Board of Governors of the Federal Reserve System

International Finance Discussion Papers

Number 1086

August 2013

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August 27, 2013

Abstract

Government support to banks through the provision of explicit or implicit guarantees affects the willingness of banks to take on risk by reducing market discipline or by increasing charter value. We use an international sample of rated banks and find that government support is associated with more risk taking by banks, especially prior and during the 2008-2009 financial crisis. We also find that restricting banks' range of activities ameliorates the link between government support and bank risk taking. We conclude that strengthening market discipline by reducing bank complexity is needed to address this moral hazard problem.

JEL classifications: G21, G28, H81

Keywords: Bank risk, market discipline, government support, bank regulation

*We thank Allen Berger, Michael Koetter, participants at the AEA 2013 Annual Meeting, the 4th Financial Stability Conference at Tilburg University, the FDIC's 12th Annual Bank Research Conference, and at the IMF-ICD and Federal Reserve Board workshops. We also thank Hal Baseman and Olivia Kim for excellent research assistance.

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1 Introduction

Bank bailouts during and after the 2007–2009 financial crisis have reignited the debate on the effect of government support on banks' management incentives and on the distortions it causes in competition in the banking sector. Explicit and implicit government support can influence banks' willingness to take on risk through two channels: by reducing market discipline and/or by increasing the banks' charter value.

According to the *market discipline* hypothesis, government support of banks decreases the incentive of outside investors (depositors, creditors, and shareholders) to monitor or influence bank risk taking. Risk-shifting may occur if deposit insurance is not fairly priced (Merton, 1977) or if governments provide guarantees to holders of bank debt (Flannery and Sorescu, 1996). Under the *charter value* hypothesis, government support decreases banks' funding costs as both depositors and creditors demand lower rates. The decline in funding costs increases their interest margin and raises banks' charter values, which leads to banks taking fewer risks to protect future rents (Keeley, 1990).

The goal of this paper is to determine which channel dominates. Since, for the most part, this is an empirical issue, we use two cross-country samples of banks to answer two questions: Do banks with more explicit or implicit government support take on more risk? Does bank regulation limit the effect of government support on bank risk taking?

To answer these questions we define bank risk as the z-score (return on assets plus capital to asset ratio, divided by the standard deviation of return on assets) which is a measure of distance to default.[1] In addition, we measure government support as the difference between each bank's deposit rating and bank financial strength rating assigned by Moody's Investors Service (Moody's),

[1]Our results are robust to measuring risk using a market based z-score (Forssbaeck, 2011), a measure of stock return volatility, and a more traditional measure of loan losses - the loan loss provisions to assets ratio.

which, as we show later in this study, is able to predict actual bank bailouts.[2] We test these hypothesis using a sample of bank and ratings data covering more than 50 developed and emerging countries for the periods 2003-2004 and 2009-2010.

Our choice of cross-sectional estimations rather than a full panel analysis is explained by the change in accounting standards in Europe in the mid-2000s. As noted later, it would be a mistake to conduct any empirical tests without taking into account this break-in-series. We chose our first cross-section (2003-2004) as a benchmark to compare our results to previous studies that have tested similar hypotheses using data for that period (e.g. Gropp et al., 2011, and Laeven and Levine, 2009). The second cross-section is intended to capture the effect of government support on risk taking leading to the global financial crisis of 2008-2009.

The sample of financial institutions in our tests is composed of banks that are rated by Moodys or Fitch Ratings. We use this specific sample to assess the potential distortions of the governments support of banks on institutions that are large enough to issue debt in capital markets.[3] Banks that do not issue this type of debt are mostly subject to distortions due to deposit insurance mispricing, which has been the subject of other studies (Demirguc-Kunt and Detragiache, 2002). Each of the two rating agencies that we consider in our analysis currently assigns ratings to about 1,000 banks globally. In these samples of banks, subsidiaries of other rated banks account for a significant share. We exclude these subsidiaries as their risk-taking should be captured in the consolidated statements of their parents. Moreover, since the ratings-based measure of support does not discriminate betweeen government support and parent support, including subsidiaries would

[2]Ratings-based measures of support have been used to assess the implicit benefit of government support on bank debt (Schich and Lindh, 2012) and equity returns (Correa et al., 2013).

