of the sets of models used to assess the specific effects of the financial determinants on banking crises. The outcomes are associated with the eight estimations of the specifications defined by equations (1) and (2). We compare the evidence with the theoretical predictions. All the estimations included

[13] Notice that our study assumes that the design of the financial and banking systems and the level of financial development are exogenous of banking crises. This is a very restrictive assumption.

[14] The econometric software used for the assessments is *Stata 9.0*.

the banking indicators as control variables and the lagged financial indicators as independent ones.

The first set of failure-determinants models focuses on the effects of the financial structure determinants on fragility. I summarize their results in Table 3.

Table 3
Financial Structure and Banking Crises
(FS specification)

Model	*Aggregate*	*Activity*	*Size*	*Efficiency*
Structure Aggregate (lagged)	-1.03 *** (-4.64)			
Structure Activity (lagged)		-0.64 *** (-4.35)		
Structure Size (lagged)			-0.83 *** (-3.31)	
Structure Efficiency (lagged)				-0.85 *** (-4.97)
Banking Activity	-4.29 *** (-3.84)	-5.07 *** (-4.64)	-5.43 *** (-4.89)	-3.79 *** (-3.43)
Banking Size	4.99*** (3.72)	5.74 *** (4.57)	6.20 *** (4.84)	4.98 *** (3.82)
Banking Concentration	0.99 (1.05)	0.40 (0.58)	0.80 (1.07)	1.03 (1.18)
Observations	339	431	411	371
LR-CHI2(4)	67.00***	63.44 ***	55.49 ***	68.81 ***
Prob > CHI2	0.000	0.000	0.000	0.000
Log Likelihood	-119.92	-158.77	-155.68	-129.43

Notes: The dependent variable is the banking crisis dummy. The z statistics are given in parenthesis and are based on IRLS variance estimators. One, two and three asterisks indicate significance levels of 10, 5 and 1 percent respectively.

Table 3 shows that the likelihood of banking crises is associated to a relative *decrease* in the level of activity of stock markets with respect to that of banks. All the financial structure determinants are negative and statistically significant (1 percent significance level). The consistency of the estimated associations holds independently of the specific failure-determinant model estimated. Therefore the evidence suggests that market-based financial systems *enhance* banking stability. Thus, it seems that financial structure matters to assess the stability of banking systems.

The second set of failure-determinants models focuses on the effects of the financial development determinants on fragility. I summarize these results in Table 4.

Table 4
Financial Development and Banking Crises
(FD specification)

Model	*Aggregate*	*Activity*	*Size*	*Efficiency*
Finance Aggregate (lagged)	-1.01*** (-3.31)			
Finance Activity (lagged)		-0.49*** (-3.34)		
Finance Size (lagged)			-0.36 (-1.57)	
Finance Efficiency (lagged)				-0.63*** (-4.05)
Banking Activity	-3.60*** (-3.07)	-4.33*** (-3.90)	-5.01*** (-4.20)	-3.74*** (-3.36)
Banking Size	5.23*** (3.93)	5.91*** (4.77)	6.47*** (5.01)	5.00*** (3.83)
Banking Concentration	1.41 (1.48)	0.60 (0.84)	1.25 (1.62)	1.47* (1.71)
Observations	339	431	411	371
LR-CHI2(4)	52.81***	54.15***	45.79***	57.30***
Prob > CHI2	0.000	0.000	0.000	0.000
Log Likelihood	-127.01	-163.41	-160.53	-135.18

Notes: The dependent variable is the banking crisis dummy. The z statistics are given in parenthesis and are based on IRLS variance estimators. One, two and three asterisks indicate significance levels of 10, 5 and 1 percent respectively.

Table 4 reports the outcomes associated with the financial-development specification. It shows that the likelihood of banking crises is associated with a relative *decrease* in the level of development of intermediaries and financial markets. All the financial development determinants are negative and most of them are statistically significant (1 percent significance level). Again, the consistency of the estimated associations holds independently of the specific failure-determinant model estimated. Thus the estimations suggest that financial development might enhance banking stability.

What effects may banking system features have on banking fragility? The estimations in the previous tables suggest that the indicators have *differentiated effects* on the likelihood of banking crises. Specifically, the size of the banking sector seems to *increase* it and banking credit activity seems to *reduce* it. In all cases, the estimations are consistent and significant. The evidence also suggests that banking concentration might increase banking fragility. However, in none of the estimated models is such variable significant. Here I should point out that some of these findings are counterintuitive.

