Macro Financial Determinants of the Great Financial Crisis:Implications for Financial Regulation

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Abstract

By analysing the macro financial determinants of the Great Financial Crisis of 2007-2009 on 83 countries, we find that the probability of suffering the crisis in 2008 was larger for countries having higher levels of credit deposit ratio whereas it was lower for countries having higher levels of: i) net interest margin, ii) concentration in the banking sector, iii) restrictions to bank activities, iv) private monitoring. Our findings contribute to the ongoing discussion that can help policymakers calibrate new regulation, by achieving a reasonable trade-off between financial stability and economic growth.

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1. Introduction

As much as it was known that the Great Depression of the 1930s was the acid test for any reputable macroeconomic theory, the outbreak of the Great Financial crisis of 2007-2009 has shaken not only financial institutions, but also long-held beliefs and theories on how the regulation of finance should be structured.

In turn, ongoing financial regulatory reforms have sparked a vibrant debate among institutions, academics and practitioners. On the one hand, the Basel Committee, through its consultative document (BCBS, 2009), seems more focused on the stability of the financial system, arguing that the costs of the new regulation will be much lower than the relative benefits (BCBS 2010, MAG 2010). On the other hand, the banking industry argues that the new measures could put economic growth at risk imposing high costs on the financial intermediaries and, in turn, on economic systems (IIF, 2010). In the middle, some academics argue that the principles implicitly or explicitly subscribed by the Basel Committee may be questionable to secure more resilient financial systems (see, among others, Ferri, 2001; Barth, Caprio and Levine, 2004, 2006; Caprio, 2010).

Thus, a definitely crucial issue is to know the impact of the future regulation issued by policymakers upon this trade-off between costs and benefits. However, the question cannot be addressed without an analysis of the determinants of the financial crisis of 2007-2009. This is exactly the purpose of this paper. More precisely, by running cross-country regressions on the determinants of the probability for a country to be in crisis in 2008, as reported by Laeven and Valencia (2010), we investigate the macro and financial structure factors which contributed to the Great Crisis that broke out in 2007.

The financial indicators we employ in our analysis refer to the nine years that preceded the Great Financial crisis and not just to the most recent years before its outbreak. In fact, we firmly believe that the early signals of what happened in 2007-2009 date back to several years before it was so manifest. Therefore, the use of "dated variables" is justified by the fact that they contain information about the health of the financial system and, as a consequence, may necessarily be

linked with the crisis. Unfortunately, however, we do not have measures of the enforcement of regulation, even though Barth, Caprio and Levine (2011) cite numerous breakdowns in enforcement as major causes of the recent crisis.

Our results show that, first, countries with a higher credit/deposit ratio had higher probability to be in crisis in 2008. Next, a few macro determinants negatively impinged on the probability of crisis. Namely, such probability was lower for countries with a higher level of net interest margin, and/or a higher level of concentration in the banking sector, and/or more restrictions on bank activities, and/or higher level of private monitoring. In particular, net interest margin tends to be more significant the greater the importance of deposits, and to vary inversely with securitization. Banks such as those in Canada and Italy that had a large and stable deposit base likely paid less for funds (and so had a higher net interest margin) than those who had to rely on wholesale markets, which proved to be more volatile. Net interest margin will also tend to be lower for banking systems more extensively engaged in securitization, both directly as securitization fees displace interest earnings (and interest on the securities was accruing to off-balance sheet entities), and indirectly as securitization boosts the supply of credit from non-bank entities and, other things equal, lending rates will diminish.

Our empirical evidence can help policymakers calibrate new regulations, by achieving a reasonable trade-off between financial stability and economic growth. Specifically, new regulations should consider that, compared to the traditional credit risks, it is more difficult to evaluate the new risks, such as those emanating from the complex financial contracts so deeply entrenched in the originate to distribute model and playing a major role in the recent crisis. At the very least this suggests ending or reversing features that arbitrarily fosters securitization, such as ratings requirements, which by protecting fund managers who comply with them from lawsuits, encourages the purchase of securities with the requisite due diligence.

The remainder of the paper is structured as follows. Section II provides a review of the literature on this topic. Section III describes the data and variables used in the econometric specifications.

Section IV looks at the empirical results. Section V offers some robustness checks. Section VI concludes with some lessons and policy implication.

2. Literature Review

A crowded strand of literature has addressed the topic of the macro determinants of banking systems' strength and resilience to crises. However, it is worthwhile to underline that, to the best of our knowledge, none of the existing papers includes the Great Financial crisis of 2007-2009 in their analysis. Furthermore, the reader should be reminded that the seriousness of the 2007-2009 financial crisis was unprecedented – since the Great Depression of the 1930s – and, therefore, the guidance provided by previous contributions may be limited as previous crises are dwarfed by the recent one.

The closest paper to ours is Barth, Caprio and Levine (2004). Using their database on bank regulation and supervision in 107 countries to assess the relationship between specific regulatory and supervisory practices and banking-sector development, efficiency, and stability, they show that the likelihood of suffering a major crisis is greater the more countries: (1) restrict bank activities (or prevent or discourage diversification of income through non-traditional activities); (2) put limits on foreign bank entry/ownership; (3) or exacerbate moral hazard via a more generous deposit insurance scheme fragility. On the other hand, neither capital stringency nor official supervisory powers – which approximate pillars one and two, respectively of Basel II, is robustly linked with banking crises when controlling for other supervisory/regulatory policies; similarly, there is no significant association between private-sector monitoring and the likelihood of a banking crisis and only a weak positive relationship between government ownership and the likelihood of a crisis. Our work differs from theirs according to several dimensions. First, we use a different classification, based on Laeven and Valencia (2010), to identify countries as borderline crisis or systemic crisis in 2008. Second, we extend the set of macro financial indicators as possible explanatory variables of the probability to be in crisis in 2008. Third, we do not restrict the observations to a precise year

(for example 1999 as done by the already cited authors), rather we consider the mean from 1998 to 2006 of these financial factors to take into account the long-term evolution of the financial sector before the Great Crisis broke out in 2007.