[3]The universe of rated banks represents a fraction of all banks in the world. For example, as of 2012, Moodys rated 59 U.S. banking groups including subsidiaries of foreign banks (Moody's Investors Service, 2012). In that same year, the Federal Deposit Insurance Corporation reported a universe of about 7,000 insured banks in the United States. However, the sample of rated banks represented about 80 percent of U.S. banking assets in that same year. See Tarullo (2013).

introduce measurement error.

Our paper has two main contributions. First, it shows that, according to a sample of roughly 340 banks from about 50 countries, higher expected government support is associated with more risk taking. The intensity of government support is positively related to our measures of bank risk taking after controlling for several factors, including bank size and liquidity, the level of bank regulations, banks'ownership structure, the degree of market concentration in the banking sector, and country-specific macroeconomic conditions. We find that this relationship is stronger during a crisis period such as the recent global financial crisis. This result is also robust to several other checks, including the possible endogeneity of government support. Similarly, we run panel regressions using bank level fixed effects with data between 2005 and 2010. These estimations use market-based measures as the proxies for banks' risk taking. We find that the link between government support and risk-taking is even stronger in this set of results.[4] Thus, in our sample, market discipline is the dominant factor shaping the relationship between support and risk in the banking industry.

Our second key result is that the adoption of regulatory impediments for banks to engage in activities involving security markets, insurance, real estate, and ownership of non-financial firms reduces the magnitude of the moral hazard problem associated with government support. Capital supervision and regulation were not enough to fully prevent additional risk taking by banks with more government support during the crisis, but banks that faced more restrictions in terms of the activities that they were allowed to perform were less likely to take on more risk. Interestingly, Barth et al. (2006) find that, for the early 2000s, increasing activity restrictions to banks led to more risk taking by these institutions. However, our finding is consistent with new studies documenting the increasing complexity of banking organizations, which have not translated into significant

[4]The fixed effect regressions control for potential unobservable bank characteristics that are static in the short run and that may affect risk taking (e.g., a managers appetite for risk or the compensation structure within banks).

economies of scope (Cetorelli et al., 2012).

Previous studies on the impact of government support on bank risk taking have to a large extent looked at either measures of explicit support such as deposit insurance (Demirguc-Kunt and Detragiache, 2002) and state ownership (De Nicoló and Loukoianova, 2007) or indirect measures of implicit support such as bank size ("too-big-to-fail"; see Boyd and Runkle, 1993, and O'Hara and Shaw, 1990), with mixed results. More recently, Forssbaeck (2011) explores the importance of deposit insurance and ownership on bank risk taking, but his work differs from ours along several dimensions. For instance, his paper focuses on the period from 1995 to 2005 and, in contrast to our findings, shows that there is no support to the proposition that the market discipline channel becomes more important during crises. Dam and Koetter (2012) find support for the market discipline channel for the period between 1995 and 2006, but their study is restricted to German banks and focus on a measure of probability of support that is derived from actual bailouts. A recent strand of papers have used a natural experiment approach to control for possible reverse causality between government support and risk taking.[5] However, we feel that we adequately address the issue of endogeneity by considering lagged expected (and not actual) support, by using an instrumental variables approach, and futher, by estimating panel regressions with firm fixed effects and market measures of risk to control for unobservable factors that are invariant in the short-run. Furthermore, the cited papers only use evidence from Germany. This has two drawbacks. The first is that a single-country analysis does not allow for the identification of the impact of regulatory factors that may affect the relation between government support and risk taking. The second is that it is difficult to draw general implications from those studies given the specificities of the German banking system, with a very large number of local savings and loans institutions and state controlled banks (Landesbanken). In related work, other authors have found a positive effect of actual