I support the results with statistical tests. Specifically, we support the adequacy of the estimated failure-determinant models with likelihood-ratio tests (See Tables 3 and 4). In all cases, such tests reject the null hypothesis that all the parameters of the models are zero. Furthermore, according to comparisons of the log-likelihood indicators, the aggregate models may be the ones that best describe the individual effects of financial structure and development. This finding may not be surprising. However, I should emphasize that, for the moment, we cannot reject the possibility of omitted variable bias.

5. Econometric assessment of the joint effects of financial structure and development determinants

In this section, I report the outcomes of the sets of models used to assess the joint effects of the financial determinants on banking crises. I report the outcomes associated with the four estimations of the specification defined by equation (3). Furthermore we report the outcomes of the tests of omitted variable bias. Such outcomes will allow us to analyze the pertinence of the study of both, financial structure and development, jointly. Again, in all the regressions we have included the banking indicators as control variables and the lagged financial indicators as independent ones.

The third set of failure-determinants models focuses on the joint effects of the financial determinants on fragility. I summarize their results in Table 5.

Table 5
Financial Structure, Financial Development and Banking Crises (FSD specification)

Model	*Aggregate*	*Activity*	*Size*	*Efficiency*
Structure Aggregate (lagged)	-3.31*** (-4.55)			
Structure Activity (lagged)		-2.16*** (-3.97)		
Structure Size (lagged)			-2.26*** (-3.89)	
Structure Efficiency (lagged)				-1.05*** (-3.27)
Finance Aggregate (lagged)	3.64*** (3.40)			
Finance Activity (lagged)		1.65*** (2.94)		
Finance Size (lagged)			1.60*** (2.84)	
Finance Efficiency (lagged)				0.23 (0.76)
Banking Activity	-7.58*** (-4.95)	-7.71*** (-5.27)	-7.81*** (-5.37)	-3.90*** (-3.52)
Banking Size	4.64*** (3.39)	5.54*** (4.24)	5.84*** (4.33)	5.02*** (3.88)
Banking Concentration	1.38 (1.33)	0.73 (0.97)	1.20 (1.47)	1.06 (1.21)
Observations	339	431	411	371
LR-CHI2(5)	81.12***	73.38***	64.71***	69.39***
Prob > CHI2	0.000	0.000	0.000	0.000
Log Likelihood	-112.86	-153.80	-151.07	-129.13

Notes: The dependent variable is the banking crisis dummy. The z statistics are given in parenthesis and are based on IRLS variance estimators. One, two and three asterisks indicate significance levels of 10, 5 and 1 percent respectively.

Table 5 shows that the likelihood of banking crises is *inversely* associated to the levels of the financial structure indicators and *directly* associated to the ones of financial development. All the determinants are statistically significant (1 percent significance level). The consistency of the estimated associations holds independently of the failure-determinant model estimated. Both financial structure and financial development matter to explain banking stability. Thus the evidence suggests that in market-based and underdeveloped financial systems the likelihood of banking crises is reduced.

I should point out that these findings seem to *contradict* the ones of the previous section regarding the individual effects of financial development. Furthermore, they are counter-intuitive. It seems plausible to believe that this may occur due to a bias associated with the econometric specification of the models. I evaluate this possibility by using tests for omitted variables (See Table 6). Such tests reject the null hypothesis of irrelevant variables in the unrestricted models. Therefore, according to the tests, I should analyze *jointly* the effects of financial structure and financial development.

Table 6
Analysis of Specification Bias
(Omitted Variable Tests)

Model	*Aggregate*	*Activity*	*Size*	*Efficiency*
		Log Likelihood		
FS specification	119.92	158.77	155.68	129.43
FD specification	127.01	163.41	160.53	135.18
FSD specification	112.86	153.8	151.07	129.13
Omitted-Variables Likelihood Ratio (Unrestricted: FSD specification)				
LR-CHI2(1) (FS specification)	14.12***	9.94***	9.22***	0.60***
LR-CHI2(1) (FD specification)	28.30***	19.22***	18.92***	12.10***

Notes: We consider the financial-structure-and-development specification models as unrestricted and the financial-development and the financial-structure specification models as the restricted ones. One, two and three asterisks indicate significance levels of 10, 5 and 1 percent respectively.

The necessity to jointly analyze the determinants of banking crises means we have to re-examine the conclusions obtained in the previous section. Such conclusions may be consistent with the latter evidence if the financial development indicators are highly correlated with the financial structure ones; in other words, if there is multicollinearity between them. Fixed-effects (within) regressions confirm this intuition (See Appendix A). Thus the hidden fragility-enhancing effects of financial development can be discovered only when we account for the degree to which a financial system is based on intermediaries or markets.