Before the Great Financial crisis of 2007-2009, Demirguc-Kunt and Detragiache (1998) investigate the relationship between banking crises and measures aimed at increasing the level of financial liberalization in 53 countries during the period 1980-1995, though they did so with no data on regulation and supervision. They find that banking crises are more likely to occur in liberalized financial systems. Mehrez and Kaufmann (2000) employ a multivariate probit model for 56 countries from 1977 to 1997 to examine how the level of corruption (i.e. transparency) affects the likelihood of a financial crises. They report that, in a country where the government policy is characterized by lack of transparency, banks have incentives to raise credit above the optimal level, thus increasing the probability of a banking crisis.

On a cross-country analysis, Beck, Demirguc-Kunt and Levine (2006), using data on 69 countries from 1980 to 1997, study the impact of bank concentration, bank regulation, and national institution on the probability that a country can experience a systemic banking crisis. Besides the relationship between systemic banking crises and concentration, they also examine international differences in bank capital regulations, rules restricting bank entry, regulatory restrictions on bank activities and the overall institutional environment. They show that crises are less likely in economies characterized by: 1) more concentrated banking systems; 2) fewer regulatory restrictions on banks, (i.e. lower barriers to bank entry and fewer restrictions on bank activities); 3) national institutions that facilitate competition. Finally, Shehzad and De Hann (2009) analyze the impact of financial reform on systemic and non systemic banking crises in 85 countries, from 1973 to 2002, finding that certain types of financial reform reduce the likelihood of crisis.

After the Great Financial crisis of 2007-2009, moving to bank-level data, Beltratti and Stulz (2009) analyzed 98 large banks from 20 countries and investigated whether bank performance is related to bank-level governance, country-level governance, bank balance sheet and profitability

characteristics before the crisis, and country-level regulation. Their key results were: 1) banks that the market favoured in 2006 had especially poor returns during the crisis; 2) banks with more shareholder-friendly boards performed worse during the crisis; 3) banks in countries with stricter capital requirement regulations and with more independent supervisors performed better; 4) banks in countries with more powerful supervisors had worse stock returns; 5) large banks with more Tier 1 capital and more deposit financing at the end of 2006 had significantly higher returns during the crisis.

Additional contribution related to micro-level data is De Jonghe (2009). He investigates why some banks are better able to shelter themselves from the storm by analyzing the impact of revenue diversity of financial corporations on banking system stability. He shows that the shift to non-traditional banking activities, which generate commissions, trading and other non-interest income, increases individual banks risks and thus reduces the stability of the financial system.

3 Data and Variables

To identify the macro and financial structure factors contributing to the Great Crisis, we ran a cross-country regression on the determinants of the probability that a country will experience crisis in 2008 as reported by Laeven and Valencia (2010). Specifically, for 83 countries we estimate a battery of specifications going from simple probit (0 = no crisis; 1 = crisis), to ordered probit (0 = no crisis; 1 = borderline crisis; 2 = systemic crisis), to tobit (where the dependent variable is the ratio of financial support offered by the government to GDP). Moreover, we also ran an instrumental variables probit specification to take into account the potential endogeneity problem related to financial globalization indicator.

In the probit specification, we use the following dependent variable:

CRISIS = dummy equal to 1 if the country is classified as either borderline crisis or systemic crisis by Laeven and Valencia (2010) and 0 otherwise. The average of this variable is 0.23 with a standard deviation of 0.42 (see Table 1).

The independent variables used are the following:

NET_INTEREST_MARGIN = mean of the accounting value of the bank's net interest revenue, as a share of its interest-bearing assets, from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine, 2000). This variable measures the banking system orientation towards traditional activity. Indeed, if this variable decreases, the incentive for banks to look for other income sources increases (Beck, Demirgüç-Kunt and Levine, 2000). The average of this variable is 4.3% with a standard deviation of 2.4% (see Table 1).

CREDIT_DEPOSIT = mean value of the ratio of loans to deposits from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine; 2000). While a high loan-deposit ratio indicates high intermediation efficiency, a ratio significantly above one also suggests that private sector lending is funded with non-deposit sources, which could result in funding instability (Beck, Demirgüç-Kunt and Levine, 2000). However, it also could be true that the other sources of funding are in the form of retail bonds and so they might be as stable as deposits. This will likely depend on national specificities (such as in the case of Italy). Although the database does not allow us to tell apart whether the unstable liabilities hypothesis – linked to wholesale funding – or the relatively stable retail bond funding apply to any specific country, we suspect the former cases are more frequent than the latter. The average of credit deposit ratio is 102.2%, with a standard deviation of 38.6% (see Table 1).

CONCENTRATION = mean of assets of the three largest banks as a share of assets of all commercial banks, from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine, 2000). The average of this variable is 67.4% with a standard deviation of 18.9%.