[5]See Gropp et al. (2013), Ongena et al. (2013), Damar et al. (2012), Fischer et al. (2012), and Schnabel and Krner (2012), among others, who use the same experiment from Germany, in 2001.

government support on bank risk taking.[6] We instead focus on *expected*, not actually received, government support and use a sample of banks from many countries. Our variable of government support measures the expected willingness and the ability of external agents to provide support to banks. It is not a measure of actual support (for which the endogeneity issue is clearly problematic) and it is not susceptible to the criticism of being less relevant during crisis periods, when governments may not have the fiscal space to provide support.

In contrast to the previously mentioned studies, Gropp et al. (2011) find that expected government support to a given bank induces more risk taking by the bank's competitors.[7] Unlike our study, they do not find a consistent relationship between support and risk taking by protected banks. In fact, their findings suggest that protected banks take on less risk, which is consistent with the charter value channel being dominant. The different findings can be explained by our use of a different measure of risk and of additional bank and country-specific controls. The z-score, our measure of risk taking, is a broader measure of risk since it encompasses both credit risk and market risk and summarizes some of the measures used by Gropp et al. (2011).[8] Furthermore, our sample excludes bank subsidiaries but includes the post-financial crisis period.

Studying and understanding bank risk-taking behavior is important for a variety of reasons. Excessive risk taking by banks is often associated with bank failures and costly government-financed rescues. Banking crises are in turn associated with sharp recessions, large drops in asset prices, protracted recoveries and big increases in government debt (Reinhart and Rogoff, 2009). In addi-

[6] See, for instance, Black and Hazelwood (2012) for the effect of TARP on U.S. banks.

[7] Government bail-out guarantees to a given bank may increase risk taking by its competitors because they decrease their charter value (Hakenes and Schnabel, 2010).

[8] The z-score is a widely used measure of risk, especially in cross-country banking studies (Laeven and Levine, 2009). Gropp et al. (2011) use four different measures: the problem loans ratio (problem loans over total assets), the risk asset ratio (risky assets over total assets), the liquidity ratio (liquid assets over short-term liabilities), and the equity ratio (book capital over total assets). However, the first two measures are difficult to compare across countries due to regulatory differences (European Bank Coordination Initiative, 2012), while the third is not an actual measure of risk taking. Finally, the equity ratio is a component of the z-score and we test its direct relation to government support, in this study, as a robustness check.

tion, banks exposed to lower default risk seem to better insulate their loan supply from monetary policy changes and to offer more credit (Altunbas et al., 2010). For these reasons, theoretical and empirical studies of bank risk taking have been used by both central banks and regulatory agencies to frame prudential policies.[9] In the sense that our results provide an estimate of the magnitude of the moral hazard effect of government support to banks, they are also useful as an input for researchers and regulators.

Our results have strikingly different policy implications from those of related papers. If the main channel through which government support affects bank's risk-taking is by increasing the charter value of guaranteed banks then it makes sense to apply a capital surcharge on protected banks to decrease their rents and their (unprotected) competitors' incentives to take on more risk (Gropp et al., 2011). Increased capital requirements would also reduce gambling incentives by putting more bank equity at risk.[10] However, we do not find empirical evidence in favor of the charter value hypothesis. Furthermore, we provide direct evidence that pre-crisis capital requirements did not weaken the link between government support and risk taking by banks.[11]

If, as we find, the dominating channel is "market-discipline" and pre-crisis capital requirements proved to be ineffective in reducing moral hazard, then measures to increase the incentives by depositors and subordinated creditors to monitor or influence banks' attitudes towards risks are preferable. These include imposing more transparency and forcing more disclosure by bank managers, mandating periodic issuance of subordinated debt or using market information to improve

[9] See Boyd and De Nicoló (2005) for a discussion on policy responses to perceived links between competition and the risk of bank failures.

