Credit quality, bank provisioning and systematic risk in banking business

Josanco Floreani[*], *Maurizio Polato*[†], *Andrea Paltrinieri*[‡] *and Flavio Pichler*[§]

Abstract

Based on a sample of 59 European banks over the period 2006-2011, we investigate the impact of the loan loss provisioning (LLP) together with a wide array of credit-risk exposure and performance variables on systematic risk measured by betas. We develop a model for assessing whether management behaviour, accounting policies, such as LLP, and the quality of loan portfolio play a significant role in explaining the banks' systematic risk exposure. Our results suggest that financial performances do not have a direct significant relation with betas; rather measures of risk exposures (risk weighted assets on total assets) substantially affect systematic risk. During crisis systematic risk significantly responsive to provisions and their impacts on performances.
Our study has several implications, in particular at light of changing European regulation on non-performing exposures reporting and forbearance practices alongside with regulators forcing banks to strengthen their capital base.

Keywords: Non-performing Loans, Loan Loss Provisioning, Cost of Capital, Banks
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[*] Josanco Floreani is Lecturer in Banking and Finance, University of Udine, Department of Economics and Statistics, Via Tomadini 30/A – 33100 Udine; mail: josanco.floreani@uniud.it; phone: +39 0432249353.
[†] Maurizio Polato is Full Professor in Banking and Finance, University of Udine, Department of Economics and Statistics, Via Tomadini 30/A – 33100 Udine; mail: maurizio.polato@uniud.it; phone: +39 0432249315.
[‡] Andrea Paltrinieri is Lecturer in Banking and Finance, University of Udine, Department of Economics and Statistics, Via Tomadini 30/A – 33100 Udine; mail: andrea.paltrinieri@uniud.it; phone: +39 0432249317.
§ Flavio Pichler is Associate Professor in Banking and Finance, University of Verona, Department of Business Administration, Via dell'Artigliere, 19 - 37129 Verona; mail: flavio.pichler@univr.it; phone: +39 0458028273.

1. Introduction

Managerial behaviour and accounting policies have a huge impact on corporate earnings and their information content. Reporting of non-performing loans and loan loss provision (LLP) practices are among the major concerns in the banking industry. Asset quality, exposure to credit-risk and provisioning bear great implications in relation to earnings volatility and capital adequacy. Managers may rely on discretionary provisioning as a mean of smoothing earnings. While there is a large debate in literature about the incentives to discretionary LLP, there's no doubt that such a practice might hinder the true riskiness of the bank and distort market perceptions. On the same vein, discretionary provisioning may be regarded as a tool for optimizing bank's capital.

The aim of the paper is to investigate the impact of the loan loss provisioning and other significant credit-risk exposure variables on the banks' cost of capital proxied by betas. The issue is of great interest at least for three reasons.

The first is related to the peculiar nature of banking industry's business. A chain of influences stemming from the social and economic environment together with managerial strategies significantly impact on earnings and exposure to risk. Since banks stand at the heart of the transmission mechanism of monetary policy, they play an important role in spreading or absorbing shocks. The structure of the financial system together with monetary authorities' policies and the regulatory framework affects banks' stability in a very different way from other financial and non-financial firms. Structural changes in the macroeconomic framework, financial system and political institutions affects the banking business and the relations with shareholders.

The second reason is that international competition, differences in the economic cycle and various industrial arrangements might be accountable for differences the cost of capital across countries. The issue has obvious practical implications in an era when banks across countries are forced to substantially rise their capital base, either by regulatory requirements and as a result of capital assessment exercises. Within this framework, differences in the cost of capital might alter competition among banks.

The third reason is tightly related to the new proposed EU regulations referring to LLP and non-performing loans reporting. A convergence in reporting standards across European banks is expected to lead to a levelling of the playing field in assessing banks' stability and the conditions of accessing to capital markets. This leads to obvious implications as regards the pricing of risks, eventually overcoming distortions in the allocation of funds across the banking sector.

Our paper makes an important contribution in this field, as there is a lack of literature assessing the impact of LLP on the cost of capital.

Although several studies have individually analysed these two factors, this is the first study trying to evaluate the influence of a particular accounting policy on a risk indicator in the banking sector. Indeed, much of the literature has investigated the LLPs as a tool for income smoothing to reduce earnings volatility or to manage regulatory capital. But it has not focused on the potential effect on overall bank's risk.

Furthermore a lot of studies focus on US banks (Wetmore and Brick, 1994 and Bhat 1996 among all) and emerging markets ones (Ismail *et al.,* 2005), but only a few of them analyse European banks, mostly investigating single countries, such as Spain or Holland (Pérez *et al.*,2008, Norden and Stoian 2013). Instead our sample include 59 European banks of 10 countries.

Our study has several implications, in particular considering the change of European regulation on non-performing exposures reporting and forbearance practices, the adoption of Basel III capital accord and at light of regulators forcing banks to substantially reinforce their capital base.
The paper is organized as follows. Section 2 provides an overview of banks' manager behaviour and its impact on earnings quality and capital endowments at light of prominent literature. Section 3 defines the theoretical framework with reference to the determinants of betas. Section 4 describes sample, data and methodology. Section 5 summarizes the main results while section 6 discusses policy implications. Section 7 concludes.

2. Literature review

The topic of loan loss provisions (LLPs) has been broadly investigated in the literature, but a consensus on whether banks' managers use LLPs for income smoothing, capital management or with a signalling effect still lacks. An important feature of the literature on LLPs is that it is mainly focused on the US banking system, since only in the most recent years researchers started investigating also non-US banks. Moreover, there are studies which focus solely on one hypothesis – either income smoothing, capital management or signalling – and studies which test for all.
Our review will be divided into four parts. In the first part we analyse the most important contributions related to the income smoothing hypothesis alone. In the second part we review the studies related to capital management only. In the third part we analyse the literature on both the income smoothing and capital management hypotheses. Finally, in the last part, we review the studies on the role of LLPs as signals of the current as well as of the future economic financial situation of banks.
The rationale for the income smoothing hypothesis lies in the fact that LLPs can be used to reduce the volatility of earnings. The early studies in the income smoothing literature date back to the end of the 1980s and the first contributions were those by Greenawalt and Sinkey (1988) and Ma (1988), who find evidence of earnings management in the U.S. banking industry. Greenawalt and Sinkey (1988) use a sample of 106 large bank holding companies for the period 1976-1984 and find that banks' managers effectively tend to use LLPs to reduce reported earnings through an increase in LLPs when income is high, while they tend to reduce LLPs when earnings are low. Moreover, they show that regional banking companies smooth their income more than money-centre banks. Ma (1988) uses data on the 45 largest U.S. banks in the period 1980-1984 and finds a strong evidence of banks' managers using LLPs to reduce (raise) their earnings when the operating income is high (low). Wahlen (1994) tests the income smoothing hypothesis on a group of 106 commercial banks for the period 1977-1988 and finds that when future cash flows are expected to be positive, banks' managers increase LLPs. On the contrary, Wetmore and Brick (1994) find no evidence of income smoothing practices in the analysed sample of 82 US banks for the 1986-1990 period. Bhat (1996) tests the income smoothing hypothesis for 148 U.S. large banks in the period 1981-1991 and finds that banks which manage their earnings through LLPs have low growth, low book-to-asset and market-to-book ratios, high loan-to-deposit and debt-to-asset ratios, low ROA and total assets. In other words, income smoothing is typical of small, badly capitalized and with poor financial conditions banks. More recently, Kanagaretnam *et al.* (2004) use a sample of 91 public listed US banks for the period 1987-2000 and find that banks'

managers reduce current income through LLPs to "save" income for the future when earnings are high and vice versa when current income is low. Liu and Ryan (2006) investigate whether banks' income was lower during the 1991-2000 period, which covers also the so called 1990s boom. The results show that profitable banks tended to decrease their income in the sample period using LLPs, in particular on homogenous loans.

In the most recent years, studies have been conducted also for non-US banks. Ismail *et al.* (2005) base their analysis on a sample of Malaysian banks, including bank-specific as well as macroeconomic factors peculiar to the Malaysian economy. They find that Malaysian bans do not smooth their income through LLPs. Norden and Stoian (2013) investigate a group of 85 Dutch banks in the period 1998-2012. They find that banks tend to increase (decrease) their LLPs when their income is high (low), thus giving strong supporting evidence to the income smoothing hypothesis.

The second hypothesis used to explain the use of LLPs is the need to manage the regulatory capital. The changes in the regulation at the end of the 1980s may have indeed modified the incentives for banks' managers to use LLPs for capital adequacy reasons. This stream of literature can be dichotomized into two categories, pre- and post-1989 capital adequacy regulation. In 1989 the US regulatory agencies changed the capital ratio computation to adhere to the then newly adopted Basel I framework excluding loan loss reserves from the numerator of the capital ratio. Two main contributions focus solely on the capital management hypothesis, i.e. Moyer (1990) and Kim and Kross (1998).