RESTRICTION = mean value of the "Overall Restrictions" index reported in the three surveys by Barth, Caprio and Levine (2004). This index measures the degree to which banks face regulatory restrictions on their activities in: (a) securities markets, (b) insurance, (c) real-estate, and (d) owning shares in non-financial firms. For each of these four sub-categories, the value ranges from a 0 to 4, where a 4 indicates the most restrictive regulations on this

sub-category of bank activity. Thus, the index of overall restrictions can potentially range from 0 to 16. The average of this index is 7.4 with a standard deviation of 1.7 (see Table 1).

PRIVATE MONITORING = mean value of the "Private Monitoring" index reported in the three surveys by Barth, Caprio and Levine (2004). This index measures the degree to which regulations empower, facilitate, and encourage the private sector to monitor banks. It is composed of information on whether (1) bank directors and officials are legally liable for the accuracy of information disclosed to the public, (2) whether banks must publish consolidated accounts, (3) whether banks must be audited by certified international auditors, (4) whether 100% of the largest 10 banks are rated by international rating agencies, (5) whether off-balance sheet items are disclosed to the public, (6) whether banks must disclose their risk management procedures to the public, (7) whether accrued, though unpaid interest/principal enter the income statement while the loan is still non-performing (8) whether subordinated debt is allowable as part of capital, and (9) whether there is no explicit deposit insurance system and no insurance was paid the last time a bank failed. The private monitoring index has a maximum value of 9 and a minimum value of 0, where larger numbers indicate greater regulatory empowerment of private monitoring of banks. This index can be seen as a measure of Basel Pillar 3. The average of this index is 8.2 with a standard deviation of 1.3 (see Table 1).

COST_INCOME = mean value of total costs as a share of total income of all commercial banks from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine; 2000). This is a measure of bank efficiency with higher ratios indicating lower levels of cost efficiency. The average of this variable is 67.7% with a standard deviation of 14.9% (see Table 1).

Z-SCORE = mean value bank z-score from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine; 2000). The z-score is the ratio of return on assets plus capital-asset-ratio to the standard deviation of return on assets. As a higher z-score indicates that the bank is more

stable, this index can be seen as the inverse of the probability of insolvency. The average of this variable is 11.3 with a standard deviation of 6.6 (see Table 1).

ROA = mean of average return on assets (net income/total assets) from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine, 2000). This variable measures the banking system profitability, but it is not influenced by leverage. The average ROA is 1% with a standard deviation of 1.1%[2].

ROE = mean of average return on equity (net income/total equity) from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine, 2000). This variable measures the banking system profitability. The average ROE is 10.7% with a standard deviation of 10.1%.

CAPITAL = mean value of the "Capital Regulation" index reported in the three surveys by Barth, Caprio and Levine (2004). This index includes information on (1) the extent of regulatory requirements regarding the amount of capital banks must hold and (2) the stringency of regulations on the source of funds that count as regulatory capital can include assets other than cash or government securities, borrowed funds, and whether the regulatory/supervisory authorities verify the sources of capital. Large values indicate more stringent capital regulations and it can be considered as a proxy of Basel Pillar I. The average of this index is 6.2 with a standard deviation of 1.5 (see Table 1).

ENTRY = mean value of the "Entry Requirements" index reported in the three surveys by Barth, Caprio and Levine (2004). This index essentially counts the number of requirements for a banking license: (1) draft by-laws; (2) intended organizational chart; (3) financial projections for first three years; (4) financial information on main potential shareholders; (5) background/experience of future directors; (6) background/experience of future managers; (7) sources of funds to be used to capitalize the new bank; and (8) market

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[2] The negative numbers for the minimum values of ROA and ROE depend on the inclusion in the sample of some countries suffering a systemic financial crises during 1998-2006: Argentina, Korea, Rep., Japan , Thailand and Uruguay.

differentiation intended for the new bank. Thus, this index is a proxy for the hurdles that entrants have to overcome to get a license. The average of this index is 7.4 with a standard deviation of 0.9 (see Table 1).

SUPERVISION = mean value of the "Official Supervisory" index reported in the three surveys by Barth, Caprio and Levine (2004). This index measures the degree to which the country's commercial bank supervisory agency has the authority to take specific actions. It is composed of information on many features of official supervision: (1) does the supervisory agency have the right to meet with external auditors about banks? (2) are auditors required to communicate directly to the supervisory agency about elicit activities, fraud, or insider abuse? (3) can supervisors take legal action against external auditors for negligence? (4) can the supervisory authority force a bank to change its internal organizational structure? (5) are off-balance sheet items disclosed to supervisors? (6) can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? (7) can the supervisory agency suspend the directors' decision to distribute: a) dividends? b) bonuses? c) management fees? (8) can the supervisory agency supersede the rights of bank shareholders-and declare a bank insolvent? (9) can the supervisory agency suspend some or all ownership rights? (10) can the supervisory agency: a) supersede shareholder rights? b) remove and replace management? c) remove and replace directors? The official supervisory index has a maximum value of 14 and a minimum value of 0, where larger numbers indicate greater power. It can be seen as a measure of Basel pillar 2. The average of this index is 10.9 with a standard deviation of 2.3 (see Table 1).

INT_DEBT_ISS_GROSS_GDP = mean of the gross flow of international bond issues, relative to GDP, from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine, 2000). This variable measures the degree to which a country's financial system is interlinked with international

financial markets. The average of international debt issues is 21.9% with a standard deviation of 25.8% (see Table 1).

For all estimates we exclude the first 25% of the sample of countries in terms of Credit/GDP, thus dropping those countries with a Credit/GDP ratio below 14.4%.