[10] However, in as much as uniform capital requirements decrease the charter value of all banks, Hellmann et al. (2000) suggest using deposit-rate controls as an additional prudential measure.

[11] The ineffectiveness of pre-crisis capital requirements does not imply that much higher capital requirements and wider risk coverage (such as the ones in Basel III) could not weaken the link between government support and risk taking by banks (see, for instance, Admati and Pfleiderer, 2010). However, the quantity and quality of required capital, before the crisis, did not prevent the build-up of excessive on- and off-balance sheet leverage by banks (Basel Committee on Banking Supervision, 2009).

the quality of supervision (Rochet, 2005). Moreover, the increase in bank complexity over the past decade may have decreased the effectiveness of investor monitoring, as it became more difficult for "outsiders" to assess the level and types of risks taken by banks. Our second finding provides evidence that investors and regulators may limit risk taking by banks, even for those that have government support, if these banks' range of activities is restricted. Thus, simple rules like those that were included in the Glass-Steagall Act could potentially be reconsidered (Haldane, 2012).

The rest of this paper is organized as follows. In Section 2, we describe our sample and detail our data sources and in Section 3 discuss our hypothesis and methods. In Section 4, we present our results on support and risk taking, as well as several robustness checks and, in Section 5, we discuss how regulation may affect this result. Section 6 concludes.

2 Data

2.1 Banks and Bank Risk Taking

We use the z-score as our measure of bank risk. The z-score equals the return on assets (ROA) plus the capital asset ratio (CAR) of each bank divided by the banks' standard deviation of return on assets (σ(ROA)). The z-score measures the distance to insolvency since it is the inverse of the probability that losses exceed equity (that is, prob(-ROA>CAR); see Laeven and Levine, 2009). A higher z-score therefore indicates that the bank is less risky.

A characteristic of the z-score is that it is highly skewed. For this reason, we use the natural logarithm of the z-score. We have data across 54 countries to calculate the z-score for 286 banks for the period 2003–2004, and for 321 banks in 2009–2010. These banks are also required to be rated by either Moody's Investors Service (Moody's) or Fitch Ratings (Fitch), two of the major rating agencies. As listed in Table 1, the number of banks per country varies from 1 to 30. The

results in the paper are robust to excluding countries with less than 2 banks.

In addition to restricting our sample of banks to those rated by Moodys or Fitch, we exclude all subsidiaries because our measure of support considers all external support, including that of parent companies. These restrictions reduce our sample size but make our approach much more rigorous. Specifically, we do not assume that, simply because a bank does not have a support rating, it does not have government support. Doing otherwise, in our opinion, would induce a measurement error that would bias our results, and helps explain why we find the opposite of what Gropp et al.(2011) find. The inclusion of most major international and systemically important banks in our sample increases the economic significance of our results and also explains why we find the opposite of other empirical studies dominated by small local banks which enjoy support mostly through deposit insurance (see Ioannidou and Penas, 2010, as well as Demirguc-Kunt et al., 2008, and references therein). For these smaller banks, mispricing of deposit insurance is the relevant incentive for their risk taking behavior. Instead, large banks fund a significant portion of their assets with senior short and long term unsecured debt. The systemic government support that investors perceive these large banks are likely to get, creates and implicit funding subsidy (Anginer et al., 2013) with consequences that have not been studied yet.

To calculate the z-score, we compute the standard deviation of ROA using 5 year rolling windows. Then we average the z-score for the years included in our two cross-sections, 2003–2004 and 2009–2010. We focus on a cross-sectional analysis due to a change in accounting standards that affected a large sample of European banks and banks in other regions. In the mid-2000s, some countries replaced local General Accepted Accounting Practices (GAAP) with International Financial Reporting Standards (IFRS) for publicly-traded banks based in these countries. The change in accounting standards had a notable impact on the way bank balance sheets are reported. For instance, under IFRS rules, derivative assets and liabilities are not netted, increasing the total value

of assets of the bank. To avoid including biases due to the change in accounting treatment we focus on periods in which banks consistently use one or the other accounting method, and focus on cross-sections of results.[12] The accounting data on banks are from Bankscope, a commercial database with extensive information on banks across the globe.

