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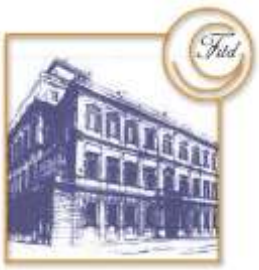

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Interbank Deposit Protection Fund

# Explaining state support to European banks during the crisis: Which implications for regulation?

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## *Abstract*

*We examine whether pre-crisis bank characteristics explain state support to European banks during the global financial crisis. We show that, before the crisis, supported and non-supported banks differ in numerous aspects and the differences reflect bank characteristics at the core of the regulatory agenda. In particular, bank size and the related too-big-to-fail concerns play a dominant role in explaining state support in Europe. Furthermore, our results suggest that income diversification produces a decline in the expected bailout costs for public finance in large banks and an increase of these costs in small and medium banks. The decline observed for large banks is nevertheless lower than the expected additional bailout costs generated by the presence of these banks in the financial system. Our findings highlight the importance of ad hoc prudential requirements and cross-country resolution regimes for large European banks and justify the introduction of regulatory restrictions on income diversification if applied to banks of small and medium size or if they lead to a significant decrease in the size of large banks.*

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# 1. Introduction

The aim of this paper is to test whether pre-crisis bank characteristics explain state support received by European Banks during the global financial crisis which erupted in the second half of 2007.

The need to implement costly rescue packages in favour of banks has been one of the major consequences of the global crisis. These emergency rescue plans have been motivated by the aim to reduce the risk of a large number of bank failures and to restore confidence in the financial system (Veronesi and Zingales, 2010). While the most popular rescue intervention has been the Trouble Asset Relief Programme (TARP) initiated in October 2008 in the US, with a total disbursement that passed US $400 billion in 2012 (Webel, 2012), European countries have also been forced to rely on costly government interventions in favour of the banking industry. European governments have spent more than €1.6 trillion to support the banking sector from October 2008 to the end of 2010, an amount equal to about 13.1% of the total GDP of the European Union (Liikanen, 2012). However, despite the relevance of state interventions in Europe, there is a lack of evidence on which pre-crisis characteristics differentiated supported-banks from the rest of the industry. This is an important omission for at least two reasons.

First, the identification of the key differences between supported and non-supported European banks can contribute to understanding which regulatory initiatives may work best in reducing the likelihood of using costly state interventions in periods of systemic crises. Public support in favour of banks is conventionally blamed on creating moral hazard (see Brandao-Marques et al., 2012; Dam and Koetter, 2012; Fischer et al., 2011; Gropp et al., 2010) and, more recently, has been accused of having generated negative spillover effects on the stability of public finance at the country level (Acharya et al., 2011; Alter and Schuler, 2012; Liikanen, 2012). The negative impact on public finances has been a major concern especially in Europe where the distress conditions of the banking system have undermined sovereign stability and contributed to the Eurozone debt crisis. It is not surprising, therefore, that the need to establish rules that reduce the risk to use costly state interventions in times of systemic distress has become a major objective of policymakers involved in the re-design of European banking regulations. At the bank level, the regulatory initiatives formulated to achieve this objective range from the introduction of more stringent prudential requirements, in the spirit of the new international capital adequacy accord (Basel III), to restrictions on bank business models advocated by the Liikanen Report on structural reforms published in October 2012. In particular, the proposed restrictions on bank activities appear more stringent than the rules adopted in the US with the Dodd–Frank Wall Street Reform and Consumer Protection Act of

July 2010. Overall, the identification of which pre-crisis characteristics differed between supported and non-supported banks in Europe is a tool to evaluate whether, and to what extent, these rules are indeed fully justified and can achieve their objective.

Second, the analysis of the pre-crisis differences between supported and non-supported banks is relevant to infer indications on how to optimally design resolution regimes in the European banking market and to distribute regulatory responsibilities between the domestic and the supranational level. In this respect, Schoenmaker and Siegmann (2013) show that in the case of large European banks, the supranational and burden-sharing approaches to bank resolution can improve the efficiency of the bailout policy well beyond the domestic approach. Hence, if state interventions in periods of systemic turmoil are especially addressed towards large entities, which normally operate across borders, a single resolution authority and forms of mutualisation of bailout costs, as advocated by the proposal to establish the European Banking Union, becomes relevant to implement. In turn, the presence of well-designed resolution mechanisms can contribute to removing the negative effects related to the uncertainty on how to deal with problematic banks in periods of systemic distress.

This study contrasts the pre-crisis characteristics of supported and non-supported European banks utilising a novel hand-collected dataset of state interventions in the European banking industry from 2007 to 2010. Our empirical design allows us to offer estimates of the likelihood of receiving state support by different types of banks and to quantify the expected bailout costs under different scenarios.

Our analysis extends the empirical evidence on the drivers of state interventions in banking. Existing studies have looked at recapitalisation policies in Germany (Dam and Koetter, 2012), in a sample of large international banks (Brei and Gadanecz, 2012; Mariathasan and Merrouche, 2012a) and in the US (Bayazitova and Shivdasani, 2012). To the best of our knowledge, this study is the first attempt to look at the drivers of bank recapitalisations and other forms of state interventions that have been implemented across European countries.

We start the analysis by comparing supported banks with a group of non-supported banks that have survived to the systemic turmoil. We show that key differences between these two samples of banks were present before the eruption of the crisis and these differences generally emerge when we compare bank characteristics that are at the core of the new regulatory landscape. Specifically, supported banks were significantly larger, more diversified, more exposed on trading, less efficient, less liquid, had faster growth and were less capitalized than the other banks. When we extend the analysis by distinguishing supported banks according to the type of state intervention that they have received, we find that guarantees on bank debts have been offered to aggressive banks with unconventional business models. In contrast, capital support has been obtained by banks with a weaker capital adequacy in 2006 and an aggressive growth in terms of wholesale funding but not in terms of lending. Hence, the

peculiarities of recapitalised banks are expressed by their funding strategies. Nonetheless, our results suggest that, in spite of the type of state intervention, among all the analysed bank characteristics, bank size exercises the largest impact on the probability of receiving state support during the crisis.

Our work also contributes to the literature on the influence of business models on bank performance during the global financial crisis. The departure of bank activities from a specialised business focus has been at the core of the regulatory debate in the aftermath of the financial crisis. Recent analyses suggest that business models are key determinants of the risk exposure of listed banks during systemic turmoil (Altunbas et al., 2011; Fahlenbrach et al., 2012) and show that not all types of non-traditional business lines have been detrimental to the survival of banks during the crisis (DeYoung and Torna, 2013). We add to this literature by assessing how the diversification of bank activities between interest-based and non-interest-based business lines influences the probability of receiving state support during the global crisis and evaluate whether this impact is moderated by bank size.

We show that a diversified business focus reduces the likelihood that large banks receive state support during the crisis while it increases this likelihood in banks of small and medium size. When we control for differences in the drivers of the different types of state interventions that have been adopted in Europe, we observe that this result holds especially in the case of bank recapitalisations. Although this result seems to indicate potential benefits arising from income diversification in large banks, we show that the positive effects for public finance due to the presence of large diversified banks are lower than the too-big-to fail costs. In other words, the expected reduction in the bailout costs that can emerge from the diversification implemented by large banks is lower than the additional bailout costs that may materialise because of the presence of these banks in the industry. More precisely, we estimate that, for the same volume of bank total assets, the expected costs of a public recapitalisation are significantly lower when there is a redistribution of assets in the banking system that reduces the market share of large banks rather than when these banks are allowed to increase their degree of income diversification.

Finally, the paper contributes to the literature on the regulatory attitude in dealing with problematic banks. Brown and Dinc (2011) show that, in the presence of a weak banking system, regulators are more prone to forbearance as they aim to avoid the closure of troubled banks. Dam and Koetter (2012) conclude that regulators prefer to support problematic institutions when they are large due to too-big-to-fail concerns. In this study, by extending the analysis to the comparison of the pre-crisis characteristics of supported banks with those of non-supported banks that have been resolved during the financial crisis, we compute the likelihood of receiving state support when a bank is under problematic conditions. This test gives us the opportunity to assess whether the size effect emerging from our previous discussion is indeed due to the influence of too-big-to-fail concerns on rescue decisions or if it is simply due to the fact that only larger

banks require state support as they are more exposed to systemic shocks than smaller banks. This analysis indicates that the too-big-to-fail paradigm was at the core of state interventions in Europe and that the likelihood of receiving state support was higher in stronger economies. Furthermore, in contrast to the results obtained by comparing surviving non-supported banks and supported banks, these additional tests do not show that the likelihood of state support was lower in a large and more diversified than in a specialised large entity. In sum, the importance of the too-big-to-fail effect does not seem to vary with the degree of income diversification in a bank's business model.

The results presented here imply that regulatory restrictions on bank business models may reduce the probability of state support only if applied to banks of small and medium size or if they generate a significant decline in the size of large banks. In effect, we show that a shift to a banking system characterised by more specialised but still large institutions does not reduce the risk to use costly emergency rescue plans in times of distress and does not prefigure any decline in the expected bailout costs supported by public finance in a period of systemic distress. Essentially, our analysis instead confirms the need to reduce too-big-to-fail concerns in Europe and points to the introduction of stringent and ad hoc prudential requirements on large banks. Furthermore, our findings enforce the importance of cross-country resolution regimes designed to contain the expected costs produced by the default of large financial institutions.

The rest of the paper is organised as follows. Section 2 discusses the research related to our analysis. The focus is on the role and implications of state interventions in the banking industry and on the determinants of a bank's risk exposure during periods of distress. Section 3 describes the sample selection, how we identified the set of state interventions in Western Europe and the variables employed in the empirical analysis. The paper proceeds with Section 4 where we compare our sample of supported banks with banks that passed through the crisis without receiving any support. Section 5 compares the impact in terms of expected bailout costs that can be generated by regulatory interventions to limit bank size with initiatives aiming at a decrease in bank diversification, while Section 6 contrasts supported banks with a sample of resolved banks. The last section contains concluding remarks and elaborates on policy implications.

# 2. Related research

The interest of academics and regulators on which banks are more likely to receive state support in a period of distress is generally motivated by the negative effects associated with government interventions in the banking industry. In this respect, extensive literature has pointed out the implications of moral hazards stemming from the presence of government guarantees in favour of banks. The major concern that emerges in this literature is the excessive risk-taking that government support may produce in the protected banks (Cordella and Yeyati. 2003; Gorton and Huang, 2004; Hazlett, 1997). Essentially, the presence of public support reduces market discipline as it undermines creditor incentives to monitor the bank's risk-taking or to demand higher risk premiums in the presence of higher observed risk-taking (Flannery, 1998; Gropp et al., 2006; Sironi, 2003).