The final data set covers 83 countries, with OECD countries as well as many non-OECD and developing countries.

4 Empirical Evidence

4.1 Probit model

As the base specification, we estimated the following probit model in which the dependent variable is *CRISIS* (dummy equal to 1 if the country is classified as crisis and 0 otherwise):[3]

$$CRISIS = \alpha + \beta_1 \; NET\_INTEREST\_MARGIN + \beta_2 \; CREDIT\_DEPOSIT + \beta_3 \; CONCENTRATION +$$

$$\beta_4 \; RESTRICTION + \beta_5 \; PRIVATE \; MONITORING + \varepsilon \tag{1}$$

Specification 1 in Table 2 shows the results. First, the coefficient of *NET_INTEREST_MARGIN* is negative and statistically significant. This indicates that countries with a higher level of net interest margin had a lower probability to be in crisis in 2008; higher net interest income is associated with less securitization, and also might be picking up the impact of competition (e.g. less competitive systems such as Australia and Canada survived the crisis quite well, though this result might be related to other features of their regulatory or institutional settings as well). Indeed, a higher level of net interest margin represents a strong incentive for banks to undertake traditional activities (e.g. loans), instead of riskier non-traditional activities (e.g. securities trading). Second, the coefficient of *CREDIT_DEPOSIT* is positive and statistically significant. This indicates that countries with a

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[3] All the regressions are estimated with heteroschedasticity robust standard errors.

higher credit/deposit ratio had a higher probability to be in crisis in 2008. As a matter of fact, a ratio significantly above one suggests that bank lending is funded with non-deposit sources. While some of the other sources may be as stable as customer deposits – i.e. retail bonds funding – several of these sources alternative to retail deposits can prove highly volatile, such as in the case of interbank or money market loans. Thus, considering that the 2007-09 crisis featured a dramatic drop in the availability of wholesale funding, our evidence suggests that in most of the countries the alternative funding sources were of the volatile type. Moreover, since non-deposit sources (e.g. wholesale funding) are typically more expensive, higher credit/deposit ratio is associated with lower net interest margin and, as a consequence, with a higher probability of crisis. Third, the coefficient of *CONCENTRATION* is negative and statistically significant. This indicates that countries with a higher level of concentration in the banking sector had lower probability to be in crisis in 2008. In truth, economic theory provides conflicting predictions about the relationship between concentration and stability. In particular, there are two different views in the literature. On the one hand, the charter value hypothesis (e.g. Allen, Gale 2000a; 2000b; 2004b) argues that concentration enhances stability. On the other hand, optimal contracting hypothesis (Boyd, De Nicolo; 2005) argues the opposite. However, our result is in line with the empirical evidence provided by Beck, Demirgüç-Kunt and Levine (2006) who find that crises are less likely in economies with more concentrated banking systems. Fourth, the coefficient of *RESTRICTION* is negative and statistically significant. This indicates that countries with more restrictions on bank activities had lower probability to be in crisis in 2008. In other words, regulatory-induced specialization in the banking sector enhances financial stability[4]. Fifth, the coefficient of *PRIVATE MONITORING* is negative and statistically significant, though previously evidence of a relationship between private monitoring and stability was hard to find. This indicates that countries with a higher level of private

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[4] The reader should bear in mind that our results pertain to the extreme financial crisis of 2007-09 and generalizing them to less extreme crisis cases may be inappropriate. The same consideration applies to the counter-intuitive result, showed hereinafter, that a higher level of Capital increases the probability of crisis.

monitoring had a lower probability to be in crisis in 2008. This finding is in line with the goal of the third pillar of the Basel II Capital Accord (Barth, Caprio and Levine; 2004)[5].

The results in model 1 show high resilience when we include the other independent variables from model 2 to model 9. Moreover, measures of banking efficiency (cost-income), stability (z-score), profitability (ROA and ROE) and the log of GDP are never significant at the conventional levels. When controlling for the other variables in the base specification of model 1, the coefficients of CAPITAL and ENTRY turn out positive and significant[6]. With regard to CAPITAL, this suggests that countries with a higher level of capital restriction had a higher probability to be in crisis in 2008. This finding is clearly at odds with the goal of the first pillar of the Basel II Capital Accord. However, one lesson of the 2008 crisis is that capital adequacy was almost irrelevant. For example, Northern Rock got in trouble just few weeks after the bank had announced plans to return excess capital to shareholders. On the other hand, the importance of capital in lowering risk taking by banks could work in some specific circumstances. For instance, Laeven and Levine (2010), combining the Bankscope data with the regulatory database, find that higher capital does lead to safer banks when there is a strategic owner, but when ownership is highly diversified, higher capital is associated with more risk taking. Indeed, when there is no strategic (large) owner, then everyone free rides and wants to go for the higher return. On the contrary, when a strategic owner has control rights, which is like a high franchise value, that keeps the banks more conservative, just as some concentrated-ownership banks adopted the practice of plowing more bonuses into deferred equity to keep managers more risk averse.

With regard to ENTRY, the result means that a country with a higher level of entry restriction had a higher probability to be in crisis in 2008. This result is in accordance with the mainstream view that entry restrictions build inefficiency and, hence, instability. It should be also noted that this result is not in contrast with the role of concentration. Indeed, Demirgüç-Kunt and Levine (2006) find that

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[5] This specification is robust to a Montecarlo simulation with 100 replications.
[6] None of these two variables showed significant if regressed individually against the dependent variable.

competition reduces fragility when controlling for concentration. Finally, the regulatory variable SUPERVISION is not significant at the conventional levels.