As a robustness check we use three additional measures of risk-taking. The first is a market-based measure of the z-score (Forssbaeck, 2011). It is defined as the ratio of a banks average stock return over a year plus its leverage ratio over the standard deviation of this banks stock return in the same year.[13] As with the accounting based z-score, we use the natural logarithm of this measure in our estimations. The second measure is the standard deviation of a banks weekly stock return, which enters in the denominator of the market-based z-score measure described above. Although these market-based measures are more forward looking, as opposed to the accounting-based z-score, the downside of using them is that an important segment of banks which are not publicly traded are dropped from the sample.[14] This is particularly important in Europe as a significant portion of its banking sector is not publicly-listed. For example, German Landesbanks, which enjoy notable implicit support from the government and took notorious risks prior to the global financial crisis (Arteta et al., 2013), are excluded from this sample as their stocks are not listed. The third alternative risk measure is the ratio of loan loss provisions to average total assets. Although this measure is available for most banks in the sample, it only captures risk-taking through one dimension: banks loan portfolios. Prior to the global financial banks took risk through assets different than traditional loans, like U.S. issued mortgage backed securities. Risk taking through these instruments is not captured by loan loss provisions.

[12]The use of a panel with the z-score is therefore impossible because of the 2005 IFRS shift, in conjunction with the five year window needed to calculate $\sigma(ROA)$.

[13]We use end-of-month stock price information from Bankscope to calculate the banks stock returns.

[14]These equity-based measures are not entirely forward looking because they are based on historical returns volatility rather than options-implied volatilities. These data are unavailable for most banks.

2.2 Bank Support

We measure bank support using bank-specific ratings information from Moody's and Fitch. Since 1995, Moody's has assigned bank financial strength ratings (BFSR) to banks in about 90 countries. According to Moody's, BFSRs "are intended to provide investors with a measure of a bank's intrinsic safety and soundness on an entity-specific basis" (Moody's Investors Service, 2007). More importantly, this measure does not include any external support that a bank may receive from its parent, other institutions under a cooperative or mutual arrangement, or the government.

Moody's also assigns a bank deposit rating to the banks it rates. This is the rating agency's opinion on a bank's ability to repay its deposit obligations punctually. As such, they incorporate both the bank's BFSR rating and Moody's opinion of any external support. Since this measure includes any type of external support, including that of parent companies, not just that of governments, we exclude from the sample all bank subsidiaries. This reduces the size of the sample considerably but eliminates an important source of measurement error.

In the main specifications, the bank-specific government support measure is defined as the difference (in rating notches) between a bank's BFSR and its long-term foreign currency deposit rating. As a robustness check, we also define support in terms of the probability of a government bailout as in Gropp et al. (2011). This amounts to assigning a default probability to each bank according to the BFSR (the default probability in the absence of a bailout, d) and another according to the deposit rating (the total default probability, taking account bailouts, td), using historical one-year ahead default frequencies collected by Moody's. The bailout probability is $p = 1 - td/d$. Fitch Ratings provides a similar measure of the probability of support which we use as an additional robustness check.

Figure 1 shows the evolution of average and median government support since 1996 for all

banks included in the sample. Support tends to increase during periods of economic distress, as was the case during the East Asian and Russian crises of the late 1990s, and the recent financial crisis.

2.3 Control Variables

We control for a series of characteristics at the bank, industry, and country levels. For the most part, we follow Laeven and Levine (2009). The bank-specific controls include revenue growth (measured as the growth in total revenues relative to the previous period), size (the bank's log of total assets), and liquidity (bank's liquid assets to liquid liabilities) and are all sourced from Bankscope. We also control for bank ownership by including a variable of cash flow rights of large shareholders (Laeven and Levine, 2009, see) and dummy variables which signal government, institutional, individual, or other type of ownership (data from Capital IQ, SNL Financial and banks' websites). All bank-specific data is from Bankscope.

