Strength of market discipline: impact on the solvency of European banks

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Abstract

The paper investigates the effectiveness of market discipline to influence the risk taking of European banks. Market discipline is defined as a component related to a number of factors that are 1) the extent of the government bail-out policies on banks inside and outside the safety net 2) the proportion of uninsured liabilities and 3) the disclosure policy of the bank which also depends on its corporate governance. A dynamic panel model is adapted to 150 listed individual banks of 13 European countries using simultaneous regression of both capital buffer and risk position. The results suggest that implicit government guaranties help to increase risk taking of supported banks and decrease the disciplining impact of uninsured liabilities. However, disclosure of information together with the concentration of the ownership play a crucial role in enhancing the default risk of European banks. Findings suggest that strengthening market discipline by reducing implicit guaranties, limiting conflicts between shareholders and managers and reinforcing the disclosure policy might mitigate the risk insolvency of European banks.

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MOTIVATION

In its recent capital adequacy framework, the Basel Committee assigns market discipline an explicit and crucial role as one of the three "pillars" of capital regulation along with minimum capital requirements and supervisory review of capital adequacy (BIS (1999)). Despite the growing recognition of market discipline importance to banking soundness, the means by which it can best be achieved are still unknown. While the Basel Committee has called for adequate disclosure as a precondition for market discipline, disclosure alone is not sufficient. Bank Incentives for risk taking are also influenced by the strength of the explicit and implicit safety net, the degree of funding sources insurance and the relationship between managers and shareholders.

It is widely maintained that market discipline requires a mechanism through which the market investors in bank liabilities (subordinated debts or uninsured depositors) can penalize excessive risk taking. One reason for which market discipline is prominent is that banks are prone to engage in moral hazard behaviour. Indeed, the moral hazard problems associated with the safety net are widely recognized (Stern, Gary.H (1999), Gropp.R and Vesala.J (2001, (2004)). In relation to deposit insurance, the problem is that depositors no longer discipline the banks by refusing to place their money in risky institutions. The lender of last resort further insulates banks from the downside consequences of risky activities. In these circumstances, regulatory capital arbitrage is one manifestation of the underlying problem that attempts to establish regulations. Indeed, to safeguard against insolvency, banks hold capital buffers against adverse outcomes in their investments in risky assets; but the bank's private solvency target may not take into account the interests of depositors.
Therefore, the traditional approach to dealing with moral hazard involves a combination of capital standards, supervision and regulation of bank activities. And, the rationale for the use of market discipline is to minimize the problems that plague traditional methods of dealing with moral hazard.
Given the concern with the possible systemic consequences of bank failure and losses to public safety nets designed to minimize systemic risk, market should provide sufficient solvency signals to permit holders to demand management changes, or to let creditors or regulators able to intervene before a banks' capital becomes critical. Whereas the previous literature has concentrated primarily on whether the market prices or liabilities react adversely to information about risk (Berger (1991)), Bliss and Flannery (2002), Evanoff and Wall (2000 a)), it does not reveal the degree to which market discipline is effective as an incentive scheme. Indeed, one wonders how market discipline can exert much pressure in the safety-net environment and influence bank behaviour.
To my knowledge, only one European study has been interested in this question (*C.f* Nier and Baumann (2006)) but it has not focused in the ownership structure nor in the extend of government bail-out policies on banks outside the safety net. To fill this gap and provide further comprehensive evidence in this respect, the paper extends the existing literature and empirically investigates the effectiveness of market discipline in containing the bank behaviour (risk position and regulatory capital buffer). Its effectiveness hinges on: 1) the extend of the government safety net, 2) the degree to which the bank is financed by uninsured liabilities and 3) the disclosure strategy of the bank.
I use a broad definition of public guaranties, including explicit and implicit guaranties.
Public guarantees are likely to reduce market discipline because creditors anticipate bank's bail out and therefore have lower monitoring of the bank's risk incentives.[2]

[2] The effect is similar to that discussed in the deposit insurance literature. If depositors are protected by a guarantee, they will punish their bank less for risk taking, reducing market discipline.

Moreover, the amount of uninsured liabilities is important because when bank deposits are uninsured and the bank risk choice is observable by depositors, the bank risk choice will be efficient and thereby market discipline is effective. Contrary, when deposits are insured, moral hazard is high and in such world market discipline is weakened.
As for the bank disclosure of the risk position, I analyse at the same time the quality, the quantity and the timeliness of information disclosed. Moreover, I analyse the disclosure efficiency from the ownership structure and agency theory point of stand.
Market discipline is likely to be more effective, the greater is the greater is the degree of bank disclosure.

The paper proceeds as following: the first section presents the estimation procedure and the hypothesis tested. The section 2 provides a description of the variables of interest used in the regressions and the data sources. The Section 3 details the models specifications and the results. The section 4 assesses the robustness of the results and in the section 5, conclusions and policy implications are made.

I- EMPIRICAL METHODOLOGY

In this section, I describe the research strategy adopted in this paper.

-Hypothesises and methodology

As described earlier, the better the quality of the information about the bank, the more likely it is that market prices will reflect the position in prospect and the more likely market discipline is effective. Therefore, market discipline should force banks to maintain a low probability of default and consequently its impact may in turn arise from the different risk taking position and the capital behaviour. I therefore conduct my empirical analysis by investigating whether market discipline do affect simultaneously banks' asset quality and risk and the capital behaviour.
First, the loan portfolio is a major source of risk that the board of directors and management control by establishing policies regarding lending limits for loan officers, limiting the loan-to-asset ratio, and limiting credit concentration among industries, loan categories, or geographic locations. Second, banks must also control risk associated with other balance sheet items. The bank is exposed to risk associated with access to funds, commitments to the cost of fixed assets, and interest rate fluctuations. Finally, because higher risk in the loan portfolio is offset to some extent by lower risk in other balance sheet accounts and higher risk in off balance-sheet accounts for owner-manager banks (and vice-versa for hired manager banks), it is useful to examine measures of the overall risk of the bank. The commonly used are market based measures of bank risk such as fluctuations in stock returns.
In the other hand, bank managers and owners must also make a fundamental decision about how much equity to hold in the bank. This decision is important because equity provides a cushion to absorb loan losses or unexpected drops in net income.

To investigate these hypotheses, I estimate a capital and risk regressions.

The first relationship is the capital regression:

$$K^{al}buffer_{it} = f\left(Risk_{it}, MD_{it}, Z_{it}\right) + u_{it} \qquad (1)$$

Where i,t denote respectively the bank and the time.
The capital buffer (K^{al}BUFF) is measured as the "excess-capital to risk-weighted asset" ratio.
I choose to use the capital buffer rather than the level of actual capital since most European banks hold a capital to asset ratio well above the required minimum level defined by the present capital adequacy regulation[3].
The risk is exogenous in year t since it is largely determined by decisions in previous years. Particularly, the risk arising from a bank's loan portfolio is not easily changed over one year. Capital on the other hand, can be adjusted in consequence over one year by changing the dividends policy distribution, by issuing new equity or by retaining earnings.
The bank asset risk is expected to have a positive effect on capital buffer as prudent banks, would hold a bigger capital buffer if they take on more portfolio risk.
Since asset risk is difficult to assess, I use a broad set of variables found in the literature to capture different aspects of risk in banking which will be detailed in the next section.
MD is the main variable of interest in this regression. Controlling for risk and other exogenous factors such that (bank size, bank type, the position of economic cycle[4], I expect a positive effect of market discipline, if effective, on capital buffer.

The second relationship estimates the risk regression as:

$$RISK_{it} = g(K^{al}buffer_{it}, MD_{it-s}, Z_{it-s}) + v_{it} \qquad (2)$$

Different risk measures used in this regression will be detailed later on.
In order to measure the default risk from measures of asset risk, it is important to take into account the amount of capital hold by the bank as an independent variable.
Moreover, the components of market discipline and other exogenous variables are expressed in lags since it is assumed that the risk position of the bank is dictated by its long term strategy. Indeed, risky assets cannot be liquidated and replaced by more liquid assets before maturity. Furthermore, the realisation of an increase in underlying asset risk could take time thus indicating ex post credit risk.

II- Variables of interest

-Independent variables

The main independent variable of the analysis is the market discipline component.
Hereafter, I describe the set of factors that are likely to establish the strength of market discipline.

MD (safety net)

The first component likely to weaken market discipline is the safety net from which can benefit the banks. This safety results in explicit guaranties (depositor insurance) and implicit guaranties (bail out policies and supportive attitude).