Moyer (1990) finds evidence that prior to 1989 US banks' managers tended to increase LLPs to raise the capital ratio and to prevent it falling under the minimum level of 5.5%, while after Basel I entered into force LLPs were no longer used to manage regulatory capital ratios. Kim and Kross (1998) use a sample of 193 US bank holding companies for the period 1985-1992, which is then divided into two sub-periods according to the entrance into force of the Basel I regulatory framework, i.e. 1985-1988 and 1990-1992. The results show that banks with low capital ratios used LLPs in the 1985-1988 period more than in the 1990-1992 one, since incentives to use them in the latter period were non existent. However, the post-1989 regulation seemed to have no effect on banks which in the 1985-1988 period had higher capital ratios.

A growing body of literature has focused on both hypotheses, thus investigating whether banks' managers use LLPs to smooth income and/or manage the regulatory capital ratios. These contributions can be divided into those studying US banks and those focusing on non-US banks, the latter being the most recent literature on LLPs. As regards the former, Collins *et al.* (1995) use data from 160 US banks in the 1971-1991 period and find supporting evidence of the income smoothing hypothesis, while no relationship exists between LLPs and capital ratios, meaning that banks' managers do not use loan loss reserves to manage their regulatory capital. Beatty *et al.* (1995) and Ahmed *et al.* (1999) find contrasting evidence to that of Collins *et al.* (1995). Beatty *et al.* (1995) use a slightly different sample from that of Collins *et al.* (1995). Their sample is made up of a smaller number of banks (148) and covers a shorter period (1985-1989). The results show no use of LLPs by banks' managers to smooth income, while LLPs are used in the management of capital ratios. Ahmed *et al.* (1999) also use a smaller sample that Collins *et al.* (1995), made up of 113 banks, but test a shorter, even though more recent time period (1986-1995). They find no supporting evidence for the income smoothing hypothesis, but find that banks' managers use LLPs for capital management

purposes, since in the pre-1989 analysis banks showed higher level of LLPs than in the post-1989 period.

In recent years studies have focused on non-US banks, in particular from Australia (Anandarajan *et al.* (2006)), Europe (Curcio and Hasan (2008) and Curcio *et al.* (2012)), Spain (Pérez *et al.* (2008)), Taiwan (Chang *et al.* (2008)) and the Middle East region (Othman and Mersni (2014)).

Anandarajan *et al.* (2006) focus their attention on a sample of 50 Australian commercial banks, 10 of which are listed, for the period 1991 to 2001. The results show that banks' managers use LLPs to manage their regulatory capital, but only in the pre-1996 period. The year 1996 is considered the cut-off date for the implementation of the Basel I framework in Australia, even though some banks may have adopted it earlier: still the Authors say that in 1996 all Australian banks had adopted the Basel I rules. Moreover, results indicate that Australian banks and, in particular listed ones, use LLPs to smooth their income. European banks' attitude towards using LLPs has been investigated both in 2008 and in 2012.

Curcio and Hasan (2008) compare the earnings- and capital-management incentives of 907 banks belonging to different countries, all geographically part of the European continent, and in particular: i) the 15 EU/pre-2004 countries; ii) the 10 EU/2004 countries; and iii) 23 non-EU/2006 countries. The time period is 1996-2006. The results show that both EU and non-EU banks use LLPs for income smoothing purposes. Moreover, EU banks, both pre- and post-2004, use LLPs to manage regulatory capital, while non-EU banks do not.

Curcio *et al.* (2012) use a sample of commercial, cooperative and savings banks belonging to 19 out of the 21 European countries of origin of the credit institutions subject to the 2010 and 2011 EBA's stress tests, for the period 2006-2010. The results support the hypothesis of income smoothing through LLPs for the sample banks, in particular for listed banks, but rejects the hypothesis of capital management, only for non tested banks. Indeed, the Authors find that banks that were tested under the EBA's 2010 and 2011 stress tests use LLPs more to manage their regulatory capital than to reduce the volatility of their earnings. Pérez *et al.* (2008) focus their attention on Spanish banks. The importance of this banking system relates to the strict rules the Banco de España had on loan loss provisions, that were expected to prevent banks' managers from using LLPs for either income smoothing or capital management purposes. The results show that in the period from 1986 to 2002 Spanish banks effectively use LLPs to reduce the volatility of their income, but they do not manage their regulatory capital ratio through loan loss provisions.

Chang *et al.* (2008) study the income smoothing and capital management hypotheses for a group of banks listed in the Taiwan Stock Exchange for the period 1999-2004. Their results indicate that the former is supported, since banks' managers effectively use LLPs to manage their earnings, while there is no evidence supporting the latter. Othman and Mersni (2014) conduct a comparative study between banks belonging to the Middle East region. These banks differentiate because 21 are Islamic banks, 18 are conventional banks but with Islamic windows and 33 are conventional banks. The results show no important differences in banks' managers use of LLPs: indeed, Islamic banks use LLPs to smooth their income and to manage their regulatory capital in the same ways as conventional banks, both with and without Islamic windows.

Another reason for using LLPs is the signalling hypothesis, under which banks' managers are supposed to increase LLPs as to indicate the financial strength or the market

value of banks. In other words, LLPs contain both bad and good news: the former relates to the fact that increasing LLPs signals a higher default risk. The latter indicates the willingness of the banks' managers to deal with problematic loans as well as with performing ones.

This stream of literature yields conflicting results as in the cases of income smoothing and capital management; indeed some Authors point to the existence of the signalling effect, whilst others support the opposite. Again, the literature is mainly US-based and is particularly focused on market reactions to the Citicorp announcement of LLPs increases in 1987. Beaver *et al.* (1989) use a sample of 91 US banks for the period 1979-1983 and show that banks which report higher loan loss provisions have higher market-to-book values and thus support the idea that banks' managers use LLPs to signal the financial strength of their bank. Wahlen (1994) reaches the same conclusion, though using abnormal returns. Elliot *et al.* (1991) and Griffin and Wallach (1991) conduct an unusual analysis to test the signalling hypothesis. Elliot *et al.* (1991) use the announcements of increased loan loss reserves by Citicorp and other US banks as well as the write-off announcement of the Bank of Boston in 1987 related to problematic loans in lesser developed countries, Brazil in particular, and look at the market reactions in the two days before and after the announcements date. Their analysis show that the Citicorp as well as other than Bank of Boston banks notice was assessed positively by investors: they thought Citicorp had to increase its LLPs to better deal with the problematic loans. The write-off announcement made by the Bank of Boston was interpreted negatively due to the fact that it would decrease the capital adequacy ratio.

Griffin and Wallach (1991) also focus on Brazil. They analyse the stockholders' returns of 13 large US banks to test whether they were affected by the increase in LLPs due to the bad credit situation in Brazil. The results show that the stock markets effectively appreciated the decision of banks' managers to rise the amount of loan loss reserves, for it meant they wanted to resolve Brazil's debt situation.

Liu and Ryan (1995) and Liu *et al.* (1997) investigate a sample of 104 US banks for the period 1983-1991. Liu and Ryan (1995) distinguish loans for which banks make the provisioning on a timely basis (small and infrequently renegotiated loans) and those for which provisioning is made on a less timely basis, thus loans that may show default problems (large and frequently renegotiated loans). Their results point to the fact that increases in LLPs are positively assessed for the latter loans, while the financial markets give a negative interpretation to increases in the LLPs of loans that are usually provisioned on a timely basis.

Liu *et al.* (1997) deepen their previous analysis by investigating whether there is difference in the signalling role of banks' LLPs between bad and good capitalized banks and across fiscal quarters. They find that stock markets value in a positive manner the LLPs only for banks with low regulatory capital levels and in the fourth quarter. Beaver and Engel (1995) distinguish between the two components of LLPs, the non-discretionary or specific and the discretionary or general ones. The former are strictly related to the assessment of the expected losses of a bank's loan portfolio. The latter are set aside against not yet identified losses, for prudential purposes. Their analysis shows that financial markets give different values to these two components; in particular, increases in the discretionary component are viewed positively, while increases in non-discretionary LLPs are seen as negative signals.