Going back to the base specification, it is worthwhile assessing also the quantitative importance of the various determinants. Using a dprobit method, column 1' in Table 2b shows that the two most important regressors − respectively among the continuous independent variables (NET_INTEREST_MARGIN, CREDIT_DEPOSIT and CONCENTRATION) and among the discrete independent variables (RESTRICTION and PRIVATE MONITORING) are NET_INTEREST_MARGIN and RESTRICTION. A marginal change in the former (latter) associates with a 4.4% (7.9%) lower probability of crisis.

4.2 Probit instrumental variables model

Up to here we have not included the variable INT_DEBT_ISS_GROSS_GDP measuring the degree to which a country's financial system is interlinked with international financial markets. This is, of course, an important variable to consider especially in view of the fact that international contagion was one of the chief channel to spread the crisis worldwide. However, the inclusion of this independent variable raises problems of endogeneity. Indeed, there is an extensive literature studying the possibility that the extent of financial globalization of a country depends not only on its level of development and on its policies but is influenced by deeper fundamental factors. Just to quote a few authors, this is one of the chief points made by Acemoglu and Johnson (2005), Collins (2005), Faria and Mauro (2005), Kose et al. (2006), Spiegel (2008), Tytell and Wei (2005), Wei (2006). Following this literature, to avoid biases in our empirical analysis it is important that we control for this endogeneity when we include the financial globalization variable in our regressions. The most common way used in the literature is the method of instrumental variables (IV) to solve this type of endogeneity problems among the dependent and the independent variables. Thus, we

use an instrumental variables probit model measuring the probability of a crisis in 2008[7]. The procedure estimates simultaneously the following two equations:

$$INT\_DEBT\_ISS\_GROSS\_GDP = \alpha + \gamma_1 \; NET\_INTEREST\_MARGIN + \gamma_2 \; CREDIT\_DEPOSIT + \gamma_3$$

$$CONCENTRATION + \gamma_4 \; RESTRICTION + \gamma_5 \; PRIVATE \; MONITORING + \gamma_6 \; LEGAL \; ORIGIN -$$

$$BRITISH + \gamma_7 \; LEGAL \; ORIGIN - FRENCH + \gamma_8 \; LEGAL \; ORIGIN - SOCIALIST + \gamma_9 \; LEGAL$$

$$ORIGIN - GERMAN + \gamma_{10} \; ETHNIC \; FRACTIONALIZATION + \gamma_{11} \; RELIGION$$

$$FRACTIONALIZATION + \gamma_{12} \; LANGUAGE \; FRACTIONALIZATION + \varepsilon_2 \tag{2}$$

$$CRISIS = \alpha + \beta_1 \; INT\_DEBT\_ISS\_GROSS\_GDP\_IV + \beta_2 \; NET\_INTEREST\_MARGIN + \beta_3$$

$$CREDIT\_DEPOSIT + \beta_4 \; CONCENTRATION + \beta_5 \; RESTRICTION + \beta_6 \; PRIVATE \; MONITORING$$

$$+ \varepsilon_3 \tag{3}$$

In equation (2), the procedure estimates INT_DEBT_ISS_GROSS_GDP with all variables in equation (3) plus legal origins (British, French, Socialist and German) taken from La Porta et al. (1997 and following updates) and ethnic, religious and language fractionalization taken from Alesina et al. (2003). In equation (3), the procedure uses the coefficient of INT_DEBT_ISS_GROSS_GDP from equation (2) and the other independent variables to estimate the probability to be in crisis in 2008 (the dependent variable is a dummy which equals 1 if the country is classified as crisis and 0 otherwise). Our econometric strategy was influenced mainly by the cited papers.

From Table 3, we can see that the results obtained with the probit specification remain almost unchanged as INT_DEBT_ISS_GROSS_GDP_IV is not significant. The only difference is that *CONCENTRATION* is no longer significant in this specification (with a p-value of 13%). As

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[7] in STATA, the ivprobit command implements Full Information Maximum Likelihood to estimate the binary and continuous parts of the model simultaneously which will yield consistent standard-errors.

regards the IV approach, the correlation coefficient between the two equations (rho) equals .86. The likelihood ratio test for whether this is significantly different from zero is reported in the last line of the output. In this case the p-value is 0.0028. The significance of this correlation coefficient confirms that the INT_DEBT_ISS_GROSS_GDP variable is endogenous[8].

5. Robustness Checks

As robustness checks, we estimate two different specifications: ordered probit and tobit.

5.1 Ordered Probit Model

As first robustness check, we estimate the following ordered probit model:

$$ORDERED\_CRISIS = \alpha + \beta_1 \ NET\_INTEREST\_MARGIN + \beta_2 \ CREDIT\_DEPOSIT + \beta_3$$

$$CONCENTRATION + \beta_4 RESTRICTION + \beta_5 \ PRIVATE \ MONITORING + \varepsilon_1 \tag{4}$$

the only difference with respect to the probit model being the dependent variable which is now *ORDERED_CRISIS* (dummy equal to 1 if the country is classified as borderline crisis, equal to 2 if the country is classified as systemic crisis and 0 otherwise). The average of this variable is 0.36 with a standard deviation of 0.71 (see Table 1).

From Table 4, we can see that even with the ordered probit specification the results obtained with the probit model remain unchanged.