[3] Banks must hold a "capital to risk adjusted asset" ratio of minimum 8 per cent
[4] There are generally 2 distinct reasons why capital levels should change over time. The first relates the change in the riskiness of the bank portfolio and the subsequent need to provide a cushion to absorb such risks. The second relates to intertemporal arbitrage. Hence, economic cycles are likely to affect the level of capital held.

As explicit guaranties, I construct an index of the depositor protection across countries. It's inspired from Demirguc-kunt and Sobaci (2000) and Demirgüç-Kunt. K and Detragiache.E (2002, 2007).

The deposit insurance index (DEPINS) is defined as the sum of values taken by the following dummies:
Depins1=1 if there is an explicit deposit insurance scheme, =0 otherwise
Depins2= 1 if there is no coinsurance, =0 otherwise
Depins3=1 if coverage is slightly limited, =0 if strongly limited
Depins4= 1 if foreign currency deposits are covered, =0 otherwise
Depins5=2 if the insurance fund is managed by only the government, = 1, if by a public actor and a private actor, =0 if by only a private manager.
Due to the way I have constructed the index, I expect market discipline to be weaker and moral hazard incentives to be stronger the higher is the value of the index DEPINS.

Regarding the bail out guaranties, I first analyse their effect inside the safety net and than outside the safety net.
Inside the safety net: there is an extensive empirical literature examining the effect of bail-out policies on the risk-taking of the protected banks. As for the theoretical literature, it confronts two theses.
From the point of view of **market discipline**, public guaranties reduce market discipline because creditors anticipate their bank's bail out and therefore have lower incentives to monitor the bank's risk-taking. This tends to increase the protected bank's risk-taking.
From the point of view of **charter value,** public guaranties affect bank's risk taking behaviour through their effect on bank margins and charter values[5]. Charter values are shown, since the pioneer works of Keeley (1990), to decrease the incentives for excessive risk taking because the threat of losing future rents discourages risk-taking.
Hence, the net effect of public bail-out guaranties on the risk-taking of protected banks is somewhat ambiguous and depends on the superiority of the two channels: higher risk taking is expected only if the market discipline effect dominates the charter value effect[6].
Implicit guaranties are difficult to measure. In my empirical analysis, I adopt a similar method than the one used by Gropp, Vesala and vulpes (2001) and Nier and Baumann (2006) by making use of the external support ratings published by Fitch IBCA and Moody's rating agencies. The support rating ranges from 1 (certain bail-out) to 5 (very unlikely bail out). Rather than using these support ratings as assigned on the scale from 1 to 5, I choose to construct a dummy variable (p_i) which takes the value 1 for the very likely support (rating 1 and 2) and the value 0 for a very unlikely support (rating 3, 4 or 5)[7]. To avoid a great restriction of the sample size, all remaining private banks not rated are assigned a support rating of 0 and all public banks are assigned a support rating of 1.
Using this specification, the market discipline is weaker when p_i=1

Outside the safety net, it is widely maintained that public guaranties to a subset of banks distort competition. Recently, Gropp, Hakenes and Schnabel (2007) have shown that such competitive distortions may provoke higher risk-taking by those banks not covered by the policy. The theoretical argument behind is that lower refinancing costs will induce the

[5] Government bail-out guarantees result in higher charter value for protected banks that benefit from lower refinancing costs.
[6] See Cordella and Yeyati (2003) and Hakenes and Schnabel (2004) for a more clear comprehension of the two channels effect.
[7] Gropp, Hakenes and Schnabel (2007) have translated the ratings into bail-out probabilities (p_i) on the basis of standard credit matrix transition matrices for non financial corporates. This method was privileged in order to calculate the market share of insured competitor banks (MSI).

protected bank to behave more aggressively. This increases competition and pushes the protected bank's competitors towards higher risk taking. So, I am interested here to shed new light on the effect of competitive distortion due to the protection of competitor banks from the perspective of each bank. Therefore, I use the constructed variables of Gropp et al (2007) that measure the distortion of competition due to the protection of competitor banks which is named the "market share of insured competitor banks" MSI_{-i}[8]. It is constructed as:

$$MSI_{-i} = \sum_{j \neq i} p_j \frac{a_j}{A} = p_{-i} \frac{A_{-i}}{A}$$

$$A = \sum_i a_i \quad , \qquad p_{-i} = \sum_{j \neq i} p_j \frac{a_j}{A_{-i}} \quad \text{and} \quad A_{-i} = A - a_i$$

Where a_i are the total assets of bank i, and a_j are the total assets of a competitor bank j.

Note that the variable MSI varies not only across countries but also across individual banks within countries because the bank itself is always excluded from the calculation.
The main hypothesis is that MSI increases banks' risk-taking and than emphasised the fact that market discipline doesn't work.

MD (Funding)
As suggested earlier, the effect of market discipline ought to be stronger the higher the amount of uninsured funding. I measure the amount of uninsured funding of a bank as the ratio of deposits due to banks to total deposits of the banking system (BANKDEP). This choice is motivated by the fact that inter-banking are free of insurance schemas and that the lending bank is likely to be subject to the same kinds of chocks to risk and profitability as the borrowing banks.
The mandatory Subordinated debt proposals which have emerged to provide the incentive for the exercise of market discipline by preventing banks from taking on too much risk[9] would also be a relevant tool of market discipline, but I did not use it because subordinated debts are a component of the tier 2 bank capital ratio and using the growth rate of the amount of subordinated debt issued by the bank would automatically have an amplifying effect on the bank capital.

MD (disclosure as a supervisory tool)
In order for market discipline of banking institutions to be effective, the pillar 3 of Basel II emphasizes that banks must be sufficiently transparent; that is banks must provide a sufficient amount of accurate and timely information regarding their conditions and operations to the public. Improved public disclosures of such information lead to increased transparency and should lead directly to more effective market discipline. The use of disclosure indices has been popularised by La Porta et al (1998). Cordella and Yeyati (1998) and Boot and Schmeits (2000), emphasise the commitment effect of bank disclosure. Bushman and Smith (2003) offer a survey of researches on disclosure. More recently, Nier and Baumann (2006), in a

[8] Gropp, Hakenes and Schnabel (2007) have also adopted a more sophisticated version that uses the complete rating information (Financial strength rating, Individual rating, Issuer rating,…) of all banks to construct the MSI. Since results are almost the same for the two methods, I choose to adopt the measures obtained from the simplest.
[9] Direct market discipline exists when higher default risk leads to increases in the risk premium demanded by potential SD creditors. Since this increases the bank's cost of raising capital, there is an incentive to limit excessive risk taking. Indirect discipline occurs when a change in a bank's default risk reduces the secondary market price of SD. Since these price movements act as a signal of the mark's perception of the bank solvency, supervisors and market participants can use this information to control the bank activities (Bliss (2001), Caldwell (2005))

cross-country study, find that greater information disclosure induce banks to hold larger capital buffers leading to lower default risk. The idea is that banking institutions, like all firms, are monitored by their customers, trade counterparties, and investors in their securities. When they disclosure their risk-profile, they will therefore get penalised for choosing higher risks[10]. The recent survey of BCBS (2003b) reports the disclosure practices of internationally active banks.
The proposed disclosure requirements consist of qualitative and quantitative information in three general areas: corporate structure, capital structure and adequacy, and risk management. Consequently, measuring the amount of information available is a hard task. For this purpose, I have tried to construct a number of measures of disclosure.

The first quantitative indicator is drawn on a previous study of Nier and Baumann (2006). It synthesises disclosure based on Fitch IBCA Bankscope Information. Indeed, the quantitative disclosures include a number of the bank's risk profile dimensions. The gross credit risk exposures must be reported in disaggregated form by exposure type such as loans or off-balance-sheet exposures, by geographic region, by industry or counterparty type, and by residual contractual maturity. Impaired loans and past-due loans also must be reported by geographic region and industry type. For market risk, the quantitative disclosures must include capital requirements for interest rate risk, equity risk, foreign exchange risk and commodity risk. I present in the table A0 of the annex, a summary of 17 categories used to construct the composite Disclosure index named (DISC1).
It is defined as: $DISC1 = \frac{1}{17}\sum_{i=1}^{17} S_i$ where each subindex S_i can be related to one or more sources of risk. For all subindices, I assign a 1 if there is no entry in any of the corresponding categories and a 0 if there is at least one informed category. Then, the composite index will range between 0 and 1.
The second one is an ordinal variable (DISC2) which measures the degree of information disclosure for banks using the"pro-disclosure" answers in section 10 of a survey on regulation and supervision (World Bank 2007).
As for the quality of information disclosed, I consider that rated banks by a major rating agency are more transparent then the unrated banks and hence help the market discipline. Indeed, these firms are allowed to incorporate inside information into the assigned ratings without disclosing specific details to the public. This process makes the investors more informed about the bank. Many studies provide evidence on the superiority of information contained in ratings and explain the reason why firms usually pay for the ratings (Kliger and Sarig (2000)).
I therefore construct a first binary indicator variable (RAT) which takes 1 if the bank is rated by any of the major rating agencies (S&P, Moody's or Fitch IBCA) and 0 otherwise.
In addition, all banks, whether publicly or privately owned, are required to file quarterly regulatory reports, such as the bank-level Call Reports, and much of this information is made publicly available. The reports contain detailed information regarding bank balance sheets and earnings. Also, agreements between banks and their supervisors, such as formal enforcement actions and cease-and-desist orders, are public documents that disclose specific steps bank management must take. To control for this form of disclosure, I construct a second binary variable that represent the "qualification" of the bank account at each year. An "unqualified" account is the one that auditors have judged as non problematic and of good quality.