Furthermore, once the public intervention materialises, investor expectations regarding future regulatory interventions in the banking sector increase with the effect of further exacerbating moral hazard problems due to an increase in the bailout expectations (Bayazitova and Shivdasani, 2012). Numerous empirical studies generally highlight that the presence of a bailout expectation motivates undue risk-taking by banks (Brandao-Marques et al., 2012; Dam and Koetter; 2012) while more prudent risk-taking strategies emerge only when this expectation is removed (Fischer et al., 2012; Gropp et al., 2010).[2] This moral hazard view is also confirmed by the ex-post risk-increasing behaviour of banks that have received state support during the global financial crisis (Black and Hazelwood, 2013; Brei and Gadanecz, 2012; Duchin and Sosyura, 2011).[3]

More recently, the distortions of bank incentives via moral hazard have been perceived as not the only costs that can be generated by the widespread use of bailout packages (Acharya et al., 2011). Specifically, these rescue actions have been under scrutiny because they have been linked to an increasing sovereign risk especially within the European context (Acharya et al., 2011; Dieckmann and Plank, 2012). The need to support domestic banking systems with costly state interventions has destabilized the public finance of several European countries and has determined further rescue actions by stronger countries aimed at avoiding sovereign debt distress. Hence, while in the short-run the interventions in favour of the banking industry might be beneficial to safeguard financial

[2] A different moral hazard effect associated with bailout expectations has been identified by Gropp et al. (2011). They show that a rating-based measure of expected government support to a given bank only shows a positive relationship with the risk-taking by the bank's competitors. In contrast, protected banks take on less risk in an attempt to preserve their charter value.

[3] Only a limited number of studies have instead pointed out the positive effects associated with bank bailouts. Berger et al. (2010) show that banks reduce their risk-taking behaviour over the five years after public interventions, while Dell'Ariccia et al. (2012) suggest that bailouts during a financial crisis can protect prudent banks against contagion, encourage monitoring efforts, reduce bank risk-taking and reduce the correlation of risks in the banking system.

stability, in the long-run they might generate negative effects on the real economy via a rise in sovereign instability.

Despite the frequent state support received by the banking industry especially during systemic crises, only a handful of studies have been conducted to investigate which banks are more likely to require intervention by the state to survive during a crisis. A shared conclusion of these analyses, focusing on bank recapitalisations via state funds, is the relevance of the too-big-to-fail paradigm in driving the rescue decisions (Dam and Koetter, 2012; Brei and Gadanecz, 2012) though it applies to a lesser degree in countries where public finance is weak (Mariathasan and Merrouche, 2012a).

A related strand of the literature has tried to assess, more generally, why some banks have faced distress conditions during the global financial crisis without distinguishing whether they have received state support. These analyses, normally with a focus on the US market, tend to confirm the existing findings from earlier studies based on the waves of bank failures observed in the 1980s and 1990s (see for instance, Cole and White, 2012). More recently, DeYoung and Torna (2013) show that different types of non-interest income exercise a different effect on bank health during the financial crisis while other studies have shown the importance of less conventional variables in predicting US bank distress such as auditor type and specialisation (Jin et al., 2011) and bank governance characteristics (Berger et al., 2012). Outside the US, the empirical evidence is more limited and based on a broad definition of bank distress. For instance, in Betz et al. (2012) the sample of distressed European banks includes failed banks, institutions subject to government interventions and those resolved via a distressed merger. A low degree of capital strength and a larger size appear to be key determinants of the distressed condition. Mariathasan and Merrouche (2012b) employ a similar definition of bank distress to show that tangible common equity and Tier 1 capital ratios are better predictors of future distress than broader measures of capital in an international sample of banks while Altunbas et al. (2011) conclude that the weakest institutions during the financial crisis were larger in size, had less capital, greater reliance on short-term market funding and aggressive credit growth.

Our study offers the first analysis of the characteristics of banks that have received state support in the European context. Furthermore, we compare supported banks not only with a sample of surviving entities during the global crisis but also with a sample of resolved institutions, defined as institutions that have been liquidated, declared as bankrupt or acquired by other entities. While the former analysis is relevant to understanding which bank characteristics offer shelter against shocks in periods of distress, the latter is more appropriate to identifying the key drivers of the regulatory decisions to support problematic banking firms. Finally, given the heterogeneity of state interventions implemented in Europe, this paper contrasts bank characteristics across different typologies of interventions.

# 3. Sampling criteria, sample size and variable definition

## *3.1 Sample*

We start the sampling process by collecting from Bankscope (Bureau van Dijk) the annual balance sheets and income statements of all banks operating in Western European countries where state support has been provided during the period from 2007 to 2010.4 As our purpose is to understand whether pre-crisis bank characteristics differed across supported and non-supported banks, following Mariathasan and Merrouche (2012a; 2012b) and Jin et al. (2011), we base the sample selection on fiscal year 2006.

From the initial sample of 7,539 banks, we exclude governmental credit institutions, Islamic banks, investment banks and institutions specializing in long-term credit, given their specificities in terms of risk-taking and business models. This reduces the sample to 4,059 banks. Next, we initially exclude resolved institutions during the crisis period as our aim is to compare the characteristics of banks receiving state support with those of banking firms that have successfully passed through the crisis without the need to rely on external government support. Applying these criteria leads to our final sample of 3,750 banks.

Next, to identify European banks that have received state support during the period from 2007 to 2010, we use the information contained in the report compiled by the Italian bank Mediobanca (2011) describing the typology and timing of state interventions in the European banking sector. Then we integrate the collected information through the network of the European Forum of Deposit Insurances (EFDI) with the lists of state support included in Mayer Brown Publications (2009), Fratianni and Marchionne (2013), Molyneux et al. (2011), Schich and Kim (2012), Bosma et al. (2012), and with reports and communications by the European Commission and the European Central Bank. Through these data sources, we identify 148 banks in our sample that have received state support during the period 2007–2010.

[TABLE 1 HERE]

Panel A of Table 1 reports the distribution of the sample of supported and non-supported banks by country. Overall, the largest number of state interventions have been implemented in Denmark (a share of 31.76% of the total number of interventions), followed by Spain (12.84%) and the UK (10.14%). The sample of not supported banks is highly concentrated in Germany with a share of 42.99%, followed by Italy (15.36%). The high concentration of the sample of non-

[4] Thus, the sample consists of banks operating in Austria, Belgium, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

supported banks in these two countries reflects the relative importance of the banking systems of these two countries in Europe.5

Panel B of Table 1 shows the distribution of supported banks in four groups indicating the presence of i) liquidity support; ii) recapitalisation; iii) guarantee on bank debt and iv) a combination of different types of interventions.

The first group includes nine banks that have received a short-term loan from national governments aiming at satisfying liquidity needs. These loans have to be remunerated by the borrowing bank but central banks can provide operations at reduced premiums or subsidized interest rates for loans.

The second group includes 57 banks that obtained capital support. This form of state support consists of recapitalizing banks by raising capital in exchange for shares underwritten by government funds. This group includes, for instance, BNP Paribas, which benefitted from two state interventions in December 2008 and in March 2009 for a total amount of €7.7 billion.

The third group considers 58 banks that have obtained a guarantee covering new issuances of short- and medium-term debt. Such a group includes, for instance, Barclays Bank, which in October 2008 and February and March 2009 obtained a government guarantee to issue bonds for a value of about £7 billion.

Finally, the last group, including 24 entities, consists of banks that have received a combination of different state support including the typologies identified by the three categories mentioned earlier. This is the case of Dexia, which in September 2008 obtained a capital injection of €3 billion via the coordinated intervention of the governments in Luxembourg, Belgium and France, and in October of the same year a guarantee from the three governments on bonds and other financial transactions with a maturity up to three years.

Panel B of Table 1 shows that recapitalisation and guarantees count for roughly 80% of the total amount of state support while liquidity support and multiple types of state support count for 6.08% and 16.22% respectively.

### *3.2 Explanatory variables: Bank-specific characteristics*

Since state intervention at the bank level is supposed to signal deteriorating bank quality, to identify the determinants of these interventions, we start with a set of bank characteristics that are conventionally related to bank stability (DeYoung and Torna, 2013; De Jonghe, 2010; Vallascas and Keasey, 2012).

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[5] With reference to the EU banking structures in 2006, provided by the ECB, the numbers of credit institutions in Germany and Italy count for 31.3% and 12.3% respectively from the total numbers of credit institutions in the EMU. www.ecb.int/pub/pdf/other/recyclingreportingrequirementsen.pdf.

The first determinant is the log of total assets measured in thousands of euro (Size). Recent analyses suggest that larger banks are more exposed to systemic shocks (De Jonghe, 2010; Vallascas and Keasey, 2012) and provide the largest contribution to systemic risk (Adrian and Brunnermeier, 2011). These findings are in line with the evidence of a higher probability of default at larger banks (Boyd and Runkle, 1993; De Nicolò et al., 2004). These results imply a higher probability of state support for large banks.

A second control is bank liquidity measured by the ratio between liquid assets and total assets (Liquidity). During the financial crisis, liquidity issues have emerged as pivotal in exacerbating the negative effects of systemic shocks (Brunnermeier, 2009), which has induced the Basel Committee to propose the introduction of new liquidity requirements for banks. In general, a higher share of liquid assets should reduce the costs associated with the liquidation of bank assets when liquidity dries up in the financial system as normally occurs under systemic shocks. We expect, therefore, a negative relationship between the share of liquid assets and the likelihood of receiving state support.

Next, we control for bank income composition (**Diversification)** by calculating an index of income diversification defined, following Stiroh and Rumble (2006), as 1 minus the Herfindahl index of income concentration between interest income and non-interest income. This index, therefore, captures the mix of traditional lending activities with less conventional activities generating commissions, fees and profits from trading. Based on previous studies, our expectation is that diversification increases the probability of receiving state support. These studies show that diversification implies that banks rely on more volatile income streams (DeYoung and Roland, 2001; Stiroh and Rumble, 2006) and they are more exposed to systemic risk (De Jonghe, 2010; Brunnermeier et al., 2012). Furthermore, Wagner (2010) shows that while diversification may reduce the default risk of an individual institution, it may increase the risk of joint failures in the banking system by raising bank exposure to common sources of risks.

Several regulatory proposals identify the involvement of banks in trading activities, including trading on the derivative market, as a possible determinant of bank vulnerability during the financial crisis and promote restrictions for this business line (Chow and Surti, 2011; Savona, 2010). We measure a bank's exposure in the trading activity via the ratio between trading securities and total earning assets (**Trading)**. In line with the regulatory view, we expect an increase in the probability of state intervention when this ratio increases. [6]

[6] This variable shows a large number of missing values. As in Kanagaretnam et al. (2010) we therefore use the method suggested by Maddala (1977) and Greene (2003) to deal with observations with missing trading data. This method, known as "modified zero order regression", substitutes a zero for missing values and adds a binary variable coded 1 if

An additional control is the bank capital strength. Equity capital acts as a protective buffer against systemic shocks and gives banks shelter against unexpected losses. Hence, better capitalized banks should be less exposed to systemic shocks. This is also confirmed by the fact that better capitalized banks experience a smaller decline in their equity value during the global financial crisis (Demirguc-Kunt et al., 2013). Furthermore, under a systemic shock, highly leveraged banks might be forced to de-leverage by liquidating assets at fire-sale prices in response to the increasing credit rationing by creditors facing liquidity constraints (Acharya and Viswanathan, 2011; Shleifer and Vishny, 2010). This would suggest that less capitalized banks are more prone to failure in the case of a systemic event (Berger and Bouwman, 2013). Initially, we measure capital strength as the ratio between total equity and total assets (**Equity**). Nonetheless, preliminary analyses of our data show clear differences in the degree of capital strength across countries and, within countries, between supported and non-supported banks. Therefore, we construct an alternative measure of capital strength by computing the difference between the equity ratio at the bank level and the aggregate equity ratio for the domestic banking sector obtained from the statistics published by the European Central Bank and the OECD in the case of Switzerland. Hence, this variable (**Relative Capital Strength**) quantifies how a bank is capitalized compared to the domestic banking sector.