At the country level, we control for per capita income, inflation, inflation variability (data from the World Bank Development Indicators), the quality of investor protection and the degree to which contracts are effectively enforced in a country (both from the 2003 and 2009 Doing Business Report of the World Bank).

The level of competition in banking markets is another factor which affects risk taking. Some studies suggest competition among banks for deposits decreases charter value and therefore leads to riskier portfolios being held by banks (for instance Keeley, 1990, and Hellmann et al., 2000). For this reason, we control for bank concentration at the industry and country level using the Hirsch-Herfindahl index (data from Bankscope).

In terms of banking regulations, we control for the existence of a deposit insurance scheme and

for the level of capital requirements (measured by the minimum capital-asset ratio requirement). Data on deposit insurance comes from Demirguc-Kunt et al. (2008), the Institute International Bankers (Global Surveys 2009 and 2010), the International Association of Deposit Insurers (IADI), the Central Bank of Egypt, and the Singapore Deposit Insurance Corporation Limited (SDIC).

Finally, we use as regressors several variables which measure the intensity and breadth of regulation in the banking sector and at the country level, as defined in Barth et al.'s (2006) bank regulatory database. We use the level of capital stringency, the level of official bank supervisory power, and an index of activity restrictions (all defined in Barth et al., 2006). *Capital stringency* measures the regulatory approach employed to determine and verify the extent of the capital at risk at banks. The variable reflects, among other information, whether the minimum capital-asset ratio (risk-weighted) requirement is based on Basel guidelines, whether market value of loan losses not realized in accounting books is deducted, or if the initial disbursement of capital can be done with borrowed funds. The *official supervisory power* variable measures the extent to which the regulatory or supervisory authorities have the power to take specific actions to prevent and correct problems. This includes the right to meet with external auditors to discuss their report without the approval of the bank, the right to order the bank's directors or management to constitute provisions to cover actual or potential losses, among other rights. *Activity restrictions* is an index measuring regulatory limitations to banks operating in securities markets, insurance activities, real estate, and engaged in the ownership of non-financial firms. For the 2003–2004 cross-section we use information from the 2003 regulatory database, and for the 2009–2010 cross-section we use the data compiled in the 2008 version of the database.

2.4 Summary Statistics

Table 2 provides summary statistics for the key regression variables. Statistics are based on averages for the periods 2003–2004 and 2009–2010 using annual data for our measure of risk taking (z-score). For for the other variables we use annual data for 2002 and 2008. The table indicates that there is ample variation in the bank risk taking measures and in the other relevant variables across banks in the sample periods. The table also shows a slight increase in the level of measured risk-taking (0.3 standard deviations of the z-score) and a somewhat more substantial increase in the average size of banks (0.5 standard deviations), when we compare 2003–2004 to 2009–2010. If we take previous studies at face value, these two facts in isolation are consistent with larger banks, possibly with more market power, taking on less risk. However, it is important to explore whether an increase in government support may have led to more risk taking by banks.

In fact, regardless of the measure we use, the data shows a sizable increase in the average level of support from 2002 to 2008. The increase is even more significant when we look at the median level of support. The median probability of support estimated by Moody's increases from 0% to 40%, from the first sample period to the second one, signaling a widespread increase in government support to banks. This increase is much more pronounced in Moody's measure than in Fitch's (Figure 1).

INSERT FIGURE 1

3 Hypothesis and Empirical Strategy

Our first hypothesis is that bank risk taking is related to government support to the banks. The basic empirical specification to test the hypothesis is formulated as follows,

$$Z_{b,c,t} = \beta_0 + \beta_1 \times GS_{b,c,t-1} + \beta_2 \times X_{b,c,t-1} + \beta_3 \times W_{c,t-1} + \varepsilon_{b,c,t}$$

where $Z_{b,c,t}$ is the natural logarithm of the z-score of bank b in country c for period t, $GS_{b,c,t-1}$ is government support for bank b from country c, $X_{b,c,t-1}$ is a matrix of bank level control variables, $W_{c,t-1}$ are country-level controls, $\varepsilon_{b,c}$ is the error term, and β_1, β_2, and β_3 are slope coefficients or vectors of coefficients. The standard errors are adjusted to control for clustering at the country level. Because we are using government support lagged by at least one period, we claim that support causes risk taking by banks.