[10] Market discipline could not work whenever investors do not know the risk profile of the bank and is weaker if the amount of information available is limited.

Therefore the variable (UNQUALIF) takes 1 if the bank account is considered as of good quality and 0 otherwise. An unqualified account is likely to reinforce the disclosure process.
Other accounting ratios might reflect the bank opacity based on the bank balance sheet structure. In theory, opacity comes from the intermediation function of banks and is often proxied by the ratio of loans to total assets. Besides, because liquidity is essential for market signals to transmit accurate information, the extent to which liabilities are market funded is crucial. Therefore the proportion of market funding on the liability side of the balance sheet is also, in several studies, a determinant variable. The hypothesis is that the more the bank activity is concentrated on credits[11] and the lower is the proportion of market funding, the less is the bank transparency. I use the ratio of bank credits over total assets (CRED) and the ratio of market funded liabilities such that bonds and subordinated debts (MARK) designed by total balance sheet less deposits less stock equity over total assets.
The variable MARK takes 1 if the ratio of the considered bank is higher than the median level and 0 otherwise.

Finally, the main novelty of my approach stands in adding the ownership structure of the bank as a key element to help the market discipline.
A firm **ownership structure** can be defined along two main dimensions. First, the degree of ownership **concentration**: firm's risk may differ because its ownership is more or less dispersed. Second, the **nature** of the owners: given the same degree of concentration, two firms may differ if the government holds a (majority) stake in one of them; similarly, a stock firm with dispersed ownership is different from a mutual firm.
The relevance of firms' ownership structure has been extensively explored in the theoretical literature. As far ownership concentration is concerned, previous literature (since the works of Bearle and Means (1932)) point out that the separation of ownership and control may create a conflict of interests between owners and managers. Moreover, Jensen and Meckling (1976) posit that the agency costs of deviation from value maximization increase as managers' equity stake decreases and ownership becomes more dispersed. Several papers (Saunders, Strock and Travlos (1990), Gorton and Rosen (1995), Houston and James (1995) and Demsetz et al.(1997) find a significant effect of ownership concentration on risk taking, although no consensus exists on the sign of this relationship.
Regarding the nature of owners, the property rights hypothesis (e.g Alchian (1965)) suggests that private firms should perform more efficiently and more profitably than both government-owned and mutual firms. Moreover, Kwan (2004) compares, on univariate basis, profitability, operating efficiency and risk taking between publicly traded and privately held US bank holding companies, finding that publicly traded banks tend to be less profitable than privately held similar bank holding companies, since they incur higher operating costs, while risk between the two groups is statistically indistinguishable. From this perspective, direct market discipline mechanism[12], such as the one envisaged by the third pillar of Basel II, cannot be effective in the case of underperforming or riskier government owned bank benefiting from explicit or implicit government guarantees. Moreover, as pointed out by Bliss and Flannery (2000), to be effective direct market discipline requires a firm's expected cost of funds to be a direct function of its risk profile. This in turn requires that the firm's management responds to market signals. Therefore, the existence of any ownership structure which (because of its specific internal or external incentives) prevents the management from reacting to market

[11] This variable reflects in fine the diversification degree of the bank. A highly diversified activity is generally associated to a higher disclosure than for a less diversified one.
[12] I refer to the definition of direct market discipline proposed by Flannery (2001), as the process whereby the market signals affect the economic and financial position of a firm.

signals would, by the direct channel, undermine the effectiveness of market discipline architecture.

Besides, the role of ownership structure (Morck et al.(1988), McConnell and Servaes (1990)) and board structure (Baysinger and Butler (1985), Rechner and Dalton (1991), Yermack(1996) and Bhagat and Black (1999, 2002)) in monitoring management and so improving firm performance has been largely investigated in empirical corporate governance literature. While the results are mixed, the approach used in studying the relation between governance mechanisms and firm performance is mostly the same.
While different ownership structures may affect the profitability and cost efficiency of banks, these differences may in turn arise from different risk taking behaviours. Consequently, governance mechanisms such as the board of directors and ownership structure are expected to play a more active role in aligning managers' interests with those of shareholders and then alleviate the agency problems resulting from the separation between ownership and control between shareholders and managers.
The internal governance mechanisms are the equity ownership by officers and directors (insider ownership), the proportion of outside directors and the number of directors sitting on the board (board size).
The corporate governance literature argues that increasing stock ownership by managers and directors can be an effective control mechanism designed to reduce the moral hazard behaviour of firm managers. Banks with high levels of insider ownership have less agency problems between managers and shareholders, and therefore have less need for monitoring by outside directors. Another interpretation is that an increase in insider ownership increases the ability to influence board appointments, thereby reducing the presence of outside directors.

The presence of shareholders holding a high proportion of the firm's capital constitutes another way to mitigate the effects of the separation of ownership and control on firm value. Indeed, a shareholder with a little stake in the firm has weak incentives to engage in the monitoring of managers since he supports all the costs of monitoring while getting only a small fraction of the benefits (the typical free rider problem). In contrast, an ownership structure in which one or more shareholders own a large block of stock has the potential for refuting managers from engaging in moral hazard behaviour. Firms with blockholder ownership are expected to have less agency problems, and the need for alternative control mechanisms is reduced.
Another mechanism designed to mitigate the moral hazard behaviour of managers is monitoring by the board of directors. Most importantly, for the board to be effective in carrying out its task of monitoring, it has to be independent of the management team. Therefore, it is argued by a number of academicians and professionals that the presence of directors who are not employees of the firm may enhance the effectiveness of the board of directors in monitoring managers, and improving firm value. The rationale behind this is that outside directors are more likely to defend the interests of outside shareholders.
Fama and Jensen (1983) argue that outside directors have the incentive to act as monitors of management because they want to protect their reputations as effective and independent decision makers.
Finally, the largely shared wisdom regarding the optimal board size is that the higher the number of directors sitting on the board the less is performance. Jensen (1993) states that "Keeping boards small can help improve their performance". When boards get beyond seven or eight people they are less likely to function effectively and are less easy for the CEO to control. Since smaller boards are considered as better monitors for managers (Jensen (1993), the presence of more outside directors on larger boards may be interpreted as evidence that

when the board gets larger, there is more need for outside directors. If banks "believe" that outside directors are better for monitoring managers, they will compensate for the lack of monitoring by larger boards by increasing the proportion of outside directors. This may be seen as a sign of good governance in banks with high levels of insider equity ownership.

Using several components of corporate governance mainly both dimensions of ownership structure (i.e ownership concentration and nature of the owners) and board size, this study try to take a more comprehensive look at the factors influencing bank risk taking and capital.

The variables aiming to control for the corporate governance are:
INSOWN: is the percentage of equity owned by the company directors and top executive officers, including the CEO.
BLOCK: is the percentage of equity owned by persons and institutions that hold 5% or more of the company's equity.
BSIZE (board size): is the number of directors sitting on the board at the shareholders' annual meeting.
GVMT: 1 if the bank is more than 50% owned by the government, 0 otherwise.
This last variable is sometimes omitted from the regressions when the control variable "type of the bank" is used; this is to avoid correlation with government owned bank type.

- RISK measures

As mentioned above, the first set of risk measures examines a bank's exposure to risk through its lending activities. The loan portfolio is the major source of risk that the board of directors and management control by establishing policies regarding lending limits for loan officers, limiting the loan-to-asset ratio, and limiting credit concentrations among industries, loan categories, or geographic locations.[13] I use a broad set of variables found in the empirical literature to capture different aspects of the asset risk as proxies of the cost of failure.