Ahmed *et al.* (1999) are the first to extend the period of analysis of the role of LLPs to after the Citicorp announcement in 1987. They investigate not only the income smooth-

ing and capital management hypotheses, but also the signalling one. They find conflicting evidence to that of previous studies. Indeed, for their sample of 113 US bank holding companies over the 1986-1995 period LLPs do not entail any signalling effect.
Hatfield and Lancaster (2000) add to the growing literature on LLPs by analysing the effects of LLPs increases for 7 different reasons (general domestic loans, adverse economy, commercial loans, lesser developed countries loans, combination of domestic and foreign loans, combination of real estate and energy loans, real estate only loans) of 33 US bank-holding companies in the 1980-1992 period, thus allowing for the examination of the post-Citicorp announcement. They use data relating to 121 announcements of increases to LLPs. Their analysis is aimed at testing the market reaction in the -15/+15 days window from the announcement date. The results show that the markets react negatively in the days before the announcement is made, while the reaction turns positive once the announcement is made. However, the markets response is not the same for all types of loans: in particular, only for the lesser developed countries and combinations of domestic and foreign as well as real estate and energy loans categories the positive market reaction after the announcement is significant.
Recently, the signalling hypothesis has been tested also for non-US banks. Anandarajan *et al.* (2006) find that Australian banks do not seem to use LLPs to signal their intentions of higher earnings in the future to outsiders. Curcio and Hasan (2008) find conflicting results for European and non-EU banks. In particular, they show that LLPs have a signalling role for non-EU banks, while provisioning policies have no signalling purpose for EU banks. Leventis *et al.* (2012) examine a sample of 91 listed commercial banks, both financial sound and unsound, originating from 18 EU countries for the period 1999-2008 in order to test for the use of LLPs, in particular after the implementation of the IFRS reporting standards in 2005. In their analysis they find no strong evidence of the signalling hypothesis. In particular, their results suggest that the managers of less financially sound banks engage in stronger signalling than financial healthy banks. Moreover, the implementation of the IFRS reporting standards affected the signalling behaviour of EU unsound banks managers, in that they make stronger use of LLPs after 2005 relative to the previous period in which they had to adhere to national accounting principles.

3. Determinats of beta and hypothesis development

Risk assessment and management are two of the major building blocks of finance in general and banking business in particular. In todays banking industry banks are required to strengthen their core capital base either for complying with regulatory requirements and as a result of supervisory pressures. More generally, new pieces of regulation force banks to rely more heavily on stable sources of funding in order to better manage liquidity risk. These capital needs cast two main problems: that of the cost of rising new equity funds and that of the relative convenience of alternative sources of funds such as subordinated debt.
The cost of capital and its determinants have been widely investigated either in corporate finance and bank specific literature. The idea that the cost of capital is to a large extent determined by the value that the stock market assigns to corporate's earnings is well established. According to the CAPM the cost of capital is function of a market risk premium according to the firm's beta where the latter is determined regressing stock returns on market returns. A variety of factors such as different time spans, frequency of

observations and proxies for the market portfolio, can lead to significant differences in betas provided by various sources.

A growing body of literature develops alternative methods for determining betas against firm's fundamentals. The rationale laying behind fundamental betas is to use financial data in order to capture systematic risk. A plenty of contributions (among others see Rosenberg and McKibben, 1973; Fama and French, 2004; Chance, 1982; Dyl and Hoffmeister, 1986 and Gahlon and Gentry, 1982) advocates the merits of fundamental betas over historical betas arguing that the latter provide better indications of the sources of systematic risk. Moreover, the analysis of fundamental betas reveals that while all firms are sensitive to systematic risk, they differ in their sensitivity to macroeconomic conditions due to their different characteristics. Firm's strategic policies are expected to significantly affect such sensitivity. Relationships between market-based risk and corporate risk variables might help managers to better understand how changes in corporate policies affect firm's systematic risk and investors to better assess systemic risk.

However, while systematic risk is related to risk factors in the underlying corporation, it is far from clear which factors are actually relevant. Prominent contributions find significant correlations between *β's* and *pay out ratios*, financial leverage and earnings yield volatility (Beaver, Kettler and Scholes, 1970); other studies account for a significant explanatory power asset size and profitability (Logue and Merville, 1972). Such studies, in particular, conclude for a negative relation between profitability and systematic risk which is coherent with the idea that successful firms reduce the chance of systematic risk.

While such an intuition might make sense in general, there are good reasons for arguing for an inverse relation in certain industries. Borde *et altri* (1994) found a positive relationship between profitability and systematic risk in insurance companies. Arguably, such a relation should be regarded as coherent with the nature of business in financial firms given that they actually earn greater returns by taking higher risks.

Arguably, relevant underlying risk factors have a significant industry specific nature. Certain businesses are particularly exposed to systematic events and macroeconomic conditions. Specifically, banking business while being highly exposed to systemic events it triggers such events itself. These features make bank's *β's* particularly interesting to analyse and claims for a thorough discussion of the factors that can plausibly be assumed to explain systemic risk.

Our study is grounded on standard corporate finance theoretical models and bank specific research as well. To our knowledge there is a lack of contributions investigating bank's cost of capital against fundamental variables while there is some research examining the influences on the cost of capital of systemic and macroeconomic variables, such as taxes, households saving behaviours, macroeconomic stabilization policies and financial policies. There are strong reasons for systemic variables having a significant impact on earning volatility and, thus, bank's riskiness. Banks run a pro-cyclical business. During expansions they experience higher returns but building up risks that can lead to sharp losses during recessions. Sovereign's budgetary tensions might cause strains to the banking sector, as we learned from the crisis, and trigger systemic losses. In many countries banks heavily invest in sovereign's debt and are forced to high impairments during crisis. The link between sovereigns and banks makes the banking sector responsive to macroeconomic and fiscal stabilization policies.

Although one could attempt to find the most significant macroeconomic variables for capturing the exposure of banks to systemic risk, almost all the possible measures are potentially subject to criticism and fallacies. For example, a useful proxy of pro-cyclical behaviour is given by the credit-to-GDP ratio. Regulators themselves became aware of systemic risks associated to excessive credit expansion when they impose countercyclical buffers. However, what the most appropriate GDP measure for an internationally active banking group is, could be a matter of debate. A feasible way to overcome this problems is determining banks' betas against an average sectorial beta and investigating which risk factors differentiate each bank from the sectorial average. This approach is equivalent to say that sectorial betas capture the impact of macroeconomic and systemic variables over the riskiness of the sector while each institution differs from the average riskiness by its peculiar characteristics.

As a major implication there could be significant differences in banks' cost of capital across countries and institutions. Banks can be differently exposed to systemic risk as a result of strategic corporate policies, different business models and different sources of funding. Given the complex nature of banking business, especially when looking at major, highly-diversified cross border groups, finding the relevant factors affecting systemic risk is not an easy task.

Several market-based and corporate-risk based variables might be assumed as determinants of betas and, in particular, to explain heterogeneity among banks. Market-based variables are related to trends in share prices. Aggressive stocks could be deemed as having higher sensitivity to systematic risk. Corporate-risk based variables could be grouped in several blocks of variables a plenty of which characteristic of banking business or, at least, have paramount implications for banks.

Major risk factors are obviously related to the asset side of the balance sheet. Assets' composition, however, depends on the specific bank's business model and its diversification. Banks largely operating according to a traditional business model are supposedly exposed to different risk events than banks having a more market oriented business model.

Dependent on the business model are, then, a group of variables capturing the exposure on credit risk. Although banks, at least major groups, are highly exposed to market risks, in the present work we focus on risks related to the core business. In an attempt to predict risk one could draw on a variety of information. Good indicators of risk could be found in the balance sheet, income statement and other disclosures (i.e., disclosure on asset quality), such as ratios in different asset categories and margins. Relevant categories could be net loans, gross loans, impaired loans, reserves for impaired loans, loan impairment charges, risk weighted assets, operating margins, interest on loans. Such categories have been, in particular, identified as determinants of betas by a pioneering work of Rosenberg and Perry (1978). In particular, the authors identified a wide array of possible explanatory variables grouped in categories capturing the asset mix, the liability mix, operating characteristics (income, cash flows), size, growth and variability in stock prices.

A more recent study on the Italian banking system (Di Biase and D'Apolito, 2012) use as explanatory variables the size (total assets) a leverage ratio (book value of debt/book value of equity) a loan to asset ratio, a liquidity ratio (cash/total assets) an intangibles ratio, a loan loss ratio and earning per shares. They find in particular a negative relation of EPS and loan loss ratio with betas.