5.2 Tobit model

As a second robustness check, we estimate the following tobit model:

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[8] Using the same set of instruments, the hypothesis of endogeneity was rejected for all the other regressors.

$$CRISIS\_COST\_GDP = \alpha + \beta_1 \ NET\_INTEREST\_MARGIN + \beta_2 \ CREDIT\_DEPOSIT + \beta_3$$

$$CONCENTRATION + \beta_4 RESTRICTION + \beta_5 \ PRIVATE \ MONITORING + \varepsilon_1 \qquad\qquad (5)$$

the only difference with respect to the probit model being the dependent variable which is now *CRISIS_COST_GDP* (a variable that measures the cost of public support to the financial system as a ratio to GDP). The average of this variable is 1.11 with a standard deviation of 3.20 (see Table 1). From Table 5, we can see that the results obtained with the probit model remain almost unchanged. The only difference is that *PRIVATE MONITORING* is no longer significant at the conventional level (with a p-value of 11%).

6. Conclusions

Although there is growing consensus that regaining stability - today as much as it did in the 1930s - requires better regulation of the marketplace (D'Apice, Ferri; 2010), there is little consensus as to what 'better' would entail. In previous decades, banking systems underwent deep transformation progressively moving away from a type of banking centred on personal relationships to hinge on more standardised and impersonal approaches. The change, designed to reach unprecedentedly high returns, theorised by some consultants and academics, prescribed gearing the banks with financial markets and modifying the bank business model. This had a notable impact on the transformation of some banking systems – those that shifted toward a new business model (e.g. originate to distribute, OTD) - , while others remained firmly fastened to a traditional business model (e.g. originate to hold, OTH). The results in this paper show that a more traditional banking system had a lower probability to be in crisis in 2008. Thus, a return to an old style banking, like the one prevailing during the Quite Period in the US after the Great Depression (Gorton, 2009), is being considered in some quarters.

The results we reached in this paper provide fuel to that discussion. In particular we touched upon five important aspects. First, countries with a higher level of net interest margin had a lower

probability to be in crisis in 2008. Indeed, a higher level of net interest margin represents a strong incentive for banks to undertake traditional activities (e.g. loans) instead of riskier non-traditional activities (e.g. securities trading). Second, countries with a higher credit/deposit ratio were more likely unstable, unless the additional funding was provided via retail sources (such as through retail bonds like in Italy). As a matter of fact, a ratio significantly high suggests that bank lending is funded with non-deposit sources, which could result in funding instability. Moreover, since non-deposit sources (e.g. wholesale funding) are typically more expensive, higher credit/deposit ratio is associated with lower net interest margin and, as a consequence, with a higher probability of crisis. Third, countries with a higher level of concentration in the banking sector had a lower probability to be in crisis in 2008. Indeed, a more concentrated banking system implies that the bank's charter value is higher and, as a consequence, the incentive for bank owners and managers to take excessive risk is lower. Apparently, the beneficial bank's charter value effect on risk taking seems to have prevailed – in our sample of countries – on the possible additional detrimental effect passing through the impact of the level of competition on manager compensation schemes. Compensation policy seemed, in fact, to be a factor in the crisis; countries with a lot of merger activity in banking tended to have compensation systems that favored growth of banks' balance sheets (rewarding return without much attention if any to risk), and these countries seemed to have the most severe problems in the crisis (see Barth, Caprio, and Levine, 2011). Fourth, countries with stiffer restrictions on bank activities were less likely unstable in 2008. This finding might be interpreted as a sort of regulatory-induced specialization in the banking sector that enhances financial stability. However, it is important to note that it contrasts with earlier studies (Barth, Caprio, and Levine, 2006), and might in fact be a proxy for enforcement – countries that cared about imposing activity restrictions might have been enforcing other regulations, and thus it might be enforcement rather than the restrictions that matter. Unfortunately we do not have good direct measures of enforcement to test this interpretation. Fifth, countries with a higher level of private monitoring had a lower probability to be in crisis in 2008 (this in contrast to earlier research – Barth, Caprio, and Levine,

2006 - which found private monitoring important in a variety of areas but with no significance for stability).

Our empirical evidence can help policymakers calibrate new regulations, by achieving a reasonable trade-off between financial stability and economic growth. At present governments are moving in the direction of higher capital requirements in response to the vulnerabilities highlighted in the paper. This requires some care. Recent years saw both countries with traditional approaches to banking (Ireland, Spain, Eastern Europe) and those that moved to a more securitized approach (the U.S) plunge into serious crisis. The fact that capital was mostly not significant should give regulators pause: like doctors who used leeches (and thought that they were helping patients), or econometricians who go into a dark room looking for a black cat that is not there and scream 'I've got it,' they may be settling for a popular cure in lieu of one that actually works. Ending those features of the broader regulatory framework that artificially boosts securitization, and divulging and verifying more information about risk taking in banking (so that market monitoring might work) are suggested. Thus, the Authorities should carefully consider the macro financial determinants of the Great Crisis, especially now that a significant increase in minimum bank capitalisation is being decided within the framework of Basel 3.

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Table 1: Summary Statistics

Independent variable are calculated for each country as average over 1998-2006. Detailed definitions are given in the Appendix.