1- The ratio of non-performing loans to total assets. It refers to the stock of bad and doubtful loans and summarises the extent of credit risk the bank has taken in the past (NPL)
2- The ratio of loan loss provisions to total assets. It is proxies by the flow of new bad loans since banks would make provisions to cover new non performing loans. (LLP)
3- The ratio of risk-weighted assets over total assets according to the Basel I standards (RWA).

It's important to note that the risk generated by off balance sheet and securitization items is important to evaluate because financial innovation, resulting in the massive securitization of illiquid assets might engage banks in very risky activities. Indeed, it is today easy to liquidate a portfolio of illiquid credits (such as a combination of bank loans or mortgages) and package them into investor portfolios -ultimately opening the door to the credit market to poor quality borrowers-. The subprime crisis in the USA is the best illustrative example of bank fragility inherent to OBS liabilities. Strong bank capital base, while essential to avoid the collapse of any major financial institution, was not sufficient to prevent the systemic effects of the sub-prime crisis.
Unfortunately, the exam of the banks annual financial reports does not allow to analyse the off balance sheet risk because of the lack of information regarding the size and the diversification degree of these items.

[13] Of course banks must also control risk associated with other balance sheet items. The bank is exposed to risk associated with access to funds, commitments to the cost of fixed assets, and interest rate fluctuations. But, I assume that this kind of risk is marginal comparing to the credit risk.

Instead, the liquidity of the bank could inform about the degree of prudence of the bank in consideration of its activity of securitisation.

4- The liquid assets over total assets and the liquid assets over customers and short term funding are used to control for the liquidity risk of the bank (LIQUID).

Finally, it is useful to examine measures of the overall risk of the bank. The commonly used market based measures of bank risk are mainly the fluctuations of equity prices, the asset return volatility, the Tobin's q (Iannotta, Nocera and Sironi (2006)) and the probability of default or the risk of insolvency reflected in the Z score (Boyd and Graham (1988), De Nicolò (2001), Iannotta (2006), Gropp, Hakenes and Schnabel (2007))[14].

To the extent that stock market data are available, I use monthly equity prices to derive the standard deviation of equity returns. The standard deviation of equity returns can be decomposed into idiosyncratic risk (IDIO) and systemic risk (BETA) and are estimated for each bank i at each year t via the market model regression such that:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

$$\Rightarrow \varepsilon_{it} = R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{mt}\right) \text{ and } \beta_i = \frac{\text{cov}(R_{it,} R_{mt})}{\text{var}(R_{mt})}$$

The idiosyncratic risk is the standard deviation of ε_{it}

The systematic risk is β_i

- Control variables

I also include some control variables that aim to influence the risk and capital choices of a given bank. I use bank-specific and country-specific control variables.

First, size can have a significant impact on the bank access to capital and consequently target capital level. Furthermore, the size of a bank may play a role in determining the bank's risk level through its impact on investment opportunities and diversification benefits. I include a size variable which is proxied by the natural log of total assets (LNSIZE). Larger banks are expected to hold smaller capital buffers relatively to the "too big to fail" hypothesis since they expect to be "bailed-out" if they are faced with difficulties. On the other hand, small banks might hold larger buffers due to their relative difficulty to access the capital markets.

Second, more profitable banks will find it easier to accumulate equity through retained earnings. I therefore include the bank's return on equity (ROE) as a variable controlling this effect. It is likely that the bank's return equity is positively associated to capital (Berger (1995)).

Third, I control for different types of business (commercial banks, savings banks, etc) by using bank type dummies.

At the country level, I control for the concentration in different market sectors by using the Herfindahl index (HERF), the sum of squared market shares. In theory a higher concentration should increase intermediation margins and thereby decrease risk-taking.

Finally, in order to control for macroeconomic conditions, I include 2 cyclical variables into the model in order to establish the magnitude and direction of the effect that the cycle has on the size of capital buffer and the risk position. The first indicator is the deviation from real GDP growth (GGDP).

[14] This last type of risk measure combines the income fluctuation, capitalization, and average profitability and then produces a unique survival likelihood index. As a robustness check of the results for risk and capital estimations, I use a Z-score of insolvency risk based on market data which resumes simultaneously the capital and risk aspects.

Furthermore, in order to control for the banking industry risk in each country, it's important to include the ratio of non performing loans in each country over the total assets. But, since many banks of the sample do not disclosure the amount of non performing loans, such a measure of the bank industry risk for each country is not reliable.

- DESCRIPTION OF THE SAMPLE AND DATA SOURCES

The major data source is Bankscope database which contains balance sheet and other bank-specific information for a large number of banks from a large variety of countries. Also, I have used the detailed annual financial reports of banks which are available in the web. Regarding bank specialisations, unlike earlier studies that focus in large listed commercial banks, I include commercial banks, cooperative banks, saving banks, real estate and mortgage banks, medium and long term credit banks as well as specialised governmental credit institutions in 13 European countries of the OECD union[15]. The sample includes all listed banks of each country and unconsolidated statements if available. This allows integrating domestic and foreign subsidiaries as independent entities.

In order to compute the idiosyncratic and systemic risk, I have used monthly series of equity prices and the main benchmark stock market index for each country from DataStream database. The table 1 in the annex summarizes the stock market indexes used in this study.

Ownership data come from a multiple data set that was compiled from bank examination reports, the World Bank survey on supervision and regulation (2007), Dafsaliens and the Guide of "Etats-majors" for French banks.

The treatment of the data revealed some dummied out observations. First, I eliminate a number of banks because of missing data. Also, banks for which information on risk or/ and on capital were unavailable or of aberrant values are excluded from the initial sample. I exclude several banks because they experienced a significant ownership change. So that, the final sample included 150 banks. Almost 64% of the sample designs commercial banks, almost 18,66% designs cooperative banks, almost 4,66% designs Real Estate and Mortgage, almost 2,6% designs saving banks, 2% Medium and Long term credit banks and 8% designs Specialized governmental credit institutions.

Moreover, the number of observations available for the regressions analysis changes according to which variables are included in the estimation.

The table 2 of the annex summarizes the distribution of the sample by country and by bank type and the table 3 summarises the descriptive statistics for the variables of interest.

III- THE MODELS SPECIFICATION and RESULTS:

In order to evaluate the impact of market discipline components on the bank behaviour, I use two equations that reflect the bank risk position and the capital safety level.

Individual Model of bank capital

I start by estimating a basic model of bank capital buffers and then examine the impact of market discipline in a second step.

As estimation method, I adopt the random effects feasible GLS estimator (FGLS) for many reasons. First, it estimates the error variance-covariance matrix assuming that the error

[15] A vast body of literature has focussed on the impact of different types of banks on the risk profile of institutions (see among others, Saunders el al (1990), Esty (1997) and Salas and Saurina (2002b) Gropp et al (2007).

follows a panel specific autoregressive process[16]. Second, the FGLS estimator controls for the error heteroscedasticity and difference in the coefficient autocorrelation across banks. This was approved by the Hausman and Breusch-Pagan tests that suggest a random effects specification. This approach is adequate to the model as some of market discipline variables of interest (depins, supp, rat) do not vary across time and can not be analysed using a fixed effects approach. A fixed effects specification ignores cross-sectional variation in market discipline variables, which for the purpose of testing my hypotheses is an important dimension.
I include both measures of risk based on equity market (IDIO and BETA) and the credit and liquidity risk as described earlier (LLP, NPL, RWA, LIQUID).
As expected, IDIO and BETA have a positive relationship with capital. The LLP included in a one period ahead is taken to reflect current credit risk as measuring expected loan losses next period. It has also a positive and significant relationship with the capital buffer. European banks are revealed to keep larger capital buffer if they expect to make large loan loss provisions in the next period.
Contrary, the NPL ratio which measures the realised credit risk has a negative effect on bank capital. Hence, current and past bad loans trigger provisions and than lower the size of the capital buffer. Finally, the more the bank assets are liquid, the less are the incentives to higher capital buffers.
As for control variables, the variables LNSIZE, ROE, HERF and GGDP are significant as shown in the results summarized in the table 4 of the appendix.