Two additional controls focus on bank cost efficiency and profitability. Bank **Inefficiency** is the ratio between overheads and total assets. Higher values of this variable should increase the likelihood of receiving state support as cost inefficiency has been frequently identified as one possible motivation behind bank distress (Wheelock and Wilson, 1995; 2000). The degree of bank profitability is the ratio between bank net income and total assets (**ROA)**. We do not have a definite expectation on the influence of this variable on the probability of receiving state support. Higher levels of profitability are generally associated with a lower default risk in banks and this should, in turn, reduce the need to rely on state support in a period of financial distress. However, higher profitability may also be achieved through more aggressive risk-taking that should result in the emergence of negative effects during systemic shocks.

Aggressive growth strategies are generally identified as detrimental for bank stability (Vallascas and Keasey, 2012, Altunbas et al., 2011; Foos et al., 2010; Laeven and Majnoni, 2003; Keeton, 1999). Therefore, in some specifications we control for the annual growth rate (from 2005 to 2006) in the volume of customer loans (**Loan Growth)** and in the volume of bank wholesale debts (**Wholesale Funding Growth**). These liabilities are deemed to be extremely volatile especially in periods of uncertainty in the financial system; as a consequence, a larger increase in their volume may indicate growing instability in a bank's funding structure. Finally, we insert the ratio between interbank deposits and total

the corresponding trading variable is missing. Specifically, we set Trading to zero if it is missing and simultaneously set an indicator variable to 1 in such a case. When Trading is not missing the indicator variable is equal to 1.

funding (**Interbank Deposits**). The interbank market is usually identified as a key channel of contagion risk especially in periods of distress (Mistrulli, 2011). Hence, a higher value of this variable should be associated with a higher likelihood of state support.

### *3.3 Country control variables*

We control for several country characteristics that may influence the likelihood of receiving state support. We include the degree of **Concentration** in the domestic banking market as the log transformation of the Herfindahl index of asset concentration. We expect a positive effect of this variable on the probability of obtaining state support because in a more concentrated market the effects of bank failure during systemic distress are likely to generate more pronounced risk spillover and induce state interventions to restore confidence. Furthermore, following Vallascas and Hagendorff (2013), we construct an index measuring the importance of **Shadow Banking** that is defined as the ratio between outstanding securitized assets and country GDP. Next, we measure the degree of **Internalization** as total foreign bank claims divided by country GDP. Overall, given the role of financial innovation in the financial crisis and the global reach of this crisis, we expect that government support is more likely where shadow banking is more developed and when the banking system is more internationalized.

Two additional banking sector characteristics refer to domestic banking regulations. We select two variables from the 2007 version of the World Bank database on banking regulations, originally proposed by Barth et al. (2001). The first variable (**Prompt**) measures the strength of prompt for corrective actions while the second (**Capital Stringency**) measures the strength of capital regulation. We expect that both variables will exercise a negative impact on the likelihood of receiving state support. Finally, we control for differences in the macroeconomic conditions at the country level. Specifically, **Economic Growth** is the sum of the annual log growth rate from 2002 to 2006. **Public Debt** is the ratio between public sector debt and country GDP. We predict a positive impact for the first variable, as long-term booming conditions are deemed to have increased bank risk appetite, and a negative effect for the second variable because of the financial constraints that the status of public finance raise on rescue policies in favour of the banking industry.

[TABLE 2 HERE]

Table 2 recaps the variable definition and the main descriptive statistics for each variable separately for the samples of supported and non-supported banks. The table also reports the results of mean comparison tests between the two groups that suggest that supported banks are significantly larger, more diversified, have a higher exposure on trading, are less capitalized, more profitable and show more aggressive growth. Furthermore, these banks operate in more concentrated banking systems with a larger presence of shadow banking and in economies with more pronounced long-term economic growth before the eruption of the crisis.

# 4. What drives State support to European banks?

## *4.1 The determinants of state support in European banking: A logit specification*

To model the probability of receiving state support in Europe during the global financial crisis, we follow an approach conventionally adopted by the literature on the probability of observing a distress condition in banks (see, for instance, Cihak and Schaeck, 2010; Jin et al. 2011) and we employ a logit specification. The dependent variable is, therefore, a binary variable, assuming a value equal to 1 if a bank has received state support during the period ranging from 2007 to 2010 and zero otherwise. This variable is assumed to depend on a set of covariates measured before the eruption of the crisis, namely, as mentioned earlier, all explanatory variables are measured at the end of fiscal year 2006 as in Jin et al., (2011) and Mariathasan and Merrouche (2012a; 2012b). The model is estimated with White–Huber standard errors robust to heteroskedasticity.

Panel A of Table 3 reports the regression results. We start in Column 1 with a parsimonious model which includes only bank and banking system characteristics available for the full sample of banks. Next, Column 2 reports the results of the analysis when equity is replaced with our measure of relative capital strength computed at the country level. We then, progressively, add control variables referring to the regulatory environment (Column 3), bank specialisation, growth strategy and the share of interbank funding (Column 4) and to the macroeconomic context (Column 5). Finally, in Column 6, we include only variables with a significant coefficient in Column 5.

The multivariate analysis confirms the evidence reported in Table 2 and shows that several bank characteristics measured at the end of 2006 drive the likelihood of receiving state support during the period 2007–2010. Specifically, all models show that this probability increases with bank size, the degree of income diversification and the degree of profitability but decreases when banks hold more liquidity or when they are better capitalized in relation to the domestic banking system. Furthermore, we find evidence in some model specifications of a higher probability of receiving support when banks hold more trading assets. In sum, these results support the growing regulatory attention on bank size and business models and on the need to impose more stringent liquidity and capital requirements, as in the Basel III Accord of 2010.

Most of these results are broadly in line with previous findings on the determinants of bank bailouts and risk (Adrian and Brunnermeier, 2011; Berger and Bouwman, 2013; Brei and Gadanecz, 2012; Brunnermeier et al., 2012; Dam and Koetter, 2012; De Jonghe, 2010; Mariathasan and Merrouche, 2012a; Vallascas and Keasey, 2012). Furthermore, when we introduce the annual growth rate in the volume of loans and in the volume of wholesale funding into the model, we are able to confirm the negative implications of aggressive growth

strategies on bank stability. Nevertheless, the positive coefficient associated with bank profitability does not confirm the results from previous studies on bank bailouts but reflects the view that banks have attempted to maximize profits in the pre-crisis period with aggressive risk-taking, the negative effects of which have emerged during the crisis.

[TABLE 3 HERE]

Moving on to the analysis of the banking sector variables, we observe that only the degree of banking sector concentration enters the models constantly with a positive and significant coefficient. This result confirms our conjecture of a higher risk of negative spillover effects in a concentrated market that requires more state support to the banking sector. Finally, our measure of economic growth is positively related to the likelihood of state interventions. Hence, banks operating under prolonged boom periods are more likely to undertake aggressive risk-taking strategies with the effect of being more exposed to systemic shocks.

Panel B of Table 3 highlights the ability of the six models to distinguish between supported and non-supported banks. The panel reports the "in-sample percentage" of banks that are corrected classified, computed on the basis of a cut-off point equal to the proportion of supported banks in the sample. The percentage of corrected classified banks is systematically higher than 85%, with a maximum above 89% in Column 5. The model performs particularly well in classifying the supported banks with a percentage of correct classification ranging from a minimum of 91.22% to a maximum of 96.03%. The difference between the two groups of banks is also highlighted by the estimated average support probability at the end of 2006. If, for instance, we consider the results related to the model in Column 6, we observe an average support probability equal to 33.96% for the banks that have received state support during the financial crisis and a probability equal to 2.47% for the rest of the sample.

[TABLE 4 HERE]

Finally, Table 4 offers a direct comparison of the impact of each explanatory variable on the probability of receiving state support. Specifically, for each bank characteristic employed in the regression model reported in Column 6 of Table 3, we compute for each bank the estimated probabilities of receiving state support when the selected variable is fixed at the 1$^{st}$ percentile and then when is fixed at the 99$^{th}$ percentile of the sample distribution with the remaining variables at the observed values. The average probability over the full sample is then computed for the two cases. This exercise identifies bank size as the key determinant of the probability of receiving state support: when this variable moves from the 1$^{st}$ to the 99$^{th}$ percentile of the sample distribution, the support probability moves from 0.22% to around 25.92%: a much larger change than what we observe for the other variables.

To recap, while our analysis confirms that bank characteristics under the scrutiny of European regulators, such as bank business models and capital strength, have

an influence on state interventions in banks in the crisis period, it also suggests a dominant role played by the size effect. To put it differently, to avoid negative externalities associated with bank distress and to restore confidence in the financial system, state support in Europe is substantially more likely when banks increase in size.

### *4.2 The determinants of different types of state support*

The models discussed in the previous section treat all types of state interventions as being homogenous. Nonetheless, this is not necessarily the case. For instance, the reasons behind a bank recapitalisation may differ from those driving a government guarantee on bank debt. The first reflects the need to cope with the erosion of a bank's capital base while the second is motivated by the attempt to restore confidence in bank debts as investors have difficulties assessing the quality of a bank given the opacity of its business. Hence, it might be the case that some of the bank characteristics identified as predictors of state interventions in the previous section exercise an influence only on a specific form of intervention.

[TABLE 5 HERE]

This section offers a formal test of this conjecture via a multinomial logit model. This model represents an extension of the conventional logit specification to cases where the dependent variable has more than two categories and each category has to be compared to a base group. In the context of the present analysis, the estimation of the multinomial specification is equivalent to three binary logit specifications for pairwise comparisons among three outcome categories (recapitalisation, guarantees and multiple types of interventions) that are compared with the reference outcome of not having received state support.[7] Applications of the multinomial logit model are not new in the banking literature and recent examples can be found in Oshinsky and Olin (2006), Koetter et al. (2007) and in Mariathasan and Merrouche (2012b).

Table 5 reports the estimation results from the multinomial logit analysis based on the set of variables included in the last logit model presented in Table 4. The results show the presence of a different effect of some bank characteristics across different types of state support. Specifically, we observe that the relative capital strength of a bank is a significant determinant only when the state intervention assumes the form of a recapitalisation while the degree of income diversification, the volume of trading securities, the growth rate of loans and the degree of profitability are significant drivers of guarantees on bank debts but not of capital support. Hence, these guarantees have been offered to aggressive banks with unconventional business models. In contrast, capital support has been obtained by banks with a weaker capital adequacy in 2006 and an aggressive growth in

[7] Given the low number of banks, the category consisting of banks that have received a liquidity infusion is excluded from the analysis.

terms of wholesale funding but not in terms of lending. Hence, the peculiarities of recapitalised banks are expressed by their funding strategies.