	Mean	Std.	Min	Max	Obs
Dependent Variables:					
CRISIS (probit model)	0.23	0.42	0.00	1.00	83
CRISIS ORDERED (ordered probit model)	0.36	0.71	0.00	2.00	83
CRISIS_COST_GDP (tobit model)	1.11	3.20	0.00	18.50	83
Independent Variables:					
NET_INTEREST_MARGIN	4.3%	2.4%	0.9%	12.8%	83
CREDIT_DEPOSIT	102.2%	38.6%	35.8%	248.8%	83
CONCENTRATION	67.4%	18.9%	24.8%	100.0%	83
RESTRICTION	7.4	1.7	3.3	12.0	83
PRIVATE MONITORING	8.2	1.3	5.5	11.0	83
COST_INCOME	67.7%	14.9%	29.8%	108.5%	83
Z-SCORE	11.3	6.6	4.2	39.2	81
ROA	1.0%	1.1%	-1.8%	4.4%	83
ROE	10.7%	10.1%	-26.6%	50.1%	83
CAPITAL	6.2	1.5	3.0	10.0	83
ENTRY	7.4	0.9	3.7	8.0	83
SUPERVISION	10.9	2.3	5.0	14.3	82
INT_DEBT_ISS_GROSS_GDP	21.4%	25.6%	0.0%	146.0%	73

Table 2: Probit Specification

Probit estimation with dependent variable = CRISIS (dummy equal to 1 if the country is classified as either borderline crisis or systemic crisis by Laeven and Valencia and 0 otherwise). *, ** and *** indicate statistical significance of the parameters at 10, 5 and 1 percent significance level respectively. Robust standard errors appear in parenthesis. Summary statistics are given in Table 1 and definitions are given in the Appendix.

Variables	Probit 1	Probit 2	Probit 3	Probit 4	Probit 5
NET_INTEREST_MARGIN	-0.241**	-0.232**	-0.251**	-0.27**	-0.24**
	(0.112)	(0.117)	(0.115)	(0.116)	(0.111)
CREDIT_DEPOSIT	0.017***	0.017***	0.017***	0.018***	0.017***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
CONCENTRATION	-0.024**	-0.023**	-0.024**	-0.024**	-0.023*
	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
RESTRICTION	-0.43***	-0.434***	-0.461***	-0.413***	-0.435***
	(0.125)	(0.126)	(0.124)	(0.125)	(0.128)
PRIVATE MONITORING	-0.386**	-0.377**	-0.408**	-0.36**	-0.389**
	(0.173)	(0.166)	(0.176)	(0.165)	(0.181)
COST_INCOME		-0.004			
		(0.011)			
Z-SCORE			-0.019		
			(0.024)		
ROA				0.221	
				(0.185)	
ROE					-0.004
					(0.02)
CONSTANT	5.971***	6.132***	6.712***	5.536***	6.05***
	(2.093)	(2.231)	(2.061)	(1.979)	(2.251)
Number of observations	83	83	81	83	83
Pseudo R-square	0.418	0.418	0.402	0.426	0.418
Wald Chi-square (p-value)	0	0	0	0	0

Table 2 (cont): Probit Specification

Probit estimation with dependent variable = CRISIS (dummy equal to 1 if the country is classified as either borderline crisis or systemic crisis by Laeven and Valencia and 0 otherwise). *, ** and *** indicate statistical significance of the parameters at 10, 5 and 1 percent significance level respectively. Robust standard errors appear in parenthesis. Summary statistics are given in Table 1 and definitions are given in the Appendix.

Variables	Probit 6	Probit 7	Probit 8	Probit 9	Probit 1'
NET_INTEREST_MARGIN	-0.257**	-0.248**	-0.254**	-0.246**	-0.044**
	(0.12)	(0.119)	(0.12)	(0.109)	
CREDIT_DEPOSIT	0.018***	0.016***	0.021***	0.017***	0.003***
	(0.005)	(0.005)	(0.005)	(0.005)	
CONCENTRATION	-0.025**	-0.022*	-0.023**	-0.023*	-0.004**
	(0.012)	(0.012)	(0.012)	(0.012)	
RESTRICTION	-0.466***	-0.458***	-0.498***	-0.444***	-0.079***
	(0.121)	(0.119)	(0.13)	(0.133)	.
PRIVATE MONITORING	-0.39**	-0.39**	-0.387**	-0.415**	-0.070**
	(0.184)	(0.178)	(0.171)	(0.169)	
CAPITAL	0.232*				
	(0.129)				
ENTRY		0.364*			
		(0.206)			
SUPERVISION			0.158		
			(0.101)		
LOG GDP				0.038	
				(0.082)	
CONSTANT	4.857**	3.537	4.376*	6.077***	
	(2.398)	(2.593)	(2.538)	(2.085)	
Number of observations	83	83	82	82	83
Pseudo R-square	0.454	0.438	0.441	0.417	0.417
Wald Chi-square (p-value)	0	0	0	0	0

Table 3: Instrumental Variables Specification

We estimate simultaneously the following two equations: (1) *INT_DEBT_ISS_GROSS_GDP = α+ γ_1 NET_INTEREST_MARGIN + γ_2 CREDIT_DEPOSIT + γ_3 RESTRICTION + γ_4 PRIVATE MONITORING + γ_5 LEGAL ORIGIN – BRITISH + γ_6 LEGAL ORIGIN – FRENCH + γ_7 LEGAL ORIGIN – SOCIALIST + γ_8 LEGAL ORIGIN – GERMAN + γ_9 ETHNIC FRACTIONALIZATION + γ_{10} RELIGION FRACTIONALIZATION + γ_{11} LANGUAGE FRACTIONALIZATION + ε_1* ; (2) *CRISIS = α + β_1 INT_DEBT_ISS_GROSS_GDP + β_2 NET_INTEREST_MARGIN + β_3 CREDIT_DEPOSIT + β_4 RESTRICTION + β_5 PRIVATE MONITORING + ε_2*. In the equation (1) we instrument INT_DEBT_ISS_GROSS_GDP with all variables in the equation (2) plus legal origins (British, French, Socialist, German) and ethnic, religious and language fractionalization. In the equation (2) we use the coefficient of INT_DEBT_ISS_GROSS_GDP from equation 1 and the other independent variables to estimate the probability to be in crisis in 2008 (the dependent variable is a dummy equals to 1 if the country is classified as crisis and 0 otherwise). *, ** and *** indicate statistical significance of the parameters at 10, 5 and 1 percent significance level respectively. Robust standard errors appear in parenthesis. Summary statistics are given in Table 1 and definitions are given in the Appendix.