Market discipline Impact
To estimate the market discipline effect on the capital bank behaviour, I was confronted to endogeneity problem. Indeed, some components of market discipline depend themselves on bank capital. For instance, Banks that hold little capital buffer may have to issue more bank deposits to their assets funding. This likely negative relationship between capital and the bank deposit ratio would obscure the positive relationship expected to arise from the incentive effect of interbank market discipline. Similarly, bank disclosure may be determined with the bank capital choice. In order to ensure that it can find sufficient investor demand, a bank that would like to raise more equity, may need to be highly transparent. Therefore, eliminating this effect would facilitate the interpretation of a positive coefficient of disclosure on bank capital buffer.
In order to take account of the endogeneity problem, I adopt an instrumental variables (2SLS) procedure. In the first step, the endogenous variables (the ratio of bank deposits and the disclosure index) are regressed on a number of bank level exogenous variables. These variables are the loan ratio (LOAN), the return on equity (ROE), the return on assets (ROA), the cost to income ratio (CIR) and the market share (MS).In addition, I include a country level dummy and a year trend and also their interaction to control for cross-country and cross time dimensions.
In the second step, the dependent variable is predicted on the base of only the information used by the first stage regression. The instrumental variables and results of the first stage regressions are detailed in the table A1 of the appendix and the table A2 gives the correlation coefficients between the fitted values from the first stage regression and their actual values

The table 5 summarises the impact of each component of market discipline on the capital buffer. The first column presents the effects of the insurance variables. Deposit insurance (DEPINS) and the market share of insured competitors (MSI_{-i}) are significant and negatively

[16] Formally, the error are assumed to follow a process of the form : $\varepsilon_{it} = \eta_i \varepsilon_{it-1} + \nu_{it}$

related to capital buffer. This result supports the fact that the existence of generous deposit insurance systems discourages the European banks to hold high capital buffers and increase their moral hazard incentives. These incentives are shown to be higher when the market share of insured competitor is large. Similarly, the support (p_i) is shown to be negatively related to the capital level hold by European banks.
The second column concentrates on the effect of the funding component of market discipline (BANKDEPFIT). This variable shows a significant positive effect on the capital buffer indicating the disciplining effects of interbank deposit market.
The last column shows that the disclosure variables (DISCFIT1, DISC2, RAT, UNQUALIF, MARK) have an expected positive impact on the capital buffer except the CRED variable which reflects the size of credit activities, has a negative sign. This last result emphasizes the fact that the more the bank activity is based on credit, the high is its opacity and the less is it's capital buffer.
As for the effects of the ownership structure, only "the percentage of equity owned by the company directors and top executive officers" (INSOWN) and "the percentage of equity owned by persons and institutions that hold 5% or more in the company's equity" (BLOCK) are positively related to the capital buffer hold by European banks.

Table 6 of the annex presents the preferred model to assess the impact of market discipline as a global feature on the European bank capital buffer[17].
To the extend that major bank-level variables (P_i, BANKDEP, DISC, MARK) range between 0 and 1, the coefficient on each of these variables can be interpreted as the absolute change in the capital ratio resulting from a unit increase in the market discipline variable. The coefficient on BANKDEP about 3,13% means that a bank which has a bank deposit ratio of unity would have a capital ratio of 3,13% higher than a bank that has no inter bank deposits. Inversely, a coefficient of 2,35% on P_i variable could mean that banks with likely government support have capital ratios about 2,35% lower than those without government support. Moreover, the coefficients on disclosure and debt market ratios are somewhat small (respectively 1,09% and 1,2%) but suggest that banks increase their capital buffer when they largely issue non insured securities such as bonds or subordinated bonds (market funded liabilities) and improve the quality of the information assigned to the market.

Individual model of bank risk

The risk regression estimates the relation between a single risk variable, capital and the market discipline components accordingly to the equation (2).

As for the capital regression, the GLS procedures are likely to be more significant than the OLS estimation. This choice is driven by the diagnostic tests on the residuals of basic pooled OLS regressions on the risk ratios that suggest non-normal residuals. Moreover, the presence of heteroscedasticity and autocorrelation in the residuals has dictated the choice of a heteroscedastic AR (1) error structure.
It is important to note that the disclosure index and the funding variables still endogenous with respect to the risk (correlated with the error terms). Here again, I instrument these variables similarly to the capital specification method.

[17] Note that it's not possible to include the support rating (P_i) and the variable RAT at the same time, since, by construction any bank which has a Fitch public support rating has a value of 1 on RAT. Therefore, to avoid perfect collinearity between the two variables, I only use the support dummy in the preferred specification.

The table 7 represents the results of the market discipline impact on different measures of risk position.

First of all, the sign of the capital buffer ratio is somewhat ambiguous and depends on the specification of risk. I note a negative relationship between the capital buffer and the risk measured by non performing loans and liquidity risk and a positive relationship with the LLP ratio, the RWA ratio and the idiosyncratic risk. This funding can be explained by two facts. On the one hand, a high ratio of NPL is generally associated with higher provisions which in turn reduce capital. On the other hand, high capital buffers are also associated to higher asset risk and generate higher loan loss provisions in the future.
Moreover, the control variable LGGDP is negatively related to the loan loss provisions and to liquidity and positively to the RWA indicating that bank provisions and liquidity decrease after an economic downgrade but at the same time banks undertake less risky assets.
The dummy related to the type of the bank show that commercial banks and public owned banks detain higher risky assets unlike saving and cooperative banks that have lower asset risk and more loan loss provisions.
The variable of the lagged logsize show that larger banks have higher LLP but also higher risk on their assets, high volatility on their market returns and less liquidity.
The banking market concentration (HERF) decreases asset risk measured by RWA and increases the loan loss provisions. In contrast, it decreases liquidity and the volatility of market returns.

Market discipline impact
Regarding the impact of market discipline, findings show that deposit insurance systems has a significant positive effect on the asset risk and on the volatility of markets returns.
The own bail-out probability, when significant, has a negative effect on the NPL but also on the loan loss provisions and on the liquidity of the bank.
The bail out of bank competitors is also determinant of the own bank risk. The results show that it has a negative impact on the loan loss provisions and the liquidity of the bank and increases the risky assets and the equity market volatility.
The bank deposit ratio (unsecured liabilities) increases the loan loss provisions of the bank but at the same time increases the risky assets and the equity market volatility. Hence, one can not argue that uninsured investors exert an effective market discipline on bank's risk.
As for the disciplining effect of the disclosure, results show that transparency has a significantly negative impact on risk taking measured by the RWA and on the idiosyncratic risk of the equity market. It has also a positive impact on the LLP and the liquidity of the European banks in the future. Inversely, it increases the non performing loans in the future. This funding could be driven by the fact that banks in transparent banking systems are obliged to disclose problems loans in the future. However, this result must be interpreted prudently because of the small size of the sample in this specification.
Rated banks are taking risky assets but at the same time increasing their provisions on loan losses.
The market based liabilities has a negative impact on the bank liquidity and on the equity market risk but it has a positive impact on the loan loss provisions hold by European banks. This sort of liabilities could be considered as a disciplining form of the bank behaviour.
Finally, the ownership structure has a significant impact on the risk behaviour of the bank. The "percentage of equity owned by the company's directors and top executive officers" (INSOWN) has a disciplining effect as it generates a less risky market returns and more loan loss provisions. Therefore, ownership concentration is associated with better loan quality, lower asset risk and lower insolvency risk.

Moreover, similarly to the previous literature, the size of the broad is important and has a significant positive effect on the European bank risk.
The coefficients on the market discipline variable could give also some information on the economic significance of a change in market discipline components. For instance, banks that increase their bank deposits of unity increase their risky assets by about 3,4% and their LLP of about 1,36%. Similarly, banks increase their own risky assets of about 2,3% and decrease their LLP of almost the same percentage when they know that their competitors can be bailed by the government. The disclosure index show that banks providing information about their risk have risky weigh assets and risky returns lower of about 3-5% than for banks not disclosing information.

Results on the impact of the capital on risk and vice versa are sometimes puzzling and do not allow to conclude about the relationship between the risk behaviour and the capital position of European banks. Indeed, the capital is a choice variable for the banks and endogenous on the risk choice. Assuming that a bank targets its default probability, the equity ratio could be determined by the amount of risky assets in a bank's balance sheet, against which it holds capital in order to reach its probability of default.
Hence, rather than instrument the capital, I investigate, in the next step, the impact of the market discipline using a simultaneous estimation of the risk and the capital specifications.
Moreover, it is interesting to know under what conditions market discipline is weakened. This interrogation is motivated by the fact that uninsured liabilities (BANKDEP) and explicit government insurance (DEPINS) are shown to not discipline the bank risk position in the two regressions run. This effect may be offset by the presence of implicit government guarantees. In fact, banks that enjoy a high support are shown to have less incentives to disclose information and to keep high capital buffers and low risk position. In the same vein, Gropp, Vesala and Vulpes (2002) show that subordinated debt spreads have predictive power in explaining bank failure for banks which benefit of Fitch IBCA public support rating of 3 and higher but do not have any impact on the banks with a support rating of 1 or 2 (high probability of bail out).
I test this hypothesis by subdividing the sample into 2 subgroups of banks: banks which have a public support rating of 1 and 2 and banks which have a support rating of 3 and higher. It is important to note that the public bail out probability is not necessary correlated to the bank size since in some countries like Greece, Finland or Switzerland, the support rating is 1 for all banks where data is available.