Given the aim of our study, we are in particular interested in investigating betas against the quality of loans portfolio with a wide array of specifications regarding in particular the provisioning behaviour, the riskiness of loans and the impact on performances.
As known, managers have some discretion in provisioning and they use discretionary provisioning as a mean of income smoothing as recognised in literature. Some author argue (see Kanagaretnamet et al., 2005) that managers have the incentive to adjust banks' current performance to an average performance of a group of benchmark banks. Should this hold, we would expect stock process volatility of banking institutions converging toward sectorial volatility with differences being due to specific characteristics of each institutions, in particular business models. Arguably, while such form of "benchmarking" could make sense during normal times, it would prove more difficult for banks to track an average sectorial performance during crisis periods.
However, the pro-cyclical behaviour of banks significantly accentuates swings in earnings and is expected to have significant implications as regards the responsiveness of systematic risk exposure. In particular, it casts the question of whether betas are actually responsive to performance measures or, rather, they are reactive to risk taking behaviour, which affects future losses and performances. As noticed other studies account for a positive relation between risk-weighted assets and betas. Loan loss provisions plays a relevant role within this framework. On the one hand they have an impact on earnings fluctuations. Since they represent provisions set aside to cover expected losses (which represent the cost of lending) an underestimation of the expected losses during benign times will lead to an increase in profits and lending activity due to overconfidence. The opposite, of course, will hold during recession or financial distress. Recall that provisions comprise specific provisions which are related to credit losses (they cover expected losses and increase specific reserves) and general provisions which are set aside against no yet identified losses (they are therefore discretionary provisions). To some extent, therefore, provisions can be used for earning management purposes and, in particular, earnings smoothing (reducing volatility in earnings). On the other hand, provisioning, together with capital requirements, has to do with the coverage of credit risk. There are convincing arguments, therefore, to think at provisioning as having an impact on systematic risk. Capital requirements themselves, which are designed to cover unexpected losses, are expected to have an impact on systematic risk and this might be particularly true during crisis given the shortage of reserves which is due to the pro-cyclical behaviour of provisioning. We develop the following hypothesis.
Hypothesis 1 – *Betas are responsive to risk exposure and risk-coverage policies rather than current performances. Loan loss provisions have a significant impact on systematic risk.*
Hypothesis 2 – *The relation between bank's betas and sectorial betas weakens during crisis periods as the impact of bank's fundamentals is expected to increase and widely affect volatility.*
Hypothesis 3 – *In crisis times, capital adequacy turns to assume a significant role in driving betas due to increasing concerns as of bank soundness*.

4. Data and methodology.

4.1 Description of the sample

Our study is based on a sample of 59 major European banking groups covering 10 countries. Our selection strategy is based on a total asset criteria. More precisely, for each country we select those groups above 10 billions in total assets. In order to avoid dupli-

cations we rely on consolidated financial information. We collect consolidated balance sheet data form the Bankscope database on a timeframe spanning the period 2005-2011. We have, therefore, a total of 413 observations. Table 1 summarizes our sample. It reports the number of banks for each country and the average total assets over the selected time span. Unfortunately, not all the banks in our sample are listed. On balance we have 38 listed banks for which betas are available.

[Insert table 1 about here]

We, then, collect from the Bloomberg database the betas for each bank in our sample. Since we are interested in testing the impact on bank's betas of macro factors, we relied on Bloomberg database to calculate sectorial betas which in our setting are entrusted to capture systemic events. Instead of collecting banking sector betas we had to rely on the broader financial sector beta for each country under investigation. Such a simplification is due to the fact that we weren't able to find the narrower banking sector beta for all the countries in our sample. We do not expect, however, this simplification to bias the results of our analysis. We get for each year the betas over a 10-year time horizon. Sectorial betas are derived from each country MSCI indexes.

Figure 1 depicts the dispersion of betas across countries and banks together with the median value for each category. Evidences show a great degree of variability among banks and within each country with betas ranging from near zero values and values above 2. At a first glance, looking at distributions and median values, it appears Dutch, Belgian and UK banks as having higher betas while Italian, Spanish and Portuguese banks presenting lower levels. Figure 1 reveals a great time dispersion as well, with the last 3 years showing a substantial increase in betas' volatility.

As previously pointed out, we assume banks' betas capturing the exposure to macro events which, in our setting, are captured by sectorial betas. Our hypothesis is systematic risk is largely driven by firm characteristics. A way to check whether sectorial factors fit well our sample of banks betas is to perform an analysis of residuals after regressing the latter on the former. Figure 2 depicts the residual vs fitted plot. At a first glance we can observe that residuals are not randomly distributed. There should be, therefore, other variables explaining betas.

4.2 Explanatory variables

We build on previous studies in choosing our variables but expand our array of variables since we wish to capture the impact on systematic risk of different specifications, in particular relating to credit risk. We predict bank's betas across a set of basic variables describing various bank's profiles of performance and risk exposure and, namely, credit-risk exposure and risks associated with financial fragility. Contrary to other studies we employ also sectorial betas in our model (see discussion in the previous section). We also employ a set of control variables. Table 2 describes our variables together with the respective predicted sign of the relation with betas.

[Insert Table 2 about here]

Profitability variables (ROE and PIMOPTA) are expected to be positively related to betas. We recall the discussion in the previous section for such a relation. For similar reasons we expect there should be a positive relation of RWATA and IMPLGL to systematic risk and a negative relation of RISECAP, RILGL and RILIMPL to systematic risk. Higher risk taking behaviour, in fact, leads to higher risk weighted assets, higher eco-

nomic capital and, potentially, a higher fraction of impaired loans on gross loans which is a measure of the magnitude of non-performing loans.
We expect a negative relation with RILGL, RILIMPL and RISECAP. The former, in particular, is a significant ratio for banks as it represents the so called coverage ratio measuring the ability of banks to absorb potential losses from non-performing loans. Related to the riskiness of the credit portfolio is the ratio of risk weighted assets on total assets for which we expect a positive relation with betas. By the way, such a relation has been already investigated (although in the opposite way) in other studies (Beltratti and Paladino, 2013). The higher the ratio the higher the funds that the bank set aside for covering losses; therefore, we expect a lower exposure ti systematic risk. Another relevant variable is LLP (loan loss provisions) which is the difference between the stock of reserves in two subsequent period.
The expected sign of LLPGL is similar to RILGL. This is another relevant ration for banks since it represents the cost of loans on total gross loans. It is another measure of trouble on loan portfolio. Higher loan provisions on loans implies that a greater fraction of risk has been already factored in current profit and loss accounts, smoothing therefore earning's patterns. Managers that adopt honest and all-encompassing loan impairment decisions should be seen more favourably by the market.
Finally, RISECAP is a measure of adequacy of provisions relative to the capital requirement. The lower the ratio, the higher the risk of banks eroding their capital base. Potentially, a low ratio implies greater fragility.
As for leverage, a high DMMSTE ratio underpin a high level of maturity transformation. While casting concerns as for financial fragility it implies, at the same time, higher expected spreads on loans given the lower cost of short term funds and the predicted sign is positive.

4.3 Control variables

Assuming share prices as the representation of future expected profits, the Tobin-q (PBV) could be deemed as expressing the convenience of expanding investments. Specifically to the core banking business, it is expected to underpin the convenience of an aggressive behaviour in issuing loans and lead us to predict a positive sign of the relation with betas.
Another control variable is of GLTA which could be assumed as a proxy of the business model and for which we expect a positive sign. Inflating the loan portfolio implies heightening the exposure of banks to credit risk, eventually leading to systemic events. Recall that due to pro-cyclicality of bank business lead to expanding the portfolio during buoyant times (when the appetite for risk is higher) which lead to losses in future periods. The attitude to risk taking, then, lead to higher risk weighted assets on total assets.

4.4 Descriptive statistics

Table 3 reports the main descriptive statistics (i.e. the mean and the coefficient of variation calculated as the ratio of mean on the standard deviation) for each variable and for each year under investigation.

[Insert Table 3 about here]

Descriptive statistics reveal a plunge in PBV and profitability measures with high coefficients of variation. As regards credit-risk variables what emerges is an increase in loan impairment charges on gross loans over time, in particular during the peaks of the fi-

nancial crisis (although with a reversion of the trend in the latest year of observations). However, not surprisingly, there emerges great variability especially in 2009 and 2010 unveiling a certain heterogeneity in provisioning behaviours across the European banking industry during the crisis. By contrast, the incidence of impairment charges on impaired loans shows a decreasing trend but whit higher coefficients of variation during pre-crisis years while variability has been declining starting with 2008. What is worth to be pointed out are the high levels of economic capital relative to total equity during the pre-crisis periods and the sharp decline in the ratio which reflects the efforts of the banking industry to strengthen capitalization. Concerns, then, arise looking at the ratio of impairment charges on the interests on loans which shows a sharp upward trend during the crisis years.

We, then, turn to the analysis of correlations among the selected variables. Table 4 reports the Pairwise correlations at a 5% significant level.