In spite of their different nature, the different forms of state interventions also share some common determinants. In particular, bank inefficiency, the degree of market concentration and, especially, bank size exercise a significant influence on all three categories employed in the multinomial specification. In sum, the size effect remains at the centre of any type of state support implemented in Europe during the global financial crisis.

### *4.3 State support and the interaction between bank size and business models*

The results discussed in the previous sections confirm the rationale of the regulatory concerns over the systemic implications of bank size and income streams. However, recent proposals for regulatory restrictions on bank activities are specifically designed to reduce the business discretion of large banks given their relevance for the stability of the whole financial system.

For instance, this is the aim of the ring-fencing approach followed by the UK authorities, under the auspices of the Independent Commission on Banking (ICB, 2011), which proposes the separation of the investment and retail units in UK banks. In the broader European context, the Liikanen Report (2012) suggests that EU banks should legally separate and independently capitalize proprietary trading activities and other activities linked with securities and derivatives from the deposit-taking banks within a banking group. This should occur when these activities amount to a significant share of the banking business.

Nonetheless, the academic literature suggests that the impact of business diversification is not necessarily negative in large banks. DeYoung and Roland (2001) argue that larger banks are better placed to manage the operating leverage associated with fee-based transactions and this is reflected in cost-savings in expanding market shares, while Stiroh (2004) shows that income diversification affects banks' risk-adjusted performance negatively in small banks but positively in the case of larger banks. More recently, Slijkerman et al. (2013) conclude that the probability of a crash is lower when European banks diversify across other sectors while it becomes higher when they increase size within the banking sector, namely, when they undertake highly correlated investments. This leads the authors to argue that bank conglomeration is beneficial for financial stability. More generally, larger banks are likely to achieve a better diversification of risks through their expansion in different business lines.

Given this background, we extend our empirical framework to evaluate how different business models adopted by large banks affect the probability of receiving state support. In essence, our purpose is to test how bank size and income diversification interact in influencing the likelihood of obtaining state support during the financial crisis. To this end, we re-estimate the models

reported in Table 3 with the addition of the cross-product between size and income diversification. Next, we repeat the analysis for different types of state interventions under a multinomial logit setting.

[TABLE 6 HERE]

The regression results for the logit specification, shown in Panel A of Table 6, indicate that the interaction term between size and diversification enters in the regression models consistently with a negative and highly significant coefficient. Nevertheless, as suggested by Norton et al. (2004) in non-linear models it is not possible to infer the role and the degree of significance of the interaction term simply through the estimated coefficient and the related standard error. Following Berger and Bouwman (2013), therefore, we report in Panel B the coefficients and standard errors of the marginal effects computed for three levels of income diversification, identified by values equal to the 1$^{st}$ percentile, the mean and the 99$^{th}$ percentile of the sample distribution, and for a very small bank (log of total assets equal to the 1$^{st}$ percentile) and a very large bank (log of total assets equal to the 99$^{st}$ percentile). While these tests show that in a small bank the marginal effect of size is increasing with income diversification, in the case of a very large bank we observe an opposite result. Thus, the findings reported in Panel B imply that the probability of receiving state support during the financial crisis increase with bank size but particularly so if a bank is characterised by a specialized business focus.

[FIGURE 1]

The importance of the interaction between size and diversification is further highlighted in Figure 1, which plots the impact of bank size on the value of the probability of receiving state support for different levels of income diversification identified by values equal to the 1$^{st}$ percentile, the mean and the 99$^{th}$ percentile of the sample distribution. This Figure shows that being a large bank substantially increases the value of the probability of receiving state support in a period of distress but this effect is stronger when these banks are more specialised. However, it is worth noting that the benefits arising from income diversification emerge when banks are very large; namely, these benefits emerge in banks with total assets larger than €43.8 billion, just below the 99$^{th}$ percentile of the sample distribution. Notably, this value of bank size is well above the threshold of €30 billion employed in Europe to identify significant banks that deserve a special supervisory regime under the European Banking Union. In sum, the banks that obtain diversification benefits are deemed to be systemically relevant according to the European standards.

Nevertheless independently from the business model, these very large banks maintain a much higher support probability than smaller banks. Overall, it appears, therefore, that the potential benefits, measured by a decline in the probability of state intervention, that can be achieved from the presence of

diversified large banks are not comparable with the negative effects associated with the large size.

These results imply that the introduction of any business restrictions in the banking industry that do not lead to a substantial reduction in bank size would not be effective in removing the need to rely on emergency rescue plans in times of systemic crises: the presence of very large and specialized institutions is likely to still require costly rescue actions by governments because of the potential negative externalities associated with the risk of failure of these banks. Therefore, the suggested structural changes pointed out earlier in this section can contribute to reducing the risk of state interventions during banking crises as tools to reduce bank size rather than as tools to restrict bank business choices.

[TABLE 7]

As shown in Panel A of Table 7, the results from the multinomial model are in line with the evidence offered by the baseline logit specification. Specifically, across all groups of supported banks the likelihood of state intervention increases with income diversification and the cross-product between bank size and income diversification is negative and significant across the three categories of state interventions. Nevertheless, Panel B, where we report the marginal effects for banks with different size, shows that the marginal effects are generally significant in the case of a large bank only when the focus is on bank recapitalisations while they are significant for all outcomes in the case of a small bank. Furthermore, unreported tests show that the degree of significance of the marginal effects of banks size increases substantially if we employ a lower value of the log of total assets to identify the size of the large bank. For instance, in the case of bank recapitalisations, about the largest 5% of the sampled banks show a lower marginal effect when they exhibit a higher degree of income diversification.

### *4.4 Additional tests*

We have conducted several additional tests to assess the robustness of our findings. The results of these tests are not reported for the sake of brevity but are available upon request. The first group of tests refers to the cross-country nature of our sample. Though we have controlled for a wide number of country characteristics, it might be the case that other country-specific characteristics are driving our results. We therefore re-estimate the main model reported in Column 6 of Table 6 with the additional introduction of country dummies. This test does not indicate significant changes in our main conclusions. Next, we assess whether our results on the interaction between size and diversification might be influenced by the high correlation between this variable and its constituent terms. Specifically, we follow Vallascas and Hagendorff (2013) and we de-mean size and diversification before computing their cross-product. Again we do not observe major changes in our findings. A final group of tests refers to the way we have measured bank size. Several recent papers suggest other indicators related to the systemic relevance of the bank (Bertay et al., 2013). Hence, we employ two

alternative measures of bank size. The first is the ratio between bank total liabilities and country GDP while the second is the bank market share with respect to the total assets of the domestic banking sector. Both variables enter with a positive and highly significant coefficient in the regression analysis. Nevertheless, the interaction of these two size variables with income diversification is not significant, namely, only stand-alone size influences the impact of business models on the likelihood of receiving state support.

# 5. Expected bailout costs under alternative banking structures

The estimates of the probability of state intervention for different types of banks discussed in the previous section permit an assessment of the impact that possible regulatory initiatives designed to safeguard bank stability may have on bailout costs. More precisely, focusing on bank recapitalisations, we employ the model presented in Table 7 to compare the expected decline in the bailout costs when large banks diversify their business models between interest-based and non-interest-based activities with the expected additional bailout costs produced by the too-big-to-fail effect. To this end, we define the expected recapitalisation costs to support *n* banks in the financial industry as follows:

$$\text{Expected Bailout Costs}_t = \sum_{i=1}^{n} \text{Pr\_B}_{i,t} \times \text{CI}_{i,t} \qquad (1)$$

where Pr_B is the probability that state intervention is required and CI is the amount of capital that has to be injected to rescue a bank at time *t*.

To quantify the bailout costs for public finance, we start by considering a government that, in order to safeguard financial stability, has to intervene to recapitalise a bank that is deemed to be too-big-to-fail. To identify a too-big-to-fail bank, we consider a value of total assets equal to €150 billion; namely, five times larger than the threshold of €30 billion of assets, above which a bank is considered to be 'significant' for the Single Supervisory Mechanism in the proposal of the European Banking Union of September 2012. Furthermore, we assume that this bank has a relative capital strength that is 3 percentage points lower than the value shown by the aggregate domestic banking sector.

We then hypothesise that the purpose of the intervention is to reduce the risk of bank distress and the related ex-post costs by aligning the capital strength of the too-big-to-fail bank to the industry standard. Hence, as suggested by equation (1), the expected amount of public funds to be injected is equivalent to 3% of bank total assets, multiplied by the probability of intervention, obtained from the model in Column 1 of Table 7 (equal to 24.12%). We proceed by assuming that the too-big-to-fail bank has an average degree of income diversification and then we repeat the same analysis in the case of an increase in the degree of diversification up to the 99$^{th}$ percentile of the sample distribution. Therefore, the difference between the expected amount of public funds to be injected between the latter and the former case is the decline in the costs for public finance due to bank diversification.

Next, we quantify the additional bailout costs due to the too-big-to-fail effect by computing the expected capital to be injected under alternative banking structures holding the degree of income diversification at the average level.

Specifically, we analyse cases where the rescue involves only non-significant banks according to the European standards (total assets up to €30 billion) that have to be recapitalised. Therefore, the difference between the expected bailout costs when the rescue involves a significant bank and the same costs in the case of a rescue of several non-significant banks can be interpreted as a measure of the too-to-fail effect. For instance, the first case we consider is a recapitalisation involving five banks with equal size of €30 billion for a total volume of assets equal to the size of our initial too-big-to-fail bank. We conclude by estimating the expected costs when the rescue involves twenty banks of equal size of €7.5 billion. In this latter case, we present the results for different degree of income diversification to highlight how the influence of business models varies substantially with bank size.

[FIGURE 2]

This analysis, summarized in Figure 2, shows that an increase in income diversification from the average to the 99$^{th}$ percentile implies an expected reduction in public funds needing to be injected to rescue a too-big-to-fail-bank of about €360 million. This is not a minor reduction, however as Figure 2 highlights, holding constant the overall amount of bank assets, the decline in the expected costs for public finance is substantially larger when the rescue involves several non-significant banks; namely, when the expected additional costs for the too-big-to-fail effect are removed. For instance, a rescue of five (10) non-significant banks leads to an additional decline in the capital to be injected of about €159 (310) million. Furthermore, as shown in the last column of Figure 2, when the rescue involves banks of medium size (€7.5 billion) an increase in specialisation is beneficial to increase the capital saved by public finance.

In sum, this analysis enforces our major finding: if one of the main purposes of the new regulatory landscape is to alleviate the burden for public finances during systemic crises, restrictions on bank business models can be effective only as regulatory tools that lead to a significant decrease in bank size. In contrast, they can be counterproductive if they produce specialized megabanks since these banks will still be likely to show a very high probability of needing support during systemic turmoil.

# 6. State support to large banks: Does the 'too-big-to-fail' effect matter?

The results presented in the previous section are crucial to understanding how to design regulatory interventions to reduce the risk to rely on emergency rescue plans during financial crises. Nevertheless, they are of little help in understanding the priorities that drive policymakers when they design rescue policies. For instance, the size effect emerging from the previous discussion can simply reflect a larger exposure to systemic shocks by big banks rather than too-big-to-fail concerns by governments and regulators. In other words, from the previous results we cannot rule out the possibility that smaller banks have been less supported during the crisis only because they had no necessity for support.