Results summarized in the table 8 show significant effects of the market discipline on the bank behaviour and that overall the beneficial effect of market discipline do not appear weaker for banks which enjoy implicit government guaranties than those banks which do not enjoy such guaranties[18]. However, it's important to note that banks that benefit from implicit guaranties are not disciplined by the explicit guaranties since their asset risk is higher in the presence of such guaranties. Inversely, the non supported ones are taking on less risk in the presence of explicit guaranties. This funding emphasizes the existence of too big to fail problem and of moral hazard from supported banks.
As for the relationship capital/risk, the supported banks have higher risky assets but also maintain high capital buffer to safeguard against this risk. The less supported banks have lower risky assets and also lower capital buffers. Therefore, results show that the capital and

[18] Results for non supported banks are not reported in this version of the paper.

the risk are positively related and that banks that run high risks, but forced to disclose more information about their risk profile, would be strongly incited to increase capital buffer.

IV-Robustness check

Overall, market discipline is effective for European banks but a question still obscure: banks that target lower solvency standards are they less or more influenced by market discipline than other banks? Moreover, at comparatively low levels of capital, do banks adopt different risk strategies?[19] To answer this question, it is necessary to split the sample into two groups of banks with low capital and high risk (high default probability) and all other banks (medium or low default probability). Rather than doing that, I calculate the probability of default or the Z-score of European banks of the sample and split the sample into 2 groups according to the median default probability of the sample[20].

There are different methods or calculation of the Z-score based on market values.

Boyd and Graham (1988), De Nicolò (2001) and Ionnatta et al (2007) calculate the Z score for the bank i and the time t such that:

$$Z_{it} = \frac{\widehat{\mu}_{it} + \frac{E_{it}}{A_{it}}}{\widehat{\sigma}_{it}}$$

Where $\widehat{\mu}_{it}$ and $\widehat{\sigma}_{it}$ are sample estimates (based on the monthly values of the return on assets R_{it}) of the mean and standard deviation of bank's i returns on assets at time t and $\frac{E_{it}}{A_{it}}$ is the time average on the market capital-to-asset ratio[21].

More simply, Furlong (1988), Boyd and Runkle (1993), De Nicolo (2000) and Bichel, Blum (2002) and recently Gropp et al (2007), calculate the Z-score on the basis of market returns such that: $Z = \frac{k + \mu}{\sigma}$

where k is the equity ratio (book values), μ is the mean return and σ is the standard deviation of returns. Formally, the z-score could also be calculated on the basis of book returns but results in this case seem less reliable (Boyd Runkle (1993)).

Similarly to this last group of authors, I choose the variance-equal weights method and calculate the log of Z-score (Ln(Z)) for each bank of the sample.

In such a case, a higher level of Ln(Z) corresponds to a lower level of insolvency, ie a lower probability of default when the Ln (Z) is larger than the median of the sample.

[19] Although the majority of the banks in the sample satisfy the minimum capital requirements, some banks are below those requirements and still allowed to continue operating.

[20] Note that various weighting techniques are considered in the literature, including factor analysis, credit aggregate-based weights, variance equal weights, and transformations of the variables using their sample cumulative distribution function. In all cases, the indexes are rebased such that they range in value from 0 to 100, with 100 being the maximum historical value of the index.

[21] For further details on the variables used to measure the ln (Z) according to this method, the lector can see Iannotta.G,Nocera.G and Sironi.A (2007).

Results show that the bank deposit ratio seems significant to influence the insolvency risk of European banks with high default probabilities (positive sign) but the coefficient of the bank deposit ratio is much higher for banks with a medium or low default probability. This suggests that interbank market discipline works better for banks that are well capitalised and with low risk positions than for those that are close to insolvency.

The disclosure variables are significant and negatively related to the insolvency risk of the 2 subgroups. However, the incentive effects of the disclosure seem more important for banks that run medium and low default probability (higher coefficient) than for banks with high default probability. This funding must be taken with prudence because the sample for banks with high default probability is relatively small, which would bias the regression's coefficients.
As for the disciplining effect based on the ownership structure, it seems that the size of the board is no more significant to influence banks that are close to insolvency but conter-intuitively influence banks that run medium and low default probabilities. Indeed, the significant and positive coefficient on the board size shows that the larger the board is the lower is the level of the bank insolvency and than the higher is the disciplining role of the board.

The "percentage of equity owned by the company's directors and top executive officers" (INSOWN) variable has a positive influence on the banks that run a low default probability but it's disciplining effect seems to not work for the banks with high default probability (negative coefficient). This result show that when managers are involved in the strategic decisions of the well capitalised banks with conservative attitude, there is less conflicting relationship between managers and shareholders and a better disciplining role of the bank behaviour. Inversely, the implication of managers in the decision process of banks running high default probability induces a negative effect perhaps due to the lack of transparency between the two actors when the bank is in difficulty.
This last result is also problematic and less reliable as the sample size for this regression is small.

V-Conclusions

The paper has aimed to examine empirically the strength of market discipline and its impact on the incentives of banks to limit their default probability. I construct 3 sets of components that reflect the strength of market discipline. First, the degree of explicit and implicit government guaranties inside and outside the safety net. Second, the amount of uninsured liabilities in the bank's funding strategy. Third, the degree of transparency of the bank via the quality and the quantity of revealed information and via the ownership structure of the firm.
I have used different specifications that reflect the default probability of the bank. Capital specification tested the impact of market discipline on the behaviour of European banks in adjusting their capital buffer, controlling for factors of risk and others variables likely to affect bank capital. Risk specification tested the impact of market discipline on the behaviour of European banking in choosing their risk position, given capital buffers and other factors driving bank risk. Results for these specifications are consistent with the fact that disclosure and concentration of the ownership affect the incentives of banks to limit their insolvency risk (high capital buffer and low risk position). The bail out of competitors and a higher share of uninsured liabilities induce an increase of the capital buffer and at the same time an increase in risk taking. However, implicit and explicit guaranties (deposit insurance and the bail out) are associated to less capital buffer and higher risk position then increasing the insolvability

risk of European banks. When looking to the simultaneous regressions of capital and risk and separating the global sample into two sub-samples of supported and no-supported banks, results show that capital and risk move similarly reducing the insolvency risk of the bank. But, the effects of market discipline are stronger for no supported banks since explicit guaranties and a high share of uninsured liabilities reduce the risk taken by these institutions. However, moral hazard increases for supported banks. In fact, for banks that benefit from a government support, interbank discipline is not effective and explicit guaranties lead to higher insolvency risk. The disclosure and the concentration of ownership have strong disciplining effects on all European banks confirming the fact that transparent banks have lower incentives to take risk and are maintaining high capital buffer.

The division of the sample into banks with high default probability (low Z score) and low default probability (high z-score) shows that the interbank discipline seems to work better for banks with low default probabilities. Also, disclosure seems working better for banks with low default probability. This last result supports the fact that for banks close to insolvency, disclosure is less effective than for banks well operating.

The ownership concentration seems to have a higher disciplining effect on banks that run a low default probability. This last result is in line with the conclusions of Iannotta et al (2007) that a higher ownership concentration is associated with better loan quality, better asset risk and lower insolvency risk.

To sum up, the results emphasize the importance of enhancing market discipline through more disclosure. The existence of implicit guaranties and explicit guaranties at the same time seems to weaken the disciplining effect of insured liabilities and increase moral hazard of supported banks. Explicit guaranties play a disciplining role for non supported banks. In addition, some forms of market discipline are less effective for banks close to insolvency. This funding emphasizes the importance of minimum capital requirements as a condition for the effectiveness of market discipline. Finally, the ownership structure seems to have an impact on the behaviour of listed European banks but further research related to this question is needed.