Here we need to recall that multicollinearity is a sample phenomenon. A traditional procedure used to deal with it is to drop a variable in order to fit in a regression. However, we *do not* follow this practice to explain the likelihood of banking crises because of the results of the tests of omitted-variable bias. Indeed, it is worthy to recall that the consequences of the specification bias introduced by omitting a financial indicator may be worse than the ones introduced by multicollinearity.[15] Notice that omitted-variable bias induces the estimation of biased and inconsistent â estimators among other consequences.

I summarize by indicating that the evidence suggests that both the financial structure and financial development matter to assess the stability of banking systems. In particular, the assessments suggest that *banking stability is enhanced* in economies with market-based financial systems. Financial development reduces it. However this fragility-enhancing effect can be discovered only when we account for financial structure as well. Thus, financial structure and development *jointly* matter. Furthermore the size of the banking sector seems to *reduce* banking stability and its lending activity seems to *enhance* it.

Summary and discussion

The issue of how financial systems affect the likelihood of banking crises is not well understood. Such understanding may be essential to avoid banking crises and their associated costs. Here we have shown the results of an investigation developed to study such issue with data for 211 countries during the period 1990-2003. The investigation uses fixed-effects logit models for panel-data and likelihood tests to analyse such issues. I have aimed at clarifying the individual and joint effects of financial structure and development by controlling for the effects of certain banking system features.

[15] Statistically, the worst consequence of multicollinearity relates to the sensitivity of the â estimators and their standard errors to small changes in data. Thus the coefficients may not be estimated with great precision and accuracy.

The main research finding suggests that the financial structure and financial development *jointly* matter to assess the stability of banking systems. In particular, the assessments imply that *banking stability is enhanced in economies with market-based financial systems*. *Financial development reduces it.* However, this fragility-enhancing effect can only be discover when we account for financial structure. Furthermore, our findings show that the size of the banking sector seems to *reduce* banking stability and its lending activity seems to *enhance* it.

The study leads us to some interesting implications: The first one is that the hypothesis that financial structure does not have independent effects on banking performances deserves to be re-examined.[16] According to our findings, financial structure seems to affect the likelihood of banking crises. However, I must recognize that the scope of the financial indicators used in this study is a very narrow one. Legal and regulatory regimes, financial and monetary institutions also shape intermediation activities. We have not considered them into our investigation due to the lack of available data.

I believe that further studies on the relationship between financial structure and banking fragility should focus on these institutional features of the financial systems. Lender-of-last-resort activities, deposit insurance schemes and solvency regulations may change the behaviour of banks and the likelihood of banking crises. Currently, most of the discussions about how to avoid and manage crises deal with the institutional features that regulatory regimes should adopt. These discussions are particularly relevant in the context of institutions that can operate not only on a domestic, but also on a global scale.

The second implication of this study relates to the fragility enhancing effects of financial development. These effects are particularly well-known in developing economies. Financial development, termed as liberalization, frequently leads to financial crises in such economies (See Diaz-Alejandro, 1985). This consideration and our previous results, make us believe that regulation must play an in-advance role there. I think that regulations and supervised market-based oriented reforms should precede financial liberalization in order to enhance banking stability.[17]

[16] Demirguc-Kunt and Huizinga, (2001), conclude that financial structure per se appears to have no effects on bank margins, neither on bank profitability after controlling for both bank and market development. The idea about the irrelevance of financial structure has support in studies that have focused on the determinants of economic growth and investment. (See Levine, 2002 and Ndikumana, 2005, respectively). Among these studies, the panel-data study of Loayza and Ranciere (2006), views financial fragility and economic growth, as the short and long-term consequences of financial development.

[17] This statement is controversial. Usually, development economists propose bank-based reforms to encourage financial and economic development (See Fry, 1995). Among other arguments, they point out that banks are "better at mobilizing savings, identifying good investments and exerting sound corporate control" (Levine, 2002: 398).

However, this recommendation may not be implementable everywhere. Particularly in developed economies, it may be unfeasible. Usually, financial innovation arises there to avoid financial regulations (Cecchetti, 2008). Nevertheless, this situation does not imply that there are not opportunities to enhance stability. Indeed, the global financial crises that we are currently experiencing (2007-2008), may contribute to enhance financial stability. As I have mentioned, we cannot dismiss the possibility of bidirectional effects between financial development and banking crises.

We believe that further studies on the joint impact of financial structure and financial development may be necessary to clarify and evaluate the statements indicated above. It is our belief that such studies will reveal us further insights that may contribute to improve our understanding of the contracting process and of the functioning of intermediaries and markets. In particular I think that regulatory issues may be the most fruitful ones. Hopefully, results based on these investigations may have some relevance for enhancing the stability and performance of banking systems.