[Insert table 4 about here]

Overall, the correlations among variables are generally low with the exception of the correlation of PBV with RILIMPL, that of RWATA with PIMOPTA and of RWATA with NLTA which is quite not surprising. In particular, such results imply that higher economic capital on total equity (higher capital required given risks compared to the banks capitalization) results in the market incorporating higher expected profits in share prices. At the same time, greater operational performance mirror greater risks (reflected in higher risk weighted assets). IMPLGL is, finally, strongly correlated with RISECAP. We therefore, exclude it from the regression analysis.

4.5 Methodology

When testing the impact of both sectorial betas and loan quality on bank's betas a concern comes to the forefront, having to do with potential autocorrelation and endogneity. Autocorrelation is likely to occur when dealing with market variables like stock market prices as documented in several studies. Endogeneity occurs when the dependent variable while being responsive to an independent variable affects the latter itself. In our setting the candidate variable to produce endogeneity is SECTBETA. In fact, while bank's betas are to a higher or lesser extent responsive to the dynamics of the sector to which they belong, it is reasonable to assume the former affect the latter since sectorial indices are constructed on basis of the stocks included in the basket. Another variable which arguably can display endogeneity is ROE. Higher performances are expected to affect betas but can be themselves affected by systematic risk, to the extent that higher risk exposure lead to higher costs of external funds. Finally, there could be exogeneity with risk weighted assets (see Beltratti and Paladino, 2013 for evidence and discussion).

To address some concerns we start with a static approach. We start by employing a GLS fixed effects panel data model for predicting our dependent variable. The general model we employ is as follows:

$$\beta_{i,t} = \alpha + b_1 sectbeta_{i,t} + b_2 llpgl_{i,t} + b_3 rilimpl_{i,t} + b_4 roe_{i,t} + b_5 ecapte_{i,t} + b_6 rwata_{i,t} + b_7 llpimpl_{i,t} + b_8 llppimop_{i,t} + b_9 dmmste_{i,t} + b_{10} glta_{i,t} + b_{11} rilgl_{i,t} + b_{12} llpiol_{i,t} + b_{13} pbv_{i,t} + b_{14} pimopta_{i,t} + b_{15} rilte_{i,t} + v_{i,t} \quad [1]$$

Where *i* denotes the *i-th* bank and *t* identifies time.

In order to investigate the impact of the crisis we then introduce a dummy (CRISIS) which take value 1 for years 2008-2011 and 0 for others. We test for the effects of the

interaction of such variable with LLPGL (CRISIS*LLPGL) and LLPPIMOP (CRISIS*LLPPIMOP) in order to assess whether the crisis alters the riskiness of the loan portfolio and hurdles financial performances.
After that, we control for endogeneity and run an instrumental-variables regression model which is generally employed in econometrics for dealing with endogenous variables. In order to check for endogeneity we follow Wooldridge (2002) and estimate a fixed effect version of equation 1 that includes future values (i.e., we create leading variables) of some regressors (see next section). We, then, run a dynamic Arellano-Bond regression for dealing with endogeneity and check for differences with our fixed-effects static panel model. Finally we check for robustness of our results through the Hansen statistic designed to verify test the overidentifying restrictions.

5. Results

In a static approach we explain bank's betas in our sample and for the reference time frame on the basis of a set of variables including the sectorial betas and other variables capturing bank's fundamentals. Table 5 presents the results. Column 1 summarizes the results including our base variables. Column 2 adds the effect of financial fragility (DMMSTE); column 3 adds the effects of interactions while column 4 comprises control variables. We apply a paned data model with fixed effects. The F-test allow us to reject the null hypothesis that individual effects are uncorrelated with regressors.

[Insert Table 5 about here]

Evidences are quite mixed. The first model shows a positive and significant relation between bank's betas and sectorial betas. We find, then, a 5% significant relation between betas and RISECAP. However, contrary to expectations, the sign of the relation is positive. Arguably, this outcome is a joint effect of a poor forward looking behaviour of banks in provisioning and a misevaluation of future risks by the market.
The other explanatory variables are not significant in explaining systematic risk. Nor performance measures (in particular the ROE) nor credit risk measures seemingly play a significant role. Arguably, risks were not factored in balance sheets in the years preceding the crisis.
It is worth nothing that as regards ROE, unexpectedly, the sigh of the relation is negative, meaning that higher profitability reduces exposure to systematic risk. It is possible that the sign is strongly influenced by the trends during the crisis, characterized by sharp increases in betas and plunges in bank's profitability. Put it in other terms, the fall in equity returns rather to be due to a more conservative attitude of managers is the result of excessive risk taking in previous years which heightened the risks of systemic events. Eventually, this could explain the "absorption" in betas of wider macro risks captured by the sectorial index. Actually, there is potentially an endogeneity problem with sectorial variables on which we'll turn later on. LLPPIMOP and LLPIOL which are the other variables entering the relation with an opposite-than-expected sign.
The inclusion of DMMSTE do not alters significantly the outcomes of the model. When we investigate the effects of impairment charges in the period 2008-2011 (see regression 3 in Table 5) we find that the sign of the coefficient CRISIS*LLPGL turns negative, coherently with prediction, and significant at 1% level meaning that the market factors an improvement in systematic risk exposure as banks increase impairment charges on their loan portfolio. Surprisingly, however, the sign of LLPGL and RILIMPL turns to be positive and significant at 1% and at 10% level respectively.

Finally, the sign of CRISIS*LLPPIMOP is positive and significant at 1% level meaning that the reduction in profitability that higher values of the ratio imply leads to higher perception of systematic risk. The sign here is coherent with the negative sign attached to ROE. It is interesting to see, however, that LLPPIMOP is again negative and significant at 1% level. On balance, the introduction of our dummy highlights a significant effect of crisis with risk loan quality variables playing a significant role in driving betas and a change in market perceptions.

When introducing the control variables we find a positive and 1% significant relation between GLTA and betas implying that systematic risk is responsive to the business model and increases with the exposure of banks to credit risk. Moreover, the introduction of GLTA leads RWTA to become significant (10%) level. The level, however, is negative, contrary to expectations.

Looking at R-square values it is interesting to note that by adding the dummy crisis we have a slight reduction in the goodness of fit of our model to between group variance. The R-square (in particular between and overall) becomes reduces significantly when introducing control variables.

We than, check whether and to what extent things change when dealing with autocorrelation and endogeneity. In table 6 we check for strict exogeneity running a fixed-effect version of equation 1 introducing leading values of our variables. While sectorial betas do not provide evidence of endogeneity, ROE, LLPGL, LLPIMOP and LLPIOL are significant. We, therefore, reject strict exogeneity of such variables and consider them as endogenous. Endogeneity of loan loss provisions on margins might seem somewhat straightforward. A possible explanation is that while loan quality affects systematic risk exposure of banks, the latter plays an effect on the yields that the market requires when supplying funds to credit institutions, thus affecting margins.

[Table 6 about here]

We employ an Arrelano-Bond dynamic model in order to deal with endogeneuty concerns. Table 7 summarizes the results of our regressions, whose design is the same as in Table 5. We introduce a lag for the dependent variable and for all the variables that we treat as endogenous according to the results summarized in table 6.

[Table 7 about here]

Contrary to the previous regression analysis, we do not find a significant impact of sectorial betas on bank's betas, either in the basic model and when controlling for our CRISIS dummy variable.

Surprisingly we do not find significant differences when introducing the CRISIS variable compared to the basic case where the impact of crisis is not taken into account. The effects of the explanatory variables and the respective signs are quite the same in the two models, marking a major difference compared to the results reported in table 5.

Interestingly, in the basic case loans quality (in particular the LLPGL ratio) becomes significant. At the same time, we find a significant relation between the ratio of LLP on IOL and PIMOP respectively and betas. The signs of the coefficients are the same as in table 5. There is another significant difference compared with the static model. Now, the adequacy of provisions relative to the capital requirement (RISECAP) is not significant in explaining betas. By contrast, risk weighted assets on total asset have, now, a positive relation with betas (although at a 10% significance level). We find, therefore, support to our hypothesis 1 that risk exposure plays a significant role in explaining systematic risk while performance measures (in particular, the Roe which enters with a negative sign as

in the model) do not play a significant role. Dealing with endogeneity bias, therefore, things change.

Risk weighted assets are related with future losses. Since the capital requirement on bases of current Basel II regulatory framework is a transformation of RWAs by applying to the latter an 8% factor, higher risk weighted assets imply a higher capital requirement and represent and indirect measure of bank's exposure to unexpected losses. LLPGL and RILIMPL enter the relation with the expected sign. LLPPIMOP, by contrast, has an opposite-than-expected sign, as in table 5.