In this respect, a better understanding of what drives the size effect is obtained by comparing the supported banks with banks that have been resolved during the financial crisis, namely, with a group of banks that, probably, would have had an interest in obtaining government support but did not receive it. For this purpose, we preliminarily identify a group of banks that have been resolved during the period 2007–2010, including institutions that have been acquired, liquidated or declared as bankrupt. We impose that the resolved banks operate in countries offering state support during the crisis and that belong to the same specialisation categories employed in the previous sections, namely, they have to be bank holding companies, commercial banks, savings and cooperative banks, or real estate banks. The application of these criteria leads to a sample of 257 institutions. Next, we repeat the analysis by employing as a dependent variable a dummy equal to 1 if the bank has been supported and zero if it has been resolved. Essentially, we are computing the probability of receiving state support when there is a problematic situation at the bank level.

[TABLE 8 HERE]

The results for the baseline specifications, reported in the first column of Table 8, suggest a pivotal role played by the too-big-to-fail effect in the implementation of rescue policies: large problematic banks are more likely to receive state support than smaller problematic entities. Hence, the size effect is not simply the result of a stronger exposure to systemic shocks by large banks. Furthermore, supported banks operate in more concentrated markets, where the risk of negative spillover effects is likely to be more pronounced, and in countries with a lower debt-to-GDP ratio that enhances the possibility of providing resources to the banking sector. They also show faster growth in loans and wholesale funding but there is no indication that before the crisis the capital strength of these banks was significantly different from that of resolved institutions or showed different degrees of income diversification. Nonetheless, the supported banks had a worse liquidity position but a lower exposure to the interbank market.

In the second column of Table 8, we modify the baseline specification to introduce the interaction term between size and income diversification as in Table 6. While the introduction of this interaction term does not modify the main findings discussed above, it offers some indications of a moderating effect of the degree of income diversification on the probability of receiving state support by a large bank under problematic conditions. In particular, the marginal effects reported in Panel B of Table 8 for three different values of income diversification, as in the previous section, are positive and significant but decreasing as large banks become less specialised.

Nonetheless, when we analyse whether this conclusion holds for different types of state interventions, in the last three columns of Table 8, we find that the moderating effect of income diversification on bank size does not emerge in the regression model while there are indications of an influence only in the case of bank recapitalisations Furthermore, in contrast to the results obtained by comparing healthy banks and supported banks, unreported tests on the computation of the probability of state interventions in this sample of problematic banking firms do not show that the likelihood of state support is lower in a large and more diversified than in a specialised entity. In sum, the importance of the too-big-to-fail effect does not seem to vary with the degree of income diversification.

# 7. Conclusions

This study identifies key pre-crisis differences between supported and non-supported banks. Specifically, supported banks were significantly larger, more diversified, more exposed on trading, less efficient, less liquid, had faster growth and were less capitalized than non-supported banks surviving to the crisis. The analysis reported here also suggests that a dominant role in shaping state interventions has been played by bank size and the related too-big-to-fail concerns. This conclusion holds for different forms of state support.

Nevertheless, crucially we find that when banks become large, the likelihood of receiving support declines if they have a diversified business focus. The benefits, measured by a decline in the expected bailout costs, arising from bank diversification are, however, lower than the additional bailout costs due to the need to rescue a large bank rather than a number of smaller entities while holding constant the overall size of the banking system. In sum, the results in this study confirm the rationale of the regulatory attention to bank business models and alert us to the way regulatory restrictions on bank activity should be ideally implemented. To put it in a different way, the results of this paper support restrictions on bank activity that vary with bank size. In effect, our finding that income diversification is detrimental, apart from when banks become large, implies that a decline in size needs to materialise with the adoption of business restrictions: a more specialised business focus has to be accompanied by a smaller bank size. By using bank public recapitalisations as an example, we suggest that the expected bailout costs may be substantially decreased with changes in the distribution of assets across banks and especially if these changes are linked with a more specialized business focus in firms of small and medium size.

Ultimately, the results point to the need to reduce the effect of too-big-to-fail concerns in Europe. However, we acknowledge that a sharp decline in bank size, though identified by our data as a meaningful choice, might not be the easiest way forward. A feasible alternative would be to enforce ad hoc prudential requirements for large banks. For instance, given the relatively low capital ratios of these banks in Europe, the implementation of specific and more stringent leverage restrictions than those postulated by the Basel III framework, jointly with minimum requirements on bail-in instruments, appear possible options.

Furthermore, our results show the urge to implement resolution regimes for very large cross-border entities and especially cross-country resolution systems. As these resolution regimes are likely to reduce the perceived costs of the too-big-to-fail status, their implementation could be a more effective solution than policy choices focusing on bank business models if the purpose is to limit the burden for public finance when the banking system is in distress.

Finally, our analysis is not exempt from limitations. In particular, due to data constraints, the tests discussed here do not consider measures of a bank's

activities in financial derivatives or in securitisation. These measures can offer relevant indications on the type of business diversification implemented at the firm level that can be beneficial for the regulatory re-design.

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**Table 1**: Sample distribution

Panel A shows the distribution of the sample of banks extracted from Bankscope. Panel B shows the distribution by country and type of intervention for the sample of supported banks. The sample consists of 3,750 unique banks selected from 16 Western European countries.

Panel A: Sample distribution by country

| | Supported Banks | | Non-Supported Banks | | Full Sample | |
|---|---|---|---|---|---|---|
| **Country** | **Total** | **(%)** | **Total** | **(%)** | **Total** | **(%)** |
| Austria | 8 | 5.41 | 271 | 7.52 | 279 | 7.44 |
| Belgium | 4 | 2.70 | 40 | 1.11 | 44 | 1.17 |
| Denmark | 47 | 31.76 | 51 | 1.42 | 98 | 2.61 |
| France | 8 | 5.41 | 208 | 5.77 | 216 | 5.76 |
| Germany | 8 | 5.41 | 1.604 | 44.53 | 1.612 | 42.99 |
| Greece | 9 | 6.08 | 10 | 0.28 | 19 | 0.51 |
| Iceland | 4 | 2.70 | 8 | 0.22 | 12 | 0.32 |
| Ireland | 5 | 3.38 | 13 | 0.36 | 18 | 0.48 |
| Italy | 4 | 2.70 | 572 | 15.88 | 576 | 15.36 |
| Luxembourg | 1 | 0.68 | 67 | 1.86 | 68 | 1.81 |
| Netherlands | 6 | 4.05 | 32 | 0.89 | 38 | 1.01 |
| Portugal | 5 | 3.38 | 28 | 0.78 | 33 | 0.88 |
| Spain | 19 | 12.84 | 134 | 3.72 | 153 | 4.08 |
| Sweden | 4 | 2.70 | 76 | 2.11 | 80 | 2.13 |
| Switzerland | 1 | 0.68 | 350 | 9.72 | 351 | 9.36 |
| UK | 15 | 10.14 | 138 | 3.83 | 153 | 4.08 |
| **Total** | **148** | **100.00** | **3.602** | **100.00** | **3.750** | **100.00** |

**Panel B**: Distribution of supported banks by country and type of intervention

| | **Liquidity Support** | **Recapitalisations** | **Guarantees** | **Multiple Interventions** | **Total** |
|---|---|---|---|---|---|
| Austria | 1 | 2 | 2 | 3 | 8 |
| Belgium | | 2 | | 2 | 4 |
| Denmark | | 2 | 33 | 12 | 47 |
| France | 2 | 6 | | | 8 |
| Germany | 1 | 2 | 2 | 3 | 8 |
| Greece | | 1 | 1 | 1 | 10 |
| Iceland | | 4 | | | 4 |
| Ireland | | 2 | 2 | 1 | 5 |
| Italy | 4 | | | | 4 |
| Luxembourg | | 1 | | | 1 |
| Netherlands | | 4 | 2 | | 6 |
| Portugal | | 2 | 3 | | 5 |
| Spain | 1 | 17 | | 1 | 19 |
| Sweden | | | 4 | | 4 |
| Switzerland | | 1 | | | 1 |
| UK | | 5 | 9 | 1 | 15 |
| **Total n.** | **9** | **57** | **58** | **24** | **148** |
| **%** | **6.08** | **38.51** | **39.19** | **16.22** | **100** |

**Table 2:** Variable definition and descriptive statistics

| | | Supported Banks | | | | Non-Supported Banks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **N** | **Mean** | **Median** | **St. Dev.** | **N** | **Mean** | **Median** | **St. Dev.** | **t-test** Mean Equality |
| Size | Ln (Total Assets) | 148 | 16.245 | 16.575 | 2.674 | 3602 | 13.276 | 13.030 | 1.793 | *** |
| Liquidity | Liquid Assets/Total Assets | 148 | 0.177 | 0.134 | 0.164 | 3602 | 0.190 | 0.134 | 0.180 | - |
| Diversification | 1- the Herfindahl index of income concentration | 148 | 0.421 | 0.457 | 0.091 | 3602 | 0.375 | 0.404 | 0.111 | *** |
| Trading | Trading securities over total earning assets | 80 | 0.096 | 0.068 | 0.109 | 1045 | 0.064 | 0.020 | 0.104 | *** |
| Equity Ratio | Equity/Total Assets | 148 | 0.087 | 0.068 | 0.057 | 3602 | 0.094 | 0.069 | 0.101 | - |
| Relative Capital Strength | Difference between an individual bank's equity ratio and the equity ratio of the domestic banking system in 2006 | 148 | 0.024 | 0.000 | 0.058 | 3602 | 0.040 | 0.017 | 0.100 | ** |
| Inefficiency | Overheads/Total Assets | 148 | 0.020 | 0.016 | 0.019 | 3602 | 0.026 | 0.023 | 0.037 | * |
| ROA | Net Income/Total Assets | 148 | 0.012 | 0.009 | 0.010 | 3602 | 0.007 | 0.004 | 0.016 | *** |
| Loan Growth | Individual bank's loan growth from 2005 to 2006 | 142 | 0.261 | 0.231 | 0.205 | 3467 | 0.084 | 0.040 | 0.175 | *** |
| Wholesale Funding Growth | Individual bank's wholesale funding growth from 2005 to 2006 | 127 | 0.532 | 0.296 | 0.711 | 3388 | 0.143 | 0.054 | 0.500 | *** |
| Interbank Deposits | Total Interbank Deposits/Total Funding | 143 | 0.171 | 0.133 | 0.147 | 3408 | 0.187 | 0.126 | 0.213 | - |
| Concentration | Asset-based Herfindahl–Hirschman Index of banking concentration | 148 | -1.853 | -1.868 | 0.727 | 3602 | -2.706 | -2.646 | 0.765 | *** |
| Shadow Banking | Outstanding Securitized Assets/GDP | 148 | 0.128 | 0.061 | 0.140 | 3602 | 0.068 | 0.028 | 0.089 | *** |
| Internalization | Total Foreign Banks Claims/GDP | 148 | 1.146 | 0.978 | 1.046 | 3602 | 1.002 | 0.643 | 1.577 | - |
| Prompt | Yearly index (0-6) which captures whether the supervisory authorities can force a bank to change its internal organizational structure | 148 | 2.682 | 2.000 | 1.235 | 3602 | 2.870 | 3.000 | 1.374 | - |
| Capital Regulation | Yearly index (0-9) which captures the regulatory approach to assessing and verifying the degree of capital at risk in a bank | 148 | 5.203 | 5.000 | 1.822 | 3602 | 5.768 | 6.000 | 1.268 | *** |
| Economic Growth | Total sum of the log growth rate in the years 2002–2006 | 148 | 0.118 | 0.089 | 0.053 | 3602 | 0.077 | 0.052 | 0.040 | *** |
| Public Debt | Public Sector Debt/GDP | 148 | 49.927 | 43.490 | 26.664 | 3602 | 54.917 | 43.490 | 27.054 | ** |