The approach just outlined may be compromised if GS is endogenous or if there are omitted variables (i.e. the possibility that $cov(Z_{b,c}, \varepsilon_{b,c}) \neq 0$). We used two approaches to deal with the problem. The first is to saturate the regression with many bank and country specific measures to capture as much of the error term as possible (Bitler et al., 2005, and Laeven and Levine, 2009). The second approach we consider is to use instrumental variables. In addition to the benchmark regression above (without instruments), we instrument each bank's government support as follows. For each bank n, we employ the average GS of the other n-1 banks in the country, which reflects industry and country factors explaining *GS*. The instrument's validity relies on the assumption that an innovation in the risk taking of any given bank does not affect government support to other banks.

The interaction between national regulations and government support, and the interaction between bank level ownership and government support, are considered in the second hypothesis. Our

second hypothesis is that bank supervision and regulation affects the impact of government support on banks' risk taking behavior, which we test using the following specification:

$$Z_{b,c,t} = \beta_0 + \beta_1 \times GS_{b,c,t-1} + \beta_2 \times R_{c,t-1} + \beta_3 \times GS_{b,c,t-1} \times R_{c,t-1} + \beta_4 \times X_{b,c,t-1} + \beta_5 \times W_{c,t-1} + \varepsilon_{b,c,t}$$

where $R_{c,t-1}$ are country-specific regulatory standards, so that $GS_{b,c,t-1} \times R_{c,t-1}$ captures the interaction between the bank-specific government support measure and national regulations, and β_3 is the coefficient estimate of the interaction effect.

4 Results

4.1 Benchmark Regression

The benchmark empirical results on the link between bank risk taking and government support are reported in Table 4. The first main finding is that larger government support is associated with greater risk taking by banks, as reflected in the negative coefficient for government support (GS) found for almost all specifications. The second important result is that the relationship between government support and bank risk taking is present for both the 2003–2004 and 2009–2010 periods, but the coefficients are generally more statistically significant during the latter period. Regressions 1 and 8 control for recent bank performance (revenue growth), and show that a one standard deviation increase in government support is associated with a 4.5 percent decrease on the average z-score for the 2003–2004 period, but the relationship is not statistically significant. For 2009–2010, the government support coefficient is negative and statistically significant, and its magnitude indicates that a one standard deviation increase in government support is associated to a 6.9 percent increase in bank risk taking, relative to the average z-Score. These findings are

consistent with the view that increasing government support to banks tends to reduce market discipline, inducing further bank risk taking. The positive association between GS and risk holds when controlling for bank characteristics and country-level features, and after including country fixed effects, as we show next.

To consider the possibility that the association between government support and bank risk taking reflects other bank level differences instead of cross-bank differences in government support, the regression results shown in columns 2 and 9 control for the bank-specific characteristics of revenue growth, size, and the liquidity ratio. We have three comments on the results. First and foremost, the positive association between GS and banks' risk-taking remains significant for the 2009–2010 period and insignificant for 2003–2004. Our results are therefore robust to the inclusion of bank-specific characteristics. Second, while revenue growth seems to capture well the charter value effect (in as much as banks with faster growth are better able to generate rents), size on its own does not seem to impact risk taking (the variable is almost never significant).[15] Third, banks with higher liquidity take (significantly) more risks. Our interpretation is that liquidity is capturing a bank-specific appetite for risk: banks with a riskier business model (for instance, more securities' trading) keep more liquidity at hand in case of losses or margin calls.