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Appendix A

Here I include the outcomes of the fixed-effects panel-data models that assess the relationships among the financial indicators. The regressions include constant terms to eliminate constant effects.

Table A.1
Financial Structure and Financial Development
Fixed-Effects (within) Regressions

	Regressor/Regressed Variables			
	Structure Aggregate	*Structure Activity*	*Structure Size*	*Structure Efficiency*
Finance Aggregate	1.12*** (52.22)			
Finance Activity		0.80*** (79.44)		
Finance Size			0.63*** (48.37)	
Finance Efficiency				0.86*** (61.62)
Constant	0.00 (0.38)	1.10*** (23.89)	1.00*** (27.84)	-6.71*** (-450.11)
Observations	990	1408	1376	1120
F	2726.87***	6310.95***	2339.85***	3796.83***
R^2 within	0.75	0.82	0.64	0.78
R^2 between	0.62	0.65	0.29	0.80
R^2 overall	0.61	0.70	0.35	0.77
Corr(u_i,Xb)	-0.58	-0.55	-0.61	-0.39
σ_u	1.19	1.29	1.09	0.98
σe	0.39	0.55	0.47	0.47
ρ	0.90	0.84	0.84	0.81
F (H_o: u_i=0)	52.98***	40.63***	37-13***	36.88***

Notes: The *t* statistics are given in parenthesis. One, two and three asterisks indicate significance levels of 10, 5 and 1 percent respectively.

Table A.1, shows that the financial structure indicators are positively and highly correlated to the financial development ones. All the associations are positive and statistically significant (1 percent significance level). The economic interpretation of these results is that *developed financial systems are associated to market-based ones*.

Appendix B
Table B.1
Recognised Banking Crises per Country (1980-2003)

Number	*Country*	*Years*	*Number*	*Country*	*Years*
1	Aruba		2	Andorra	
3	Afghanistan		4	Angola	1991-2003
5	Anguilla		6	Albania	1992
7	Netherlands Antilles		8	United Arab Emirates	
9	Argentina	1980-1982, 1989-1990, 1995-1997, 2001-2003	10	Armenia	1994-1996
11	American Samoa		12	Antigua and Barbuda	
13	Australia	1989-1992	14	Austria	
15	Azerbaijan	1995	16	Burundi	1994-2003
17	Belgium		18	Benin	1988-1990
19	Burkina Faso	1988-1994	20	Bangladesh	1986-1996
21	Bulgaria	1995-1997	22	Bahrain	
23	Bahamas, The		24	Bosnia and Herze-govina	1992-2003
25	Belarus	1995-2003	26	Belize	
27	Bermuda		28	Bolivia	1986-1988, 1994-2003
29	Brazil	1990, 1994-1999	30	Barbados	
31	Brunei	1983-1987	32	Bhutan	
33	Botswana	1994-1995	34	Central African Republic	1976-1992

Number	*Country*	*Years*	*Number*	*Country*	*Years*
35	Canada	1983-1985,	36	Switzerland	
37	Channel Islands		38	Chile	1976, 1981-1986,
39	China	1990-1999	40	Cote d'Ivoire	1998, 1989-1991
41	Cameroon	1987-1993, 1995-1998	42	Congo, Rep.	1992-2003
43	Colombia	1982-1987	44	Comoros	
45	Cape Verde	1993-2003	46	Costa Rica	1987-2003
47	Cuba		48	Cayman Islands	
49	Cyprus		50	Czech Republic	1989-2003
51	Germany	1976, 1978-1980	52	Djibouti	1991-1993
53	Dominica		54	Denmark	1987, 1988, 1989, 1990, 1991, 1992
55	Dominican Republic		56	Algeria	1990-1992
57	Ecuador	1980-1984, 1996-2003	58	Egypt, Arab Rep.	1980-1985, 1991-1995M
59	Eritrea	1993	60	Spain	1977-1985
61	Estonia	1992-1995, 1998	62	Ethiopia	1994, 1995,
63	Finland	1991, 1992, 1994, 1995	64	Fiji	
65	France	1994, 1995	66	Faeroe Islands	
67	Micronesia, Fed. Sts.		68	Gabon	1995-2003
69	United Kingdom	1974-1976, 1980-1999,	70	Georgia	1991
71	Ghana	1982-1989, 1997-2003	72	Guinea	1985, 1993-1994
73	Gambia, The	1985-1992	74	Guinea-Bissau	1995-2003
75	Equatorial Guinea	1983-1985	76	Greece	1991-1995
77	Grenada		78	Greenland	
79	Guatemala		80	Guam	