*** p<0.01, ** p<0.05, * p<0.10.

**Table 3:** Determinants of state support in European banking – logit model

This table reports the regression results of the logit model described in section 4.1. The dependent variable is a dummy equal to 1 if a bank has received state support during the period 2007–2010. The explanatory variables are measured at the end of fiscal year 2006. **Size** is the log of total assets measured in thousands of €, **Liquidity** is the ratio between liquid assets and total assets, **Diversification** is the Herfindahl index of income diversification, **Equity** is the ratio between total equity and total assets, **Relative Capital Strength** is the difference between the equity and the equity ratio computed for the domestic banking system, **Inefficiency** is the ratio between overheads and total assets, **ROA** is the return on assets, **Loan Growth** is the annual growth rate (2005–2006) of customer loans, **Wholesale Funding Growth** is the annual growth rate (2005–2006) of bank debts excluding customer deposits, **Interbank Deposits** is the ratio between interbank deposits and total funding, **Concentration** is the log transformation of the Herfindahl index of asset concentration measured at the level of the domestic banking sector, **Shadow Banking** is the ratio between outstanding securitized assets and country GDP. **Internalization** is total foreign banks claims/GDP. **Prompt** is an index measuring the strength of prompt for corrective actions from the World Bank regulatory dataset (2007), **Capital Stringency** is an index measuring the strength of capital regulation from the World Bank regulatory dataset (2007), **Economic Growth** is the total sum of the annual log growth rate in the years 2002–2006 and **Public Debt** is the ratio between public sector debt and country GDP. Heteroskedasticity robust standard errors are reported in round brackets. *** p<0.01, ** p<0.05, * p<0.10.

| Panel A: Regression Analysis | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Size | 0.588*** | 0.577*** | 0.588*** | 0.673*** | 0.658*** | 0.680*** |
| | (0.055) | (0.056) | (0.056) | (0.081) | (0.082) | (0.077) |
| Liquidity | -2.387** | -2.481** | -2.291** | -4.254*** | -3.998*** | -4.466*** |
| | (1.079) | (1.088) | (1.091) | (1.143) | (1.141) | (1.102) |
| Diversification | 5.738*** | 5.709*** | 5.026*** | 4.060*** | 3.776** | 4.849*** |
| | (1.245) | (1.241) | (1.250) | (1.505) | (1.525) | (1.337) |
| Trading | 2.342 | 2.337 | 1.717 | 3.967* | 3.925* | 4.231** |
| | (1.829) | (1.864) | (1.903) | (2.090) | (2.091) | (1.899) |
| Equity | -1.466 | | | | | |
| | (1.043) | | | | | |
| Relative Capital Strength | | -3.560*** | -3.638*** | -7.779** | -7.774** | -5.396* |
| | | (1.076) | (1.090) | (3.486) | (3.373) | (2.948) |
| Inefficiency | 1.994 | 1.818 | 1.318 | 10.195*** | 10.207*** | 10.163*** |
| | (2.599) | (2.523) | (2.548) | (1.909) | (1.886) | (1.851) |
| ROA | 16.565*** | 21.945*** | 20.959*** | 34.347*** | 30.216*** | 27.314*** |
| | (4.457) | (3.986) | (3.972) | (9.558) | (9.622) | (8.994) |
| Loan Growth | | | | 1.969*** | 1.993*** | 1.828*** |
| | | | | (0.581) | (0.583) | (0.577) |
| Wholesale Funding Growth | | | | 0.488*** | 0.423*** | 0.415*** |
| | | | | (0.150) | (0.150) | (0.157) |
| Interbank Deposits | | | | -0.984* | -0.910 | |
| | | | | (0.590) | (0.606) | |
| Concentration | 1.683*** | 1.716*** | 1.732*** | 1.512*** | 1.382*** | 1.479*** |
| | (0.160) | (0.163) | (0.166) | (0.210) | (0.227) | (0.182) |
| Shadow Banking | 1.847* | 1.747 | 1.338 | 1.597 | 0.503 | |
| | (1.058) | (1.063) | (1.073) | (1.174) | (1.268) | |
| Internationalization | -0.104 | -0.098 | -0.037 | 0.001 | -0.073 | |
| | (0.235) | (0.232) | (0.157) | (0.141) | (0.145) | |
| Prompt | | | -0.122 | -0.040 | -0.087 | |
| | | | (0.080) | (0.092) | (0.097) | |
| Capital Stringency | | | -0.036 | -0.039 | -0.075 | |
| | | | (0.075) | (0.079) | (0.088) | |
| Economic Growth | | | | | 6.025* | 6.664*** |
| | | | | | (3.087) | (2.574) |
| Public Debt | | | | | -0.007 | |
| | | | | | (0.007) | |
| Constant | -10.394*** | -10.191*** | -9.484*** | -10.885*** | -10.504*** | -12.152*** |
| | (0.980) | (0.979) | (0.951) | (1.410) | (1.584) | (1.289) |
| Specialisation Dummies | No | No | No | Yes | Yes | Yes |
| Observations | 3,750 | 3,750 | 3,750 | 3,378 | 3,378 | 3,498 |
| Pseudo R2 | 0.380 | 0.384 | 0.388 | 0.469 | 0.475 | 0.469 |
| Panel B: Model Performance and Support Probability | | | | | | |
| In-sample Correct Classification (%) | 85.17 | 85.15 | 85.87 | 88.81 | 89.08 | 88.77 |
| Supported Correct Classification (%) | 91.89 | 91.89 | 91.22 | 95.16 | 95.16 | 96.03 |
| Average Support Probability (%) | 3.95 | 3.94 | 3.95 | 3.67 | 3.67 | 3.60 |
| Average Support Probability – Supported Banks (%) | 27.7 | 28.1 | 28.4 | 34.21 | 34.76 | 33.96 |
| Average Support Probability – Non-Supported Banks %) | 2.97 | 2.96 | 2.94 | 2.50 | 2.49 | 2.47 |

**Table 4:** Determinants of state support in European banking – predicted probabilities

This table reports the probability of state support for different values of one explanatory variable when the remaining variables are fixed at the observed values in for each observation. The resulting probabilities for each bank are then averaged over the sample. The calculation is based on the model in Column 6. **Size** is the log of total assets measured in thousands of €, **Liquidity** is the ratio between liquid assets and total assets, **Diversification** is the Herfindahl index of income diversification, **Trading** is the ratio between trading securities and total earning assets, **Relative Capital Strength** is the difference between the equity and the equity ratio computed for the domestic banking system, **Inefficiency** is the ratio between overheads and total assets, **ROA** is the return on assets, **Loan Growth** is the annual growth rate (2005–2006) of customer loans, **Wholesale Funding Growth** is the annual growth rate (2005–2006) of bank debts excluding customer deposits

| | (1) | (2) | (3) |
|---|---|---|---|
| | Probability of State Support: 1st Percentile (%) | Probability of State Support: 99th Percentile (%) | Absolute Change in Probability: (2)-(1) |
| Size | 0.22 | 25.92 | 25.70 |
| Liquidity | 5.82 | 0.33 | 5.49 |
| Diversification | 0.89 | 4.74 | 3.85 |
| Trading | 3.22 | 7.26 | 4.04 |
| Relative Capital Strength | 4.60 | 0.31 | 4.29 |
| Inefficiency | 3.20 | 7.00 | 3.80 |
| ROA | 2.72 | 8.32 | 5.60 |
| Loan Growth | 1.90 | 8.57 | 6.67 |
| Wholesale Funding Growth | 2.66 | 7.62 | 4.96 |

**Table 5**: Determinants of different types of state support in European banking – multinomial logit

This table reports the regression results of the multinomial logit model described in section 4.2. The dependent variable is a dummy equal to 1 if a bank has received recapitalisation support, equal to 2 if a bank was granted the guarantees and equal to 3 if a bank has received multiple state support interventions during the period 2007–2010. The liquidity support dummy was not employed due to the low number of state support interventions. The explanatory variables are measured at the end of fiscal year 2006. **Size** is the log of total assets measured in thousands of €, **Liquidity** is the ratio between liquid assets and total assets, **Diversification** is the Herfindahl index of income diversification, **Trading** is the ratio between trading securities and total earning assets, **Relative Capital Strength** is the difference between the equity and the equity ratio computed for the domestic banking system, **Inefficiency** is the ratio between overheads and total assets, **ROA** is the return on assets, **Loan Growth** is the annual growth rate (2005–2006) of customer loans, **Wholesale Funding Growth** is the annual growth rate (2005–2006) of bank debts excluding customer deposits, **Concentration** is the log transformation of the Herfindahl index of asset concentration measured at the level of the domestic banking sector, **Economic Growth** is the total sum of the annual log growth rate in the years 2002–2006. Heteroskedasticity robust standard errors are reported in round brackets. *** p<0.01, ** p<0.05, * p<0.10.

| | (1) | (2) | (3) |
|---|---|---|---|
| | Recapitalisations | Guarantees | Multiple Interventions |
| Size | 0.756*** | 0.634*** | 0.510*** |
| | (0.108) | (0.115) | (0.133) |
| Liquidity | -5.070** | -4.635*** | -2.933 |
| | (2.080) | (1.399) | (2.163) |
| Diversification | 0.294 | 7.443*** | 10.252** |
| | (1.615) | (2.420) | (4.060) |
| Trading | 3.337 | 6.189** | 1.551 |
| | (3.126) | (2.435) | (2.412) |
| Relative Capital Strength | -23.820*** | -0.085 | -3.711 |
| | (8.311) | (2.305) | (4.892) |
| Inefficiency | 13.272*** | 8.734*** | 9.821*** |
| | (2.486) | (2.715) | (3.240) |
| ROA | 40.117* | 24.946*** | 30.854** |
| | (23.870) | (8.089) | (12.401) |
| Loan Growth | 1.708 | 1.518** | 1.974** |
| | (1.205) | (0.650) | (0.849) |
| Wholesale Funding Growth | 0.687** | 0.409** | 0.237 |
| | (0.316) | (0.169) | (0.308) |
| Concentration | 1.155*** | 1.799*** | 1.657*** |
| | (0.295) | (0.250) | (0.447) |
| Economic Growth | 15.345*** | -0.390 | 1.922 |
| | (3.794) | (4.411) | (5.669) |
| Constant | -15.923*** | -11.695*** | -12.598*** |
| | (2.023) | (2.141) | (3.029) |
| Specialisation Dummies | Yes | Yes | Yes |
| Observations | 3,491 | 3,491 | 3,491 |
| Pseudo R2 | 0.450 | 0.450 | 0.450 |

**Table 6:** Determinants of state support in European banking – interaction between size and diversification – logit model