Our results suggest that while risk exposure and fundamentals (represented by loans' quality and, in particular, the ratio of LLP on margins) significantly affects beta, reserves for impaired loans (risk coverage policies) do not have such a significant impact, arguably due to the fact that in good times loan losses are not a great concern. We, therefore, find partial support to hypothesis 1 in that coverage policies are not significant in explaining betas. Bank's soundness measures (the DMMSTE ratio) have a positive relation, contrary to the previous panel model, with betas. Again, however, the relation proves not to be significant.

In a CRISIS environment, fundamental factors are again significant in explaining systematic risk as stated in our hypothesis 2 (column 3 in Table 7). However, contrary to what stated in hypothesis 2, the impact of sectorial betas are not significant in pre-crisis period nor during crisis and there is no significant change in the impact of fundamentals.

The major difference compared to the basic case is that risk weighted assets on total assets doesn't enter the relation with a significant coefficient. Nor betas are now responsive to loan loss provisions on gross loans. However, they are responsive (although at a 10% significance level) to the lagged variable and with a positive coefficient (which is contrary to what expected).

Actually, traditional performance measures such as ROE again do not are significantly related with beta. Rather, we find that a significant role is played by loan loss provisions and, in particular, the ratios of provisions on gross loans, pre-impairment operative profit and interest on loans. The impact of provisions has, however, an obvious impact on financial performances. The significance of LLPGL and LLPPIMOP resembles the results we found with our static model.

As said, LLPGL enters with a positive sign which, as noted, is contrary to the predicted sign. The change in sign (which was negative in a non-CRISIS environment) could find a possible explanation in the backward-looking behaviour of banks when dealing with provisioning, relating provisions to problem loans. Underestimation of losses during benign times naturally lead to overcharging when non-performing loans increases and the magnitude of the effect would be particularly strong during a financial turmoil. Therefore, a positive impact of LLPGL (together with the lagged variable) might be due to the failure of provisioning policies (building up reserves during benign times) as a tool of smoothing earnings volatility. Controlling for our CRISIS variable, both LLPGL and LLPPIMOP itself enter the relation with betas with the expected sign (see the interactions).

Apparently, we do not find support to our hypothesis 3 predicting the significance of the ratio of capital requirement on total equity in a crisis environment. However, during crisis periods while risks turn to heighten risk weighted assets (and, therefore, capital requirements), higher loan loss provisions might erode bank's capitalization to the extent that give rise to bottom line losses. In that, capital adequacy obviously becomes a con-

cern. Finally, we carry out the Hansen test which distributes as a χ^2 under the null hypothesis of the validity of the instruments we employ. Looking at p-values, we do not reject the null hypothesis. Therefore, our test hints a proper specification.

6. Discussion and implications

Our analysis has several implications at light of the extant literature on bank's earning quality, managerial incentives and the current debate surrounding the soundness of the banking industry, accompanied by a tighter attention of supervisors on supervised entities. First of all, we find a positive relation between betas and fundamentals. As in Beltrati and Paladino (2013) we find a positive relation between betas and RWATA, although our test goes in the different direction in that we try to explain betas against a set of variables comprising RWATA while the authors we cited take the latter as the dependent variable and explain it against the beta.

Such a relation has significant implications. It obviously implies the incentive to optimize risk exposure (risk weighted assets on total assets) in order to economize in the cost of capital. At this regard, banks adopting an IRB approach for determining the regulatory capital might benefit of the advantages of a more precise alignment of regulatory capital to economic capital.

There are, however, other interesting implications regarding a potential strategic optimization of risk weighted assets. The relation we found between betas and RWATA, in fact, might hinder an incentive for bank's managers to dampen the magnitude of risk on total assets should the bank have future growth opportunities to exploit. Should this be the case and given that exploiting growth opportunities requires banks to expand total assets, credit institutions might find it convenient to optimize in RWAs, whenever allowed by regulation, in order to avoid raising too much capital or enter the capital market at easier conditions. Moreover, we found a possible explanation to our finding that the impact of LLPGL on betas turns to be positive and significant (at least in the lagged variable) in a crisis environment in an underestimation of losses during benign conditions which would lead to overcharge provisioning in bed times. Should this hold banks would lack flexibility when growth opportunities would emerge. Again, a more forward-looking provisioning might act as a strategic policy in light of future growth.

We feel, then, our results having significant implications as regards the impacts of different pieces of regulation and, namely, prudential capital adequacy regulation and accounting standards on managerial behaviours. Banking supervisors favours the use of accounting approaches based on conservatives valuations while IFRS counting standards are supportive to an incurred-loss approach. This scant coordination might be particularly concerning for credit institutions.

We found that the impact of loan loss provisioning proves to be significant in determining betas and, therefore, the cost of capital. Such a relation is, arguably, particularly concerning during periods of distress when provisions sharply rise and banks are forced to rise their capital levels, both as a sound managerial practice but also because forced by regulators.

Following the crisis supervisors have been requesting banks to increase their capital base. The latter are concerned with a potential increase in the weighted average cost of capital following a strengthening of the capital base due to higher levels of Tier 1 capital, supposedly more expensive than other sources of funds. While many theorists stress the fallacy of such an argument claiming that higher capital base reinforce bank's financial strength and, therefore, would imply a lowering of the cost of capital we put to the

forefront another argument. We feel that our result of a positive and significant impact of loan loss provisioning in a crisis environment is an indirect argument in support of the income smoothing incentive. Rather to track an average benchmark-banks performance, such a behaviour should be targeted at dampening the volatility of betas and alleviating the impacts on the cost of capital during distress periods. Our results goes in favour of reducing the cyclicality of capital requirements through a system of dynamic provisioning such that experienced in Spain. In fact, where capital requirements are designed to cover unexpected losses, provisioning policies would be able to dampen the pro-cyclicality of the former. In fact, by increasing loan loss reserves during benign times and drawing from then (and, therefore, reducing provisions) bank's would be able to ease the access of capital markets. By the way, this is also supportive of an alignment pf IFRS standards to Basel II capital regulations.

Finally, our results casts significant concerns as regards different forbearance behaviours and heterogeneous definitions of non-performing exposure across countries. This is a serious concern especially in Europe. The European Banking Authority (EBA) itself is concerned by the general deterioration of asset quality across European Union and the decrease of loss coverage across European countries. The major concerns here arise with regard to forbearance practices potentially leading to delay loss recognition and masking asset quality deterioration and the consistency of asset quality assessment across countries. As regards asset quality assessments different countries draw different lines between performing and non-performing loans.

While the EBA has recently issued two draft definitions of forbearance and non performing loans on basis of the Capital Requirement Regulation (Regulation EU No 575/2013) with the aim of promoting consistency and comparability of credit-risk figures at light of a more precise assessment of asset quality in Europe, such comparability has much far-reaching implications.

Apart hinder a proper assessment of asset quality by regulators, a lack of consistency in forbearance and non-performing loans definitions might have serious drawbacks for the market assessing the real soundness of banks across Europe. To the extent that such heterogeneity leads to biased systematic risk assessment it would imply distortions in accessing equity capital by banks, which is a major concern in the current environment of persisting uncertainty surrounding the banking industry. Harmonization of forbearance and non-performing loans regulation should, therefore, be welcomed as a levelling-the-playing-field policy.

7. Conclusions

Based on a sample of European banks we test for the determinants of bank's systematic risk in order to add evidence to extant literature and shad light into whether and to what extent betas respond to fundamentals. Our work is also another way to approach the issues relating to incentives to earnings management which have been widely analysed in literature. Our main findings are that bank's betas, apart being responsive to sectorial betas, are affected by the exposure to credit risk which could be measured as the ratio of risk weighted assets on total assets and fundamentals. Current performances are not significant in explaining systematic risk. The magnitude of loan loss provisions plays the most significant role. By contrast we do not find evidence of a significant relation of banks' soundness measures with betas. Our work has several implications, in particular at light of current debate on banks recapitalization and supervisors' efforts to strengthen bank resilience. Other relevant implications, in particular across European countries, are

related to the efforts of the European Banking Authority to harmonize the regulatory framework of forbearance practices and non-performing loans definitions. There remains room for future research investigating the impact of new pieces of regulation on capital requirements (Basel III) and forbearance practices on systematic risk assessment.