Number	*Country*	*Years*	*Number*	*Country*	*Years*
81	Guyana		82	Hong Kong, China	1982-1986, 1998
83	Honduras		84	Croatia	1996
85	Haiti		86	Hungary	1991-1995
87	Indonesia	1994, 1997-2003	88	Isle of Man	
89	India	1993-2003	90	Ireland	
91	Iran, Islamic Rep.		92	Iraq	
93	Iceland	1985, 1986, 1993,	94	Israel	1977-1983
95	Italy	1990-1995	96	Jamaica	1994-2000
97	Jordan	1989, 1990	98	Japan	1991-2003
99	Kazakhstan		100	Kenya	1985-1989, 1992-2003
101	Kyrgyz Republic	1990-1999	102	Cambodia	
103	Kiribati		104	St. Kitts and Nevis	
105	Korea, Rep.	1997-2003	106	Kuwait	1980-1989
107	Lao PDR	1990-1995	108	Lebanon	
109	Liberia	1991-1995	110	Libya	
111	St. Lucia		112	Liechtenstein	
113	Sri Lanka	1989-1993	114	Lesotho	1988-2003
115	Lithuania	1995-1996	116	Luxembourg	
117	Latvia	1995-2003	118	Macao, China	
119	Morocco	1980-1985	120	Monaco	
121	Moldova		122	Madagascar	
123	Maldives		124	Mexico	1981-1991, 1994-1997
125	Marshall Islands		126	Macedonia, FYR	1993-1994
127	Mali	1987-1989	128	Malta	
129	Myanmar	1996-2003	130	Mongolia	
131	Northern Mariana Islands		132	Mozambique	1987-1995
133	Mauritania	1984-1993	134	Montserrat	

Number	*Country*	*Years*	*Number*	*Country*	*Years*
135	Mauritius	1996	136	Malawi	
137	Malaysia	1985-1988, 1997-2003	138	Mayotte	
139	Namibia		140	New Caledonia	
141	Niger	1983-2003	142	Nigeria	1990-1999
143	Nicaragua	1986-1996	144	Netherlands	
145	Norway	1987-1993	146	Nepal	1988
147	New Zealand	1987-1990	148	Oman	
149	Pakistan		150	Panama	1988-1989
151	Peru	1983-1990	152	Philippines	1981-1987, 1998-2003
153	Palau		154	Papua New Guinea	1989-2003
155	Poland	1990-1999	156	Puerto Rico	
157	Korea, Dem. Rep.		158	Portugal	
159	Paraguay	1995-1999, 2001	160	French Polynesia	
161	Qatar		162	Romania	1990-2003
163	Russian Federation	1995-2003	164	Rwanda	1991-2003
165	Saudi Arabia		166	Sudan	
167	Senegal	1988-1991	168	Singapore	1982
169	Solomon Islands		170	Sierra Leone	1990-2003
171	El Salvador	1989	172	San Marino	
173	Somalia		174	Sao Tome and Principe	1980-1999
175	Suriname		176	Slovak Republic	1991-2003
177	Slovenia	1992-1994	178	Sweden	1991-1994
179	Swaziland	1995	180	Seychelles	
181	Syrian Arab Republic		182	Chad	1980-1989, 1992
183	Togo	1993-1995	184	Thailand	1983-1987, 1997-2003
185	Tajikistan	1996	186	Turkmenistan	

Number	*Country*	*Years*	*Number*	*Country*	*Years*
187	Timor-Leste		188	Tonga	
189	Trinidad and Tobago	1982-1993	190	Tunisia	1991-1995
191	Turkey	1982-1985, 1994, 2000-2003	192	Taiwan, China	1983-1984, 1995, 1998
193	Tanzania	1986-1999	194	Uganda	1994-2003
195	Ukraine	1997-1998	196	Uruguay	1981-1984, 2002-2003
197	United States	1984-1991	198	Uzbekistan	
199	St. Vincent and the Grenadines		200	Venezuela	1975-1989, 1994-1995
201	Virgin Islands		202	Vietnam	1997-2003
203	Vanuatu		204	West Bank and Gaza	
205	Samoa		206	Yemen, Rep.	1996-2003
207	Serbia and Montenegro		208	South Africa	1977, 1989-2003
209	Congo, Dem. Rep.	1980-1989, 1991-1992, 1994-2003	210	Zambia	1995
211	Zimbabwe	1995-2003			