ANNEXES

Table 1
Market indexes of the countries in the sample

Countries	Market Index
ITALIE	MIB 30
FRANCE	CAC40
GERMANY	DAX 30
SPAIN	MADRID GENERAL SE
UNITED KINGDOM	FT100
NETHERLANDS	AEX INDEX
PORTUGAL	DJTM PRG
GREECE	ATEX COMPOSITE
AUSTRIA	DS (General Index)
BELGIIUM	BEL 20
SUIZERLAND	DJTM SWISS
IRLAND	DJTM IRD
FINLANDE	DJTM FLDS

Table2
Total sample distribution by country and by bank type

COUNTRY		BANK TYPE					
	TOTAL	COMMERCIAL	COOPERATIVE	SAVINGS	REAL ESTATE AND MORTAGE	MEDIUM &LONG TERM CREDIT	SPECIALISED GOVERMENTAL CREDIT INSTITUTIONS
AUSTRIA	9	4	3	1	1	0	0
FINLANDE	2	2	0	0	0	0	0
FRANCE	29	11	16	1	1	0	0
GERMANY	21	16	0	0	3	1	1
GREECE	12	11	0	1	0	0	0
ITALY	31	19	9	1	0	2	0
IRELAND	5	5	0	0	0	0	0
NETHERLANDS	2	2	0	0	0	0	0
PORTUGAL	2	2	0	0	0	0	0
SPAIN	14	14	0	0	0	0	0
SUIZERLAND	19	7	0	0	1	0	11
UNITED KINGDOM	4	3	0	0	1	0	0
TOTAL	150	96	28	4	7	3	12

Table 3

Summary statistics of the default risk and market discipline variables during the period 1999-2005

Variables	Mean	Minimum	Maximum	Overall Std.Dev	Between[22] Std. Dev	Within[23] Std.Dev
Risk and Capital Variables						
Asset quality risk						
Ratio of non-performing loans (%)	3,26	0,00	38,74	6,31	4,42	5,11
Ratio of loan loss reserves (%)	102,98	10,87	576,69	25,35	16,73	20,02
Ratio of risk-weighted assets (%)	71,36	0,12	152,34	21,61	14,83	19,03
Asset return volatility[24] (σROA)	0,96	-11,94	18,63	1,85	1,12	1,74
Liquidity risk						
Ratio of Liquid assets (%) (LIQUID)	25,12	4,92	115,62	12,91	11,08	9,21
Market risk						
Idiosyncratic risk	6,21	0,01	12,18	5,22	3,15	2,64
Systematic risk (β_i)	37,20	9,76	93,81	32,07	27,24	18,10
Capital						
Capital Buffer (%)	3,6	-1,9	31,5	4,04	3,54	1,85
Market discipline variables						
Deposit Insurance design						
Deposit Insurance Index	2,75	1	4	0,86	0,86	0
Funding						
Bank Deposit Ratio	23,62	3,08	57,93	28,11	26,35	9,34
Subordinated debt (millions euros)	3843,4	0	18191,2	4127,6	2051,73	2327,92
Disclosure						
Quantity						
Disclosure bank Index 1	9,65	4	18	6,85	6,11	2,54
Disclosure Country Index 2	10,15	8	12	1,28	0,54	0
Net Loans to Total Assets ratio (CRED) (%)	61,64	19,10	88,73	23,04	18,32	10,15
Market funded resources (MARK) (%)	19,72	13,87	31,99	24,99	22,61	15,03
Quality						
Support rating (P_i)	0,31	0	1	0,43	0,25	0,12
Market Share of insured competitor (MSI_i)	0,645	0,3	0,87	0,16	0,16	0
Ownership Structure						
Concentration						

[22] The between standard deviation ignores any variation over time.
[23] The within standard deviation ignores any cross-sectional variation.
[24] Here are reported the values of the ROA level.

% equity owned by persons and institutions that hold 5% or more of the company's equity (BLOCK)	48,57	0,01	100	29,83	13,68	0,15
% Equity owned by the company directors and top executive officers, including the CEO. (INSOWN)	25,17	0	76,21	18,03	11,42	3,76
% directors not currently employed by the company (OUTDIR)	49,54	27,83	81,03	21,02	18,91	8,32
Number of directors sitting on the board at the shareholders' annual meeting (BSIZE)	10,53	5	22	6,07	5,16	3,72
Control variables						
Total assets (LNSIZE) millions EURO	76634,57	18.1	1002503	187855,51	154638,87	574810
Return on equity (ROE)	13,17	-15,61	28,54	18,66	15,24	11,87
Real GDP growth (%) (DEVGDP)	2,28	0,8	3,4	8,12	6,51	4,23

Table 4

Capital buffer and risk relationship: FGLS regression model with heteroscedastic panels

	Random effects FGLS
	Dependant variable: CBUFF
NPL	-0,15260**
LLLP	0,12871**
RWA	0,13238***
LIQUID	-0,02310***
IDIO	0,07541**
BETA	0,17335*
Year	0,00563***
GGDP	0,00174**
LNSIZE	-0,03611**
HERF	-0,07541***
ROE	0,01823***
Nbre of observations	1528
Log Likelihood ratio	1113
R^{2bar}	0,589

*** Statistical significance at 1% level
** Statistical significance at 5% level
* Statistical significance at 10% level

Table 5

Market discipline effect: instrumental FGLS regression model: capital specification

	Random effects FGLS		
	Dependant variable: CBUFF		
	Insurance	**Funding**	**Disclosure**
CONS	1,832573***	1,742154***	1,23488**
Risk variables			
NPL	-0,163822***	-0,219419**	-0,08631**

LLLP	0,183945**	0,093728**	0,278455*
RWA	0,203782***	0,140351***	0,180391***
LIQUID	-0,194907*	-0,072860**	-0,061028**
IDIO	0,09350**	0,141989*	0,047321
Market discipline variables			
DEPINS	-0,073410***		
P_i	-0,082910**		
MSI_{-i}	-0,137225**		
BANKDEPFIT		0,075110***	
DISCFIT1			0,251929**
DISC2			0,133655*
RAT			0,003831**
UNQUALIF			0,039212*
CRED			-0,006311**
MARK			0, 00114*
GVMT			-0,193746
INSOWN			0,085973***
BLOCK			0,102549**
BSIZE			0,003893
Control Variables			
HERF	-0,066382**	-0,192541***	-0,023956**
YEAR	0,002384***	0,003921***	0,003115***
GGDP	0,094558**	0,114703**	0,101942**
LNSIZE	-0,003937**	-0,039256***	-0,153950**
ROE	0,184764***	0,120835***	0,085832***
N° observations	987	1332	1011
Log likelihood ratio	2027	2685	3720
R^{2bar}	0,53	0,44	0,67

Table A0 : categories of sub-indexes used for the construction of DISC1

Items	Sub-index	Categories
Assets		
Loans	S_1 : Loans by maturity	Loans and advances ⟨3 months, Loans and advances 3-12 months, Loans and advances ⟩ 1 year
	S_2 : Loans by counterparty	Loans to Group Companies, loans to other corporate, Loans to banks.
	S_3 : Problem Loans	Total problem banks
	S_4 : Problem loans by type S_5: risk weighted assets	Overdue/ restructured/ Other non performing Total of risk weighted assets
Other Earning Assets	S_6 : Securities by type	Treasury bills, other bills, Bonds, CDs, Equity investments, other investments
	S_7: Securities by holding purpose	Investment, trading
Liabilities		
Deposits	S_8: Deposits by maturity	Demand, Savings, Sub 3 months , 3-6 months, 6monthes-1 year, 1-5 years, + 1 year
	S_9: Deposits by type of customer	Banks/customers/ Municipal, Government
Other funding	S_{10}: Money market funding	Total Money Market Funding
	S_{11}: Long term funding	Convertible Bonds, Mortgage Bonds, Other Bonds, Subordinated debt, Hybrid Capital
Income statement		
	S_{12}: Non-interest income	Net Commission Income, Net fee Income, Net Trading income

	S_{13}: Loan Loss Provisions	Total Loan loss Provisions
Memo lines		
	S_{14}: Reserves	Loan loss reserves (memo)
	S_{15}: Capital	Total capital ratio, Tier 1 ratio, total capital
	S_{16}: Off-balance sheet (OBS) Items S_{17}: liquid assets	OBS items Total liquid assets

Table A1

Results of the first stage estimation with Instrumental Variables (IV): GLS regression with dynamic panel