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Table 1 – The sample

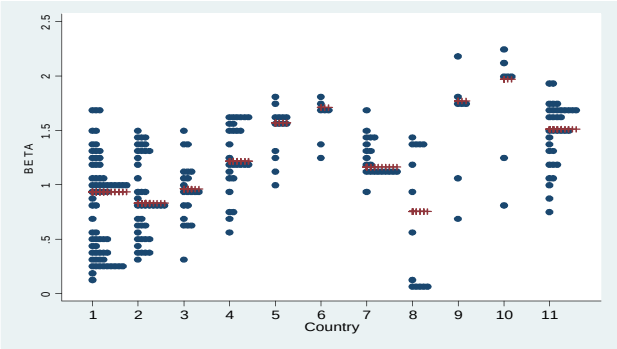
Country	Number of banks	Total assets 2011 (bn €)
Italy	12	197,120,225
Germany	7	560,840,714.3
Spain	11	233,697,909
Portugal	4	84,310,175
France	6	932,250,483.3
Netherland	2	1,005,446,500
Belgium	2	349,070,500
Austria	3	88,489,400
UK	9	824,654,733.3
Ireland	3	115,690,667
Total	59	

Source: Bankscope database.

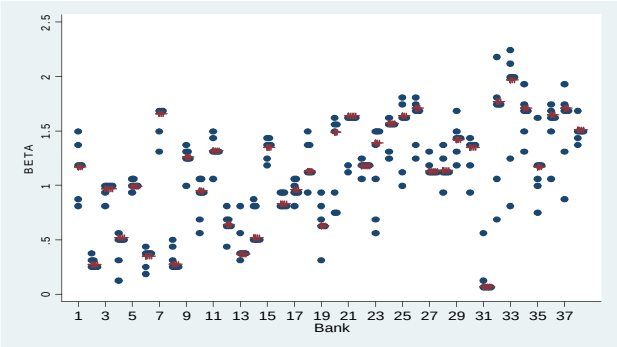
Figure 1 – Dispersion of betas across countries, banks and time

Panel A below depicts the dispersion of betas across countries, Panel B represents the dispersion across banks while Panel C depicts time dispersion. Red lines represents median values within each category.

Panel (A)



Panel (B)



Panel (C)

Figure 2 – Banks' betas and sectorial betas: residual vs fitted plot

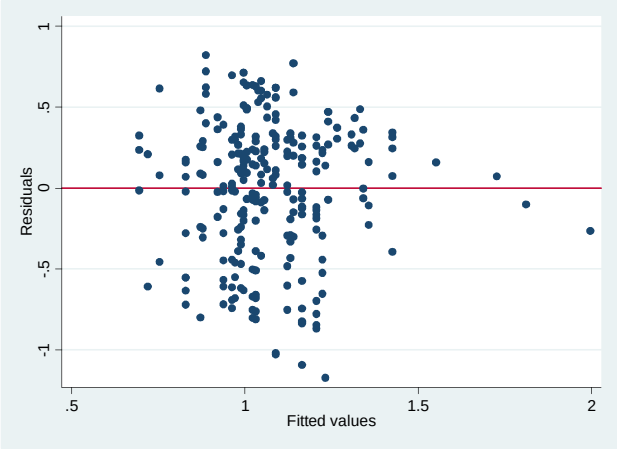


Table 2 – Description of the variables

Table below describes the variables we employ in our study (grouped by different categories capturing different profiles of bank's risk exposure) and the respective predicted sign of the relation with betas.

Category	Variable	Description	Predicted sign
Market-based risk	P/BV	Price-to-book value	(+)
Credit risk variables	GL/TA	Ratio of net loans on total assets	(+)
	IMPL/GL	Ratio of impaired loans on gross loans	(+)
	LLP/GL	Ratio of loan impairment charges on gross loans	(-)
	RIL/GL	Ratio of reserves for impaired loans on gross loans	(-)
	RIL/IMPL	Ratio of reserves for impaired loans on impaired loans	(-)
	LLP/IOL	Ratio of loan impairment charges on interest on loans	(+)
	LLP/PIMOP	Ratio of loan impairment charges on pre-impairment operative profit	(+)
	RIL/TE	Ratio of reserves for impaired loans on total equity	(-)
	RIS/ECAP	Ratio of reserves for impaired loans on economic capital	(-)
	LLP/IMPL	Ratio of loan impairment charges on impaired loans	(-)
	RWA/TA	Ratio of risk weighted assets on total assets	(+)
Liquidity	DMMS/TE	Domestic money market an short term funds on total equity	(+)
Performance variables	ROE	Net income on total equity	(+)
	PIMOP/TA	Pre-impairment operative profit on total assets	(+)

Table 3 – Descriptive statistics

		SECTBETA	P/BV	ROE	PI-MOP/TA	DMMS/TE	GL/TA	IMPL/GL	RIL/GL	RIL/IMPL	LLP/IOL	LLP/PIMOP	RIS/ECAP	LLP/IMPL	RWA/TA
2005	Mean	1.033	322.237	12.938	0.010	0.671	0.571	0.026	0.018	1.473	0.079	0.208	24.318	0.544	0.006
	St. Dev.	0.096	2.377	0.506	0.443	0.263	0.327	1.088	0.786	1.258	0.727	1.002	0.926	3.431	0.369
2006	Mean	1.041	336.743	15.723	0.010	0.663	0.564	0.022	0.016	1.356	0.068	0.185	20.948	0.167	0.005
	St. Dev.	0.111	2.532	0.426	0.427	0.269	0.357	0.944	0.695	1.090	0.666	0.623	0.676	6.604	0.387
2007	Mean	1.144	349.771	14.220	0.010	0.651	0.576	0.022	0.016	1.093	0.060	0.181	20.991	0.270	0.006
	St. Dev.	0.054	2.506	0.427	0.491	0.264	0.354	0.891	0.647	0.857	0.768	0.793	0.611	1.165	0.389
2008	Mean	1.179	238.686	2.194	0.008	0.641	0.582	0.029	0.018	0.690	0.100	4.900	27.219	0.254	0.005
	St. Dev.	0.125	2.511	10.861	0.756	0.285	0.356	0.562	0.548	0.480	0.642	6.612	0.480	0.786	0.367
2009	Mean	1.281	165.496	-11.235	0.009	0.656	0.581	0.047	0.024	0.607	0.286	0.887	35.951	0.297	0.005
	St. Dev.	0.156	2.644	-8.301	0.540	0.250	0.339	0.806	0.772	0.587	1.567	5.157	0.473	0.962	0.391
2010	Mean	1.440	139.423	-3.619	0.008	0.671	0.577	0.056	0.029	0.582	0.452	1.432	45.002	0.186	0.005
	St. Dev.	0.148	2.520	-15.207	0.540	0.233	0.350	1.281	1.241	0.594	3.189	4.306	0.973	0.739	0.402
2011	Mean	1.352	5.857	-4.746	0.007	0.669	0.566	0.068	0.035	0.569	0.261	0.326	57.581	0.170	0.005
	St. Dev.	0.118	3.256	-6.249	0.669	0.249	0.350	1.281	1.425	0.657	1.586	10.461	1.254	0.758	0.398
Total	Mean	1.210	221.628	3.145	0.009	0.660	0.574	0.038	0.022	0.901	0.193	1.169	33.529	0.266	0.005
	St. Dev.	0.171	2.853	14.448	0.554	0.258	0.345	1.270	1.202	1.151	3.226	10.881	1.112	3.080	0.388

The table reports the mean and the coefficient of variation (standard deviation/mean) of the variables for each year within the time span 2005-2011.

Table 4 – Pairwise correlations of the variables (represents significance at 5% level)*

	SECTBETA	P/BV	ROE	PIMOP/TA	DMMS/TE	GL/TA	IMPL/GL	RIL/GL	RIL/IMPL	LLP/IOL	LLP/PIMOP	RISECAP	LLP/IMPL	RWA/TA
SECTBETA	1													
P/BV	-0.1881*	1												
ROE	-0.0888	0.1037*	1											
PIMOP/TA	-0.1920*	0.2754*	0.2722*	1										
DMMS/TE	0.0242	0.0249	-0.0096	0.318	1									
GL/TA	-0.0526	0.2201*	0.0543	0.4231*	0.3319*	1								
IMPL/GL	0.1557*	0.0179	-0.0028	-0.0066	0.051	0.0023	1							
RIL/GL	0.0406	0.0176	-0.0025	-0.0077	0.0413	-0.0005	1*	1						
RIL/IMPL	-0.2201	0.4229*	0.0939	0.2132*	0.1666*	0.0249	0.0156	0.0157	1					
LLP/IOL	0.0919	-0.0406	-0.2711*	-0.0384	0.0836	-0.1203*	-0.0042	-0.0046	-0.00796	1				
LLP/PIMOP	-0.0156	-0.0236	-0.1207*	-0.0965	0.0561	-0.0375	0.0029	0.0028	-0.0308	0.0617	1			
RIS/ECAP	0.1757*	-0.1668*	-0.3227*	-0.0256	0.0259	0.0378	0.9147*	0.9642*	-0.0911	0.2758*	0.2813*	1		
LLP/IMPL	-0.0424	0.0961	-0.022	0.0877	0.0942	-0.0246	0.0105	0.0105	0.4561*	0.2190*	0.0044	-0.0414	1	
RWA/TA	-0.2605*	0.2517*	0.0373	0.6357*	0.2742*	0.6736*	0.0063	0.0048	0.1919*	0.0177	0.0981	0.0428	0.0542	1

Table 5 – Fixed effects panel data model

Regressions are estimated using a panel data model with fixed effects. The dependent variable is BETA. We include a dummy variable which is CRISIS taking value 1 for years comprised in the timeframe 2008-2011 and 0 otherwise.