Variables	IV Probit
INT_DEBT_ISS_GROSS_GDP_IV	-0.019
	(0.014)
NET_INTEREST_MARGIN	-0.176**
	(0.081)
CREDIT_DEPOSIT	0.018***
	(0.005)
CONCENTRATION	-0.017
	(0.012)
RESTRICTION	-0.366***
	(0.122)
PRIVATE MONITORING	-0.387***
	(0.138)
CONSTANT	5.664**
	(2.347)
Number of observations	71
Wald Chi-square (p-value)	0
Wald test of exogeneity (p-value)	0

Table 4: Ordered Probit Specification

Ordered probit estimation with dependent variable = ORDERED_CRISIS (dummy equal to 1 if the country is classified as borderline crisis, equal to 2 if the country is classified as systemic crisis by Laeven and Valencia and 0 otherwise. *, ** and *** indicate statistical significance of the parameters at 10, 5 and 1 percent significance level respectively. Robust standard errors appear in parenthesis. Summary statistics are given in Table 1 and definitions are given in the Appendix.

Variables	Ordered Probit
NET_INTEREST_MARGIN	-0.253**
	(0.103)
CREDIT_DEPOSIT	0.018***
	(0.005)
CONCENTRATION	-0.032***
	(0.012)
RESTRICTION	-0.472***
	(0.124)
PRIVATE MONITORING	-0.325**
	(0.157)
P-value	0
Pseudo R-square	0.368
Number of observations	83

Table 5: Tobit Specification

Tobit estimation with left-censoring limit = 0 and dependent variable = CRISIS_COST_GDP (variable as provided by Laeven and Valencia that measures the cost of public support to the financial system in term of GDP. *, ** and *** indicate statistical significance of the parameters at 10, 5 and 1 percent significance level respectively. Robust standard errors appear in parenthesis. Summary statistics are given in Table 1 and definitions are given in the Appendix.

Variables	Tobit
NET_INTEREST_MARGIN	-1.494**
	(0.702)
CREDIT_DEPOSIT	0.108***
	(0.037)
CONCENTRATION	-0.196**
	(0.096)
RESTRICTION	-2.772***
	(0.972)
PRIVATE MONITORING	-1.565
	(0.968)
CONSTANT	32.019***
	(10.362)
P-value	0
Pseudo R-square	0.189
Number of observations	83

Appendix: Variable Definitions and Sources

Dependent variable probit model: CRISIS	Dummy equal to 1 if the country is classified as either borderline crisis or systemic crisis by Laeven and Valencia (2010) and 0 otherwise.
Dependent variable ordered probit model: ORDERED_CRISIS	Dummy equal to 1 if the country is classified as borderline crisis, equal to 2 if the country is classified as systemic crisis and 0 otherwise (source: Laeven and Valencia; 2010).
Dependent variable tobit model:CRISIS_COST_GDP	Variable as provided by Laeven and Valencia (2010) that measures the cost of public support to the financial system in term of GDP.

Indipendent variables:

NET INTEREST MARGIN	Mean of the accounting value of bank's net interest revenue, as a share of its interest-bearing assets, from 1998 to 2006 (source Beck, Demirgüç-Kunt and Levine; 2000)
BANK CREDIT / BANK DEPOSITS	Mean value of the ratio of loans to deposits from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine; 2000).
CONCENTRATION	Mean of assets of three largest banks as a share of assets of all commercial banks, from 1998 to 2006 (source Beck, Demirgüç-Kunt and Levine; 2000).
RESTRICTION	Mean value of the "Overall Restrictions" index reported in the three surveys (source Barth, Caprio and Levine; 2004).
PRIVATE MONITORING	Mean value of the "Private Monitoring" index reported in the three surveys (source: Barth, Caprio and Levine, 2004).
COST_INCOME	Mean of total costs as a share of total income of all commercial banks, from 1998 to 2006 (source Beck, Demirgüç-Kunt and Levine; 2000).
Z-SCORE	Mean value bank z-score from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine; 2000).
ROE	Mean of average return on assets (net income/total equity), from 1998 to 2006 (source Beck, Demirgüç-Kunt and Levine; 2000).
ROA	Mean of average return on assets (net income/total assets), from 1998 to 2006 (source Beck, Demirgüç-Kunt and Levine; 2000).
CAPITAL	Mean value of the "Capital Regulation" index reported in the three surveys (source Barth, Caprio and Levine; 2004).
ENTRY	Mean value of the "Entry Requirements" index reported in the three surveys (source Barth, Caprio and Levine; 2004).
SUPERVISION	Mean value of the "Official Supervisory" index reported in the three surveys (source: Barth, Caprio and Levine, 2004).
INT_DEBT_ISS_GROSS_GDP	Mean of the gross flow of international bond issues, relative to GDP, from 1998 to 2006 (source: Beck, Demirgüç-Kunt and Levine; 2000).