This table reports the regression results of the logit model described in section 4.1. The dependent variable is a dummy equal to 1 if a bank has received state support during the period 2007–2010. The explanatory variables are measured at the end of fiscal year 2006. **Size** is the log of total assets measured in thousands of €, **Liquidity** is the ratio between liquid assets and total assets, **Diversification** is the Herfindahl index of income diversification, **Equity** is the ratio between total equity and total assets, **Relative Capital Strength** is the difference between the equity and the equity ratio computed for the domestic banking system, **Inefficiency** is the ratio between overheads and total assets, **ROA** is the return on assets, **Loan Growth** is the annual growth rate (2005–2006) of customer loans, **Wholesale Funding Growth** is the annual growth rate (2005–2006) of bank debts excluding customer deposits, **Interbank Deposits** is the ratio between interbank deposits and total funding, **Concentration** is the log transformation of the Herfindahl index of asset concentration measured at the level of the domestic banking sector, **Shadow Banking** is the ratio between outstanding securitized assets and country GDP. **Internalization** is total foreign banks claims/GDP. **Prompt** is an index measuring the strength of prompt for corrective actions from the World Bank regulatory dataset (2007), **Capital Stringency** is an index measuring the strength of capital regulation from the World Bank regulatory dataset (2007), **Economic Growth** is the total sum of the annual log growth rate in the years 2002–2006 and **Public Debt** is the ratio between public sector debt and country GDP. Heteroskedasticity robust standard errors are reported in round brackets. *** p<0.01, ** p<0.05, * p<0.10.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Panel A: Regression Analysis | | | | | | |
| Size | 1.550*** | 1.620*** | 1.591*** | 1.776*** | 1.745*** | 1.808*** |
| | (0.231) | (0.225) | (0.232) | (0.247) | (0.251) | (0.254) |
| Liquidity | -2.432** | -2.517** | -2.416** | -4.169*** | -4.004*** | -4.332*** |
| | (1.113) | (1.111) | (1.127) | (1.163) | (1.175) | (1.114) |
| Diversification | 42.177*** | 45.215*** | 43.633*** | 45.988*** | 45.094*** | 46.796*** |
| | (8.325) | (8.211) | (8.666) | (8.960) | (9.186) | (8.941) |
| Size*Diversification | -2.335*** | -2.535*** | -2.450*** | -2.632*** | -2.589*** | -2.660*** |
| | (0.529) | (0.521) | (0.544) | (0.561) | (0.573) | (0.571) |
| Trading | 2.312 | 2.211 | 1.829 | 3.651 | 3.636 | 3.626* |
| | (1.940) | (1.950) | (2.045) | (2.272) | (2.295) | (2.043) |
| Equity | -3.662** | | | | | |
| | (1.563) | | | | | |
| Relative Capital Strength | | -6.596*** | -6.457*** | -10.444*** | -10.209*** | -7.862** |
| | | (1.542) | (1.554) | (3.623) | (3.530) | (3.175) |
| Inefficiency | 4.065 | 4.074 | 3.775 | 14.777*** | 14.794*** | 14.586*** |
| | (3.727) | (2.963) | (2.991) | (2.229) | (2.218) | (2.158) |
| ROA | 26.286*** | 35.999*** | 35.036*** | 48.348*** | 43.338*** | 39.354*** |
| | (8.570) | (5.902) | (6.036) | (13.234) | (13.631) | (12.690) |
| Loan Growth | | | | 1.833*** | 1.844*** | 1.706*** |
| | | | | (0.608) | (0.615) | (0.611) |
| Wholesale Funding Growth | | | | 0.478*** | 0.421*** | 0.402** |
| | | | | (0.160) | (0.158) | (0.162) |
| Interbank Deposits | | | | -1.047* | -0.964 | |
| | | | | (0.616) | (0.635) | |
| Concentration | 1.660*** | 1.706*** | 1.700*** | 1.514*** | 1.393*** | 1.485*** |
| | (0.147) | (0.150) | (0.157) | (0.208) | (0.229) | (0.183) |
| Shadow Banking | 2.022** | 1.883* | 1.689* | 1.870* | 0.877 | |
| | (0.982) | (0.968) | (1.001) | (1.096) | (1.220) | |
| Internationalization | -0.092 | -0.085 | -0.056 | 0.018 | -0.051 | |
| | (0.202) | (0.190) | (0.163) | (0.132) | (0.139) | |
| Prompt | | | -0.066 | 0.006 | -0.040 | |
| | | | (0.078) | (0.090) | (0.098) | |
| Capital Stringency | | | -0.024 | -0.036 | -0.067 | |
| | | | (0.068) | (0.074) | (0.083) | |
| Economic Growth | | | | | 5.492* | 6.614*** |
| | | | | | (3.054) | (2.473) |
| Public Debt | | | | | -0.006 | |
| | | | | | (0.007) | |
| Constant | -25.324*** | -26.490*** | -25.620*** | -28.840*** | -29.552*** | -30.114*** |
| | (3.649) | (3.583) | (3.792) | (4.086) | (4.184) | (3.995) |
| Specialisation Dummies | No | No | No | Yes | Yes | Yes |
| Observations | 3,750 | 3,750 | 3,750 | 3,378 | 3,378 | 3,498 |
| Pseudo R2 | 0.399 | 0.407 | 0.408 | 0.488 | 0.493 | 0.488 |
| Panel B: Marginal Effect of Bank Size on the probability of State support | | | | | | |
| B1: Small Bank (log of total assets=1th percentile sample distribution) | | | | | | |
| Low Diversified Banks | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Average Diversified Banks | 0.002*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| High Diversified Banks | 0.007*** | 0.007*** | 0.006*** | 0.004*** | 0.004*** | 0.004*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| B2: Large Bank (log of total assets=1th percentile sample distribution) | | | | | | |
| Low Diversified Banks | 0.289*** | 0.291*** | 0.285*** | 0.291*** | 0.295** | 0.298*** |
| | (0.030) | (0.021) | (0.022) | (0.024) | (0.025) | (0.023) |
| Average Diversified Banks | 0.107*** | 0.102*** | 0.104*** | 0.104*** | 0.101*** | 0.109*** |
| | (0.019) | (0.017) | (0.018) | (0.026) | (0.027) | (0.026) |
| High Diversified Banks | 0.054*** | 0.046*** | 0.049*** | 0.051*** | 0.048*** | 0.053*** |
| | (0.016) | (0.015) | (0.016) | (0.018) | (0.018) | (0.018) |

**Table 7:** Determinants of state support in European banking – interaction between size and diversification – multinomial logit

This table reports the regression results of the multinomial logit model described in section 4.2. The dependent variable is a dummy equal to 1 if a bank has received recapitalisation support, equal to 2 if a bank was granted the guarantees and equal to 3 if a bank has received multiple state support interventions during the period 2007–2010. The liquidity support dummy was not employed due to the low number of state support interventions. The explanatory variables are measured at the end of fiscal year 2006. **Size** is the log of total assets measured in thousands of €, **Liquidity** is the ratio between liquid assets and total assets, **Diversification** is the Herfindahl index of income diversification, **Trading** is the ratio between trading securities and total earning assets, **Relative Capital Strength** is the difference between the equity and the equity ratio computed for the domestic banking system, **Inefficiency** is the ratio between overheads and total assets, **ROA** is the return on assets, **Loan Growth** is the annual growth rate (2005–2006) of customer loans, **Wholesale Funding Growth** is the annual growth rate (2005–2006) of bank debts excluding customer deposits, **Concentration** is the log transformation of the Herfindahl index of asset concentration measured at the level of the domestic banking sector, **Economic Growth** is the total sum of the annual log growth rate in the years 2002–2006. Heteroskedasticity robust standard errors are reported in round brackets. *** p<0.01, ** p<0.05, * p<0.10.

| | (1) | (2) | (3) |
|---|---|---|---|
| | Recapitalisations | Guarantees | Multiple Interventions |
| Panel A: Regression Analysis | | | |
| Size | 1.690*** | 1.600*** | 1.446*** |
| | (0.330) | (0.332) | (0.426) |
| Liquidity | -5.329** | -4.284*** | -2.675 |
| | (2.147) | (1.370) | (2.166) |
| Diversification | 36.670*** | 42.829*** | 42.974*** |
| | (12.206) | (11.291) | (16.018) |
| Size*Diversification | -2.243*** | -2.300*** | -2.131** |
| | (0.750) | (0.787) | (0.936) |
| Trading | 3.271 | 5.318** | 0.971 |
| | (3.176) | (2.539) | (2.437) |
| Relative Capital Strength | -26.517*** | -1.433 | -5.527 |
| | (8.511) | (2.734) | (5.112) |
| Inefficiency | 17.609*** | 10.502** | 12.733*** |
| | (3.250) | (5.220) | (3.992) |
| ROA | 50.055* | 31.880*** | 39.473** |
| | (30.104) | (10.851) | (15.501) |
| Loan Growth | 1.484 | 1.453** | 1.895** |
| | (1.399) | (0.653) | (0.872) |
| Wholesale Funding Growth | 0.686** | 0.385** | 0.249 |
| | (0.331) | (0.169) | (0.305) |
| Concentration | 1.201*** | 1.768*** | 1.660*** |
| | (0.314) | (0.246) | (0.440) |
| Economic Growth | 15.082*** | -0.008 | 1.833 |
| | (3.737) | (4.339) | (5.656) |
| Constant | -31.048*** | -26.721*** | -27.090*** |
| | (5.510) | (4.829) | (7.748) |
| Specialisation Dummies | Yes | Yes | Yes |
| Observations | 3,491 | 3,491 | 3,491 |
| Pseudo R2 | 0.462 | 0.462 | 0.462 |
| Panel B: Marginal Effect of Bank Size on the probability of State support | | | |
| B1: Very Small Bank (log of total assets=1th percentile sample distribution | | | |
| Low Diversified Banks | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| Average Diversified Banks | 0.000** | 0.000*** | 0.000* |
| | (0.000) | (0.000) | (0.000) |
| High Diversified Banks | 0.001** | 0.002*** | 0.001** |
| | (0.000) | (0.001) | (0.000) |
| B2: Very Large Bank (log of total assets=1th percentile sample distribution) | | | |
| Low Diversified Banks | 0.256*** | 0.020 | 0.001 |
| | (0.064) | (0.034) | (0.005) |
| Average Diversified Banks | 0.068** | 0.022* | 0.006 |
| | (0.029) | (0.013) | (0.007) |
| High Diversified Banks | 0.026 | 0.015 | 0.005 |
| | (0.017) | (0.012) | (0.008) |