BETA	1	2	3	4
LAG BETA	.2582***	.2568***	.1864***	.1789***
	(0.000)	(0.000)	(0.000)	(0.000)
SECTBETA	.2430**	.2440**	.3901***	.3753***
	(0.014)	(0.014)	(0.000)	(0.000)
LLPGL	-4.3444	-4.3862	87.8578***	97.9181***
	(0.670)	(0.668)	(0.000)	(0.000)
RILIMPL	-.0338	-.0338	.0658*	.1007**
	(0.373)	(0.374)	(0.070)	(0.013)
ROE	-.0884	-.0902	-0.0968	-.1092
	(0.244)	(0.241)	(0.150)	(0.208)
RISECAP	.0030**	.0030**	.0005	-.0014
	(0.036)	(0.036)	(0.699)	(0.367)
RWATA	3.27	3.2452	-13.9976	-50.8286*
	(0.904)	(0.905)	(0.571)	(0.074)
LLPIMPL	0.1421	.1433	-.1992	-.3640**
	(0.389)	(0.387)	(0.199)	(0.029)
LLPPIMOP	-.0117	-.0114	-1.6344***	-1.5674***
	(0.345)	(0.357)	(0.000)	(0.000)
LLPIOL	.2520	.2500	.0827	-.0470
	(0.447)	(0.452)	(0.777)	(0.880)
DMMSTE		-.0508	-.1835	-.0840
		(0.864)	(0.486)	(0.755)
CRISIS*LLPGL			-79.1637***	-80.5372***
			(0.000)	(0.000)
CRISIS*LLPPIMOP			1.6190***	1.5464***
			(0.000)	(0.000)
GLTA				.8668***
				(0.009)
PBV				.00001
				(0.989)
PIMOPTA				-3.2825
				(0.549)
CONS	.3122*	.3454	.4484	.1505
	(0.098)	(0.203)	(0.060)	(0.560)
F-test (model)	10.70***	9.67***	14.61***	12.67***
R^2 within	.4054	.4055	.5522	.5730
R^2 between	.7931	.7978	.6820	.4195
R^2 overall	.5817	.5886	.5415	.3387
F-test (fixed effect)	5.08***	4.90***	7.50***	7.30***

Table 6 – Test of strict exogeneity

BETA	1	2	3	4	5
SECTBETA	.3833***	.3560	.3454***	.4458***	.3681***
	(0.001)	(0.002)	(0.003)	(0.000)	(0.003)
LLPGL	6.1677	7.3024	8.1424	6.0168	16.1345
	(0.282)	(0.231)	(0.184)	(0.296)	(0.219)
RILIMPL	.00002	-.0022	.0001	-.0123	.0665
	(1.000)	(0.957)	(0.998)	(0.785)	(0.229)
ROE	-.1685*	-.3104	-.3209	-.2003**	-.2568**
	(0.075)	(0.127)	(0.114)	(0.028)	(0.033)
RISECAP	.0010	.0004	0.0000	.00005	-.0037
	(0.493)	(0.789)	(0.995)	(0.973)	(0.054)*
RWATA	-10.3272	13.8197	13.7015	-17.8676	-78.941**
	(0.742)	(0.675)	(0.677)	(0.595)	(0.038)
LLPIMPL	.0748	.1046	.0972	.0001	-.1062
	(0.679)	(0.551)	(0.580)	(0.999)	(0.628)
LLPPIMOP	-.0152	-.0249*	-.0268*	-.0142	-.0201
	(0.287)	(0.086)	(0.066)	(0.310)	(0.189)
$SECTBETA_{t+1}$	-.0125	-.0958	-.1607		
	(0.895)	(0.350)	(0.169)		
ROE_{t+1}		-.1872**	-.1673*		
		(0.027)	(0.053)		
$RWATA_{t+1}$		-25.2639	-20.0666		
		(0.163)	(0.281)		
$RISECAP_{t+1}$			.0015		
			(0.244)		
DMMSTE				-.1177	-.1228
				(0.748)	(0.189)
$LLPGL_{t+1}$				20.8962*	
				(0.054)	
$RILIMPL_{t+1}$				-.0313	
				(0.450)	
$LLPIMPL_{t+1}$				.0758	
				(0.622)	
$LLPPIMOP_{t+1}$				-.0014*	
				(0.079)	
$LLPIOL_{t+1}$				-.6861*	
				(0.069)	
$DMMSTE_{t+1}$				-.0634	
				(0.719)	
GL/TA					1.4539***
					(0.002)
PBV					-.00006
					(0.142)
PIMOP/TA					2.5424
					(0.728)
$GLTA_{t+1}$					-.2721
					(0.190)
PBV_{t+1}					0.00001
					(0.691)
$PIMOPTA_{t+1}$					-5.6122
					(0.267)
CONS	.5271	.6948	.7124	.5744	.2770
	(0.027)	(0.006)	(0.005)	(0.094)	(0.422)
F-test (model)	6.08***	5.33***	5.01***	4.59***	4.60***
R^2 within	0.2435	0.2745	0.2809	0.3077	0.3338
R^2 between	0.1592	00638	0.0163	0.3012	0.0088
R^2 overall	0.1264	0.0858	0.0517	0.2469	0.0190

Table 7 – Arellano-Bond regression model

Regressions are estimated using the Arellano Bond model. We include a dummy variable which is CRISIS taking value 1 for years comprised in the timeframe 2008-2011 and 0 otherwise. Endogenous variables are lagged.

BETA	1	2	3	4
BETA (L1)	.6620***	.6766	.5002***	.4591***
	(0.000)	(0.000)	(0.000)	(0.000)
LLPGL	-36.0956**	-33.2117**	28.4554	41.3281
	(0.028)	(0.042)	(0.270)	(0.116)
(L1)	16.7540*	15.2741	15.7896*	16.2685*
	(0.087)	(0.118)	(0.082)	(0.073)
ROE	-.0253	.0017	-.0264	.0305
	(0.737)	(0.983)	(0.717)	(0.749)
(L1)	-.2614	-.2311	-.3015	-.3734*
	(0.305)	(0.366)	(0.195)	(0.067)
LLPPIMOP	-.0257**	-.0292**	-.8092**	-.8993**
	(0.041)	(0.024)	(0.025)	(0.011)
(L1)	.0021***	.0021***	.0018**	.0013**
	(0.006)	(0.007)	(0.013)	(0.034)
LLPIOL	1.3858***	1.3448***	.7887*	.5455
	(0.005)	(0.006)	(0.081)	(0.209)
(L1)	-.7670*	-.7067	-.4668	-.5134
	(0.095)	(0.122)	(0.263)	(0.215)
SECT_IND	.0161	.0134	.0858	.1332
	(0.890)	(0.908)	(0.445)	(0.236)
RILIMPL	-.0731	-.0699	-.0153	-.0059
	(0.155)	(0.175)	(0.740)	(0.904)
RISECAP	.0035	.0029	.0014	.0022
	(0.202)	(0.288)	(0.490)	(0.336)
RWATA	56.7096*	53.6913*	38.1783	36.2678
	(0.063)	(0.078)	(0.181)	(0.305)
LLPIMPL	.1980	.1807	-.0189	-.0104
	(0.366)	(0.411)	(0.921)	(0.958)
DMMSTE		.3924	.1155	.1374
		(0.211)	(0.713)	(0.656)
CRISIS*LLPGL			-41.6980**	-47.9465***
			(0.016)	(0.005)
CRISIS*LLPPIMOP			.7854**	.8713**
			(0.031)	(0.014)
GLTA				-.0704
				(0.893)
(L1)				.0135
				(0.977)
PIMOPTA				-6.5422
				(0.267)
PBV				.00001
				(0.722)
CONS	-.0038	-.2461	.0637	.0971
Number of instruments	61	62	64	76
Number of observations	139	139	139	139
Number of groups	32	32	32	32
Wald χ^2	152.9***	152.6***	186.90***	189.12***
Sargan Hansen χ^2	33.5011	33.2786	34.4836	47.9323
	(0.9151)	(0.9195)	(0.8939)	(0.7062)