	DISC1	**BANKDEP**
CONS	-13,7348**	-10,9310***
ROE	0,069372***	-0,82609**
ROA	0,182661***	-25,0738**
CIR	0,120371**	0,17275
LOAN	-0,084639**	0,06921*
LIQUIDR	0,033028*	-20,8683*
MS	-0,173936**	-0,12744**
BANKTYPE	0,084725**	13,9712**
DUMCOUNTRY		
DUMIT	11,8411***	34,9137***
DUMFR	18,9478***	87,980***
DUMGER	-6,04832**	54,0291**
DUMSPN	20,8103***	25,18**
DUMUK	-4,93752**	46,2415**
DUMNTHS	6,70287***	-16,4839**
DUMPGL	-13,8571**	8,27901**
DUMGRC	-18,0993*	-65,9180**
DUMAST	-7,28439**	-23,7307***
DUMBLG	34,0873**	-11,1963**
DUMSWS	-10,8462***	92,2732**
DUMIRL	76,9328**	-5,72927**
DUMFLD	-48,8359*	-8,24318**
DUMYEAR*DUMCOUNTRY		
DUMITY	0,27461***	0,14964***
DUMFRY	-0,49921**	-0,00830***
DUMGERY	-0,19758***	0,05749***
DUMSPNY	-0,07389***	0,98341***
DUMUKY	0,18233**	-0,0736***
DUMNTHY	-0,08754**	-0,02912***
DUMPGLY	0,74930***	-0,02038***
DUMGRCY	0,00493***	0,18305***
DUMASTY	0,04739***	-0,02903***
DUMBLGY	-0,09478***	-0,11390**
DUMSWSY	-0,11872***	0,01831**
DUMIRLY	-0,02933**	0,07298**
DUMFLDY	-0,10359**	-0,00457**
Nbre of observations	3720	3532
R^{2bar}	0,4801	0,5190

Table A2

Correlation coefficients between the fitted and the actual values of DISC and BANKDEP

	DISCFIT	BANKDEPFIT
DISC	**0,42,98**	
BANKDEP		**0,5661**

Table 6

IV GLS Preferred regression with panel data:

	GLS 1 (IV)
Dependant variable CBUFF	
CONS	
Risk variables	
NPL	-0,07531***
LLLP	0,18902***
RWA	0,20816***
LIQUID	-0,02879**
IDIO	0,06290**
Market discipline variables	
DEPINS	-0,11285***
P_i	-0,023551***
MSI_{-i}	-0,06011***
BANKDEPFIT	0,031357**
DISCFIT1	0,006381**
DISC2	0,01097***
CRED	-0,08435**
MARK	0,01217**
BLOCK	0,03122**
CONTROL VARIABLES	
HERF	-0,07532**
YEAR	0,04295***
GGDP	-0,16511**
LNSIZE	-0,00897***
ROE	0,04926***
N° observations	583
Log likelihood ratio	1864
R^{2bar}	0,57

Only significant variables are retained in this regression

Table 7

IV GLS regression model with panel data for risk specification Impact of market discipline components in conjunction.

GLS For all MD CATEGORIES		**DEPENDENT VARIABLE**			
	NPL	**LLP**	**RWA**	**LIQUID**	**IDIO**
CONS	0,58746***	0,29802***	0,38103***	0,37320***	0,15601***
Capital variable CBUFF	-0,08272***	0,13638**	0,12945**	-0,31441**	0,07634**
Market discipline variables					
DEPINS	0,19005*	-0,06522	0,09651**	0,04783	-0,05721**
P_i	-0,42061**	-0,29370**	0,00538	-0,08126**	0,01840
$LMSI_{-i}$	0,01903**	-0,03848*	0,02360**	-0,07038**	0,03104**
LBANKDEPFIT	0,05801	0,0136*	0,03430**	0,00703	0,09238**
LDISCFIT1	-0,06362**	0,04017*	-0,03874*	0,03171***	-0,05760***
DISC2	-0,00644	0,04480*	0,28371	0,01739**	0,10382

RAT	0,0712	0,05309*	0,01020**	0,00512	0,02900
MARK	0,003821**	0,012902**	0,01923	-0,00282*	0,03934*
INSOWN	-0,38115***	0,14973***	0,08205**	0,02205	-0,17380*
BSIZE	2,4039**	-3,02381**	3,0297***	2,99423	1,28474**
Control variables					
LGGDP	-0,81138***	-0,17492***	-0,04847**	-0,19208***	-0,23095
LLNSIZE	-0,09207	0,00263***	0,01320***	-0,04115*	0,02800*
HERF	-0,00181	0,03460**	-0,05511**	-0,08013**	0,09520*
COMMERC	0,03248**	0,02844	0,01563***	-0,02459	0,02033
COOP	-0,00327***	0,18021**	-0,02933**	0,02051	0,01743
SAV	-0,18341***	0,03866***	-0,10858	0,12903***	-0,13421
REAL	-0,00774**	0,01893	0,03211***	0,09384**	0,00487**
MLTCR	0,02901*	0,02040**	0,01080**	-0,01717***	0,01498**
GVMT	-0,01552**	0,02272	0,19481**	0,28103	-0,00302**
N° observations	421	571	483	602	611
Log likelihood ratio	1028	2382	1705	1144	1203
R^{2bar}	0,34	0,41	0,36	0,55	0,28

Table 8

Results of the simultaneous equation estimation for the supported banks of the sample (Support =1)

Dependant variable : CBUFF	**GLS with IV (all MD components)**
CONS	0,32189**
Risk variables	
NPL	0,01402**
LLLP	-0,03928**
RWA	0, 00832*
LIQUID	-0,14512*
IDIO	0,02441**
Market discipline variables	
DEPINS	-0,01897**
MSI_{-i}	-0,03230**
BANKDEPFIT	0,01356*
DISCFIT1	0,09238*
DISC2	0,02310**
CRED	-0,00219*
RAT	0,05821*
MARK	0,00172**
BLOCK	0,02983*
CONTROL VARIABLES	
HERF	-0,09210*
YEAR	0,1033**
GGDP	-0,04871***
LNSIZE	-0,01059*
ROE	0,01237*
R^{2bar}	**0,471**
Dependant variable : Risk (RWA)	**GLS with IV (all MD components)**
CONS	0,28721***
Capital variable CBUFF	0,01139**
Market discipline variables	
DEPINS	0,03351*
$LMSI_{-i}$	0,01181**
LBANKDEPFIT	-0,02962

LDISCFIT1	-0,07279**
DISC2	-0,01938*
RAT	-0,00147*
MARK	-0,01535***
INSOWN	-0,02206**
BSIZE	3,02931*
Control variables	
LGGDP	-0,02508**
LLNSIZE	0,01149*
HERF	-0,01102**
COMMERC	0,05940*
COOP	-0,03933*
SAV	-0,01272*
REAL	0,00205*
MLTCR	0,03904**
GVMT	0,01057**
R^{2bar}	**0,341**

Index of variables used in the regressions

Variable Name	Description	Data source
CBUFF	**Capital buffer : actual capital minus regulatory capital**	**Bankscope**
DEPINS	**Composite index of deposit insurance**	**Bankscope**
P_i	**Support probability**	**Bankscope and Gropp et al (2007)**
$LMSI_{-i}$	**Lagged market share of protected competitors**	**Gropp et al (2007)**
LBANKDEP	**INTERBANK DEPOSITS OVER TOTAL LIABILITIES**	**Bankscope**
DISC1	**DISCLOSURE INDEX**	**OWN CONSTRUCTION**
DISC2	**DISCLOSURE INDEX at country level.**	**WORLD BANK (2007)**
INSOWN	Percentage of equity owned by the company directors and top executive officers, including the CEO.	**BANKSCOPE, reports**
BLOCK	Percentage of equity owned by persons and institutions that hold 5% or more of the company's equity.	**BANKSCOPE, reports**
OUTDIR	Proportion of directors not currently employed by the company. It is calculated as the number of outside directors divided by the total number of directors.	**BANKSCOPE, reports, DAFSALIENS**
BSIZE	Number of directors sitting on the board at the shareholders' annual meeting.	**Bankscope, reports, DAFSALIENS**
GVMT	1 if the bank is more than 50% owned by the government, 0 otherwise.	**Bankscope, reports, DAFSALIENS**
NPL	**Non performing loans**	**Bankscope, reports, DAFSALIENS**
LLP	**Loans loss provisions**	**Bankscope, reports**
RWA	**Risk weight assets**	**Bankscope**
LIQUID	**Liquid Assets over total assets**	**BANKSCOPE**
GGDP	**Gdp growth**	**OECD DATASOURCE**
IDIO	**Idiosyncratic risk**	**DATASTREAM**
BETA	**SYSTEMATIC RISK**	**DATASTREEM**

HERF	**HERFENDHALL INDEX (CONCENTRATION)**	**Own construction**
MS	**Market share : assets over total assets of the banking system**	**Bankscope**

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