**Table 8:** Supported banks versus resolved banks during the financial crisis

This table reports the regression results of a modified version of the logit model described in section 4.1 where the dependent variable is a dummy equal to 1 if a bank has received state support during the period 2007–2010 and zero if it has been resolved. The explanatory variables are measured at the end of fiscal year 2006. **Size** is the log of total assets measured in thousands of €, **Liquidity** is the ratio between liquid assets and total assets, **Diversification** is the Herfindahl index of income diversification, **Trading** is the ratio between trading securities and total earning assets, **Relative Capital Strength** is the difference between the equity and the equity ratio computed for the domestic banking system, **Inefficiency** is the ratio between overheads and total assets, **ROA** is the return on assets, **Loan Growth** is the annual growth rate (2005–2006) of customer loans, **Wholesale Funding Growth** is the annual growth rate (2005–2006) of bank debts excluding customer deposits, **Interbank Deposits** is the ratio between interbank deposits and total funding, **Concentration** is the log transformation of the Herfindahl index of asset concentration measured at the level of the domestic banking sector, **Shadow Banking** is the ratio between outstanding securitized assets and country GDP. **Internalization** is total foreign banks claims/GDP. **Prompt** is an index measuring the strength of prompt for corrective actions from the World Bank regulatory dataset (2007), **Capital Stringency** is an index measuring the strength of capital regulation from the World Bank regulatory dataset (2007), **Long-Term Economic Growth** is the total sum of the annual log growth rate in the years 2002–2006 and **Public Debt** is the ratio between public sector debt and country GDP. Heteroskedasticity robust standard errors are reported in round brackets. *** p<0.01, ** p<0.05, * p<0.10.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Full Sample of State Support | | Recapitalisations | Guarantees | Multiple Interventions |
| Panel A: Regression Analysis | | | | | |
| Size | 1.318*** | 2.029*** | 2.346*** | 1.166*** | 1.791** |
| | (0.208) | (0.475) | (0.673) | (0.419) | (0.859) |
| Liquidity | -9.427*** | -8.578*** | -12.560** | -5.727*** | -9.865** |
| | (2.510) | (2.299) | (5.268) | (2.163) | (4.605) |
| Diversification | -0.452 | 28.454* | 35.107 | 0.671 | 19.784 |
| | (2.423) | (15.405) | (23.964) | (16.534) | (28.944) |
| Size*Diversification | | -1.839* | -2.256 | -0.085 | -1.233 |
| | | (1.022) | (1.490) | (1.091) | (1.784) |
| Trading | 3.487 | 2.632 | 2.072 | 0.340 | 1.460 |
| | (3.710) | (3.337) | (4.674) | (3.338) | (5.076) |
| Relative Capital Strength | -2.608 | -2.877 | -26.466** | 4.549 | -8.049 |
| | (5.606) | (5.181) | (11.357) | (3.534) | (7.352) |
| Inefficiency | 32.660** | 36.342*** | 61.781*** | -2.639 | 45.275 |
| | (14.310) | (12.569) | (20.038) | (19.971) | (28.917) |
| ROA | -4.090 | 4.890 | 30.398 | 13.181 | 51.866 |
| | (16.745) | (20.069) | (63.710) | (21.158) | (38.347) |
| Loan Growth | 3.181** | 3.244*** | 5.407*** | 2.913* | 1.154 |
| | (1.271) | (1.194) | (1.709) | (1.651) | (1.824) |
| Wholesale Funding | 4.032*** | 4.065*** | 5.185** | 2.352 | 10.170** |
| | (1.310) | (1.404) | (2.326) | (1.767) | (4.630) |
| Interbank Deposits Growth | -4.490*** | -4.827*** | -2.253 | -7.174*** | -5.570** |
| | (1.405) | (1.433) | (2.687) | (1.765) | (2.163) |
| Concentration | 1.617*** | 1.742*** | 1.860*** | 1.923*** | 0.814 |
| | (0.446) | (0.474) | (0.654) | (0.578) | (0.954) |
| Shadow Banking | -12.397*** | -11.109*** | -10.250*** | -7.406 | -13.413** |
| | (3.153) | (3.116) | (3.972) | (4.670) | (6.533) |
| Internationalization | 0.212 | 0.231 | 0.395** | -0.201 | -0.749 |
| | (0.160) | (0.169) | (0.182) | (0.489) | (2.170) |
| Prompt | 0.045 | 0.106 | 0.645** | -0.228 | 0.364 |
| | (0.200) | (0.191) | (0.256) | (0.315) | (0.415) |
| Capital Stringency | -0.425** | -0.355* | 0.231 | -0.791*** | -1.415*** |
| | (0.194) | (0.196) | (0.209) | (0.232) | (0.431) |
| Economic Growth | 9.345* | 7.923 | 14.003** | -5.510 | -5.089 |
| | (4.985) | (4.866) | (5.661) | (11.329) | (10.297) |
| Public Debt | -0.046*** | -0.040*** | -0.006 | -0.072*** | -0.077*** |
| | (0.011) | (0.012) | (0.014) | (0.018) | (0.021) |
| Constant | -10.089*** | -21.814*** | -37.483*** | -1.343 | -12.413 |
| | (3.279) | (6.988) | (11.098) | (7.097) | (16.687) |
| Specialisation Dummies | Yes | Yes | Yes | Yes | Yes |
| Observations | 341 | 341 | 334 | 334 | 334 |
| Pseudo R2 | 0.596 | 0.605 | 0.586 | 0.586 | 0.586 |
| Panel B: Marginal Effect of Bank Size on the probability of State support | | | | | |
| B1: Very Small Bank (log of total assets=1th percentile sample distribution | | | | | |
| Low Diversified Banks | | 0.000 | 0.000 | 0.006 | 0.000 |
| | | (0.000) | (0.000) | (0.042) | (0.000) |
| Average Diversified Banks | | 0.079 | 0.003 | 0.008 | 0.001 |
| | | (0.007) | (0.012) | (0.013) | (0.000) |
| High Diversified Banks | | 0.027 | 0.018 | 0.008* | 0.002 |
| | | (0.024)) | (0.024) | (0.045) | (0.002) |
| B2: Very Large Bank (log of total assets=99th percentile sample distribution) | | | | | |
| Low Diversified Banks | | 0.172*** | 0.044 | 0.020 | 0.057 |
| | | (0.014) | (0.081) | (0.007) | (0.093) |
| Average Diversified Banks | | 0.029*** | 0.059** | -0.019** | -0.010 |
| | | (0.010) | (0.023) | (0.006) | (0.021) |
| High Diversified Banks | | 0.006*** | 0.034** | -0.008 | -0.015 |
| | | (0.002) | (0.016) | (0.004) | (0.013) |

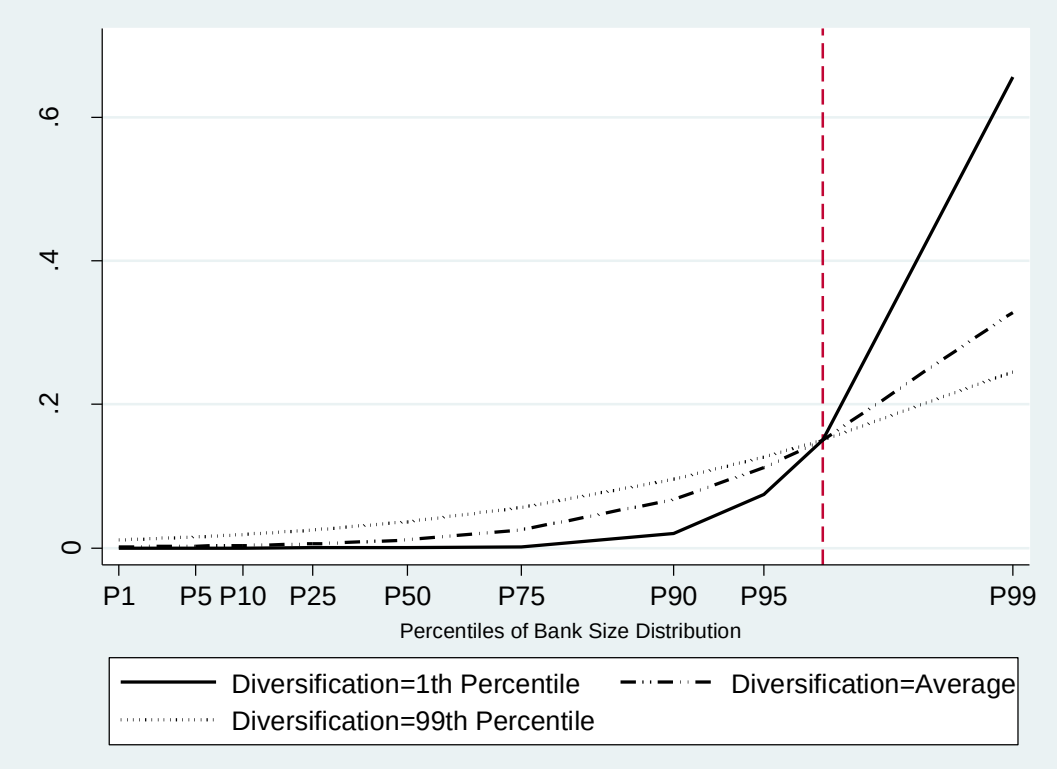


**Figure 1**: The impact of bank size on the probability of state support for different levels of income diversification

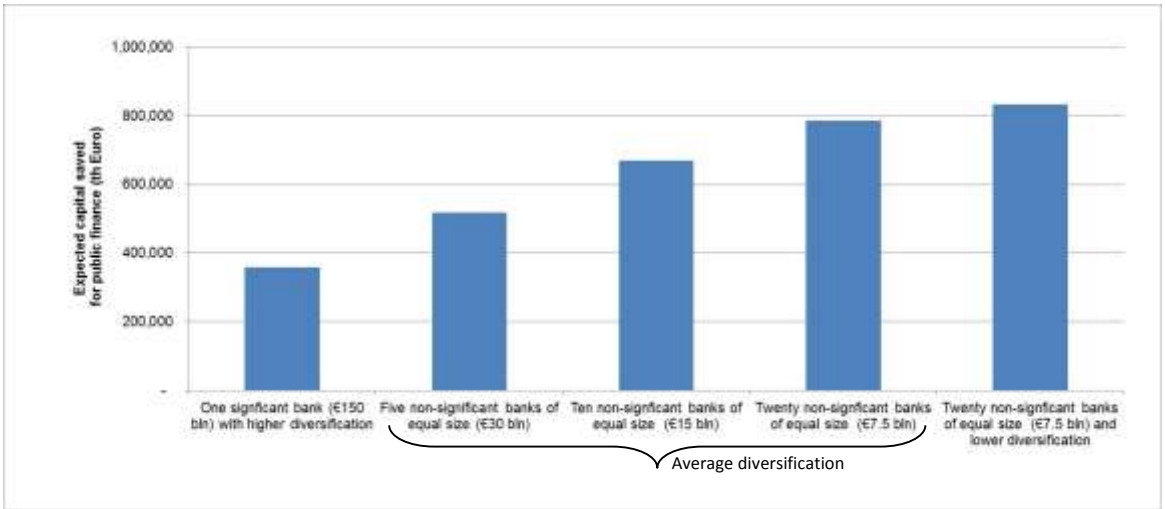


**Figure 2:** Expected reduction in the recapitalisation costs under alternative banking structures

This figure shows the reduction in the expected amount of capital that a government has to provide to recapitalise a bank or a group of banks with a total volume of assets equal to €150 billion under alternative scenarios. The benchmark case is a 'significant' bank according to the Single Supervisory Mechanism with an *average degree* of diversification. The change in the expected amount of public funds in each scenario is the difference between the product of the recapitalisation probability and the amount of capital to be injected in the benchmark case and the same product in an alternative scenario.