We also take into account the possibility that the link between government support and bank risk taking captures cross-country heterogeneity instead of cross-bank differences in government support by running regressions with country fixed effects (columns 4 and 11). Alternatively, regressions in columns 5 and 12 control for several country-specific characteristics, including the level of economic development in each bank's home country (per capita income), indicators of capital requirements, the level of investment protection,[16] the presence of deposit insurance, the degree to

[15] One explanation for the low significance of growth as a determinant of risk taking is that the too-big-to-fail effect and the charter value hypothesis cancel each other out. Another explanation is that larger banks are better at risk diversification but also harder to monitor because of increased complexity.

[16] Using Djankov et al.'s (2008) revised anti-directors index or their anti-self-dealing index does not change the

which the law is effectively and fairly enforced in a country, and the Herfindahl concentration index for the banking system. The results yield two comments. First, for both cross-sections, the result that government support leads to riskier banks is robust to conditioning on either country controls or fixed effects. Second, of all country controls, only per capita income and inflation volatility are significant for both time periods. While an increase in inflation volatility always causes riskier banks, the change in the sign of the coefficient associated with income per capita reflects the fact that advanced economies were the most affected by the 2007–2009 crisis.[17]

It is possible that our results are affected by a possible endogeneity of government support. We explicitly tackle this using an instrumental variables approach. As shown in regressions 3 and 10, the instrumental variable results confirm that GS is positively and significantly associated with bank's risk taking, at least for the crisis period. In fact, not only does the coefficient associated with *GS* remain statistically significant, but its magnitude does not change.

Bank ownership structure has been shown to be an important explanation of the level of risk taking by banks since it critically conditions the conflict over risk between bank managers and owners (Laeven and Levine, 2009). In regressions 6 and 13, in addition to the previous bank and country level controls, we control for cash-flow rights and for ownership structure (as in Laeven and Levine, 2009) by looking at the extent to which there are large shareholders in the bank and by differentiating between government, institutions, individuals and others. The positive and significant association between bank risk taking and government support is robust to these additional controls.

flavor of results, which are available from the authors if requested.

[17] Since the two time periods reflected different macroeconomic and financial sector conditions, we checked whether controlling for equity market volatility made a difference. For this effect, we used the previous year's average daily volatility of the banking sector stock index from Datastream for each country (when available). The (untabulated) results were unchanged. We also tried to control for financial sector soundness (which would proxy for regulatory forbearance), using the Bank Soundness index from the Global Competitiveness Report but this did not affect results either.

A final specification issue we tackle is the one pertaining to the timing of support being given and risk materializing. In our benchmark specifications support is lagged by one period (we regress the 2003–2004 and 2009–2010 z-Scores on 2002 and 2008 supports, respectively). Since investment and credit decisions (possibly affected by government support) may take longer than one year to affect results, we regress the z-Score averages on 2001 and 2007 support (using a longer lag would restrict severely our sample size). The results, shown in columns 7 and 14, are basically the same as in the other regressions.

4.2 Robustness

We perform three robustness exercises which involve using alternative definitions for risk taking and government support, estimating panel regressions with fixed effects, and considering changes in bank valuation in the tests. Finally, we assess the predictive power of the selected Moody's measure of government support to anticipate actual government bailouts, and compare it to Fitch's alternative. In the first exercise, instead of the z-Score, we use the individual components of the z-score (ROA, Capital to Assets, and the standard deviation of ROA). We regress these measures on bank controls and on country controls, as in the benchmark regression discussed before.[18]

The results are available on Table 5 for the selected time periods: 2003–2004 and 2009–2010. The regressions show a strong and statistically significant effect of government support on ROA regardless of the time period. In the pre-crisis sample, government support was also positively

[18]We also tried using loan loss provisions as a percentage of assets as an alternative measure of risk. This measure presents two problems. First, the definition of what are loan losses and of how much and when to provision for those losses varies across countries by a great deal. This causes a misspecification problem. A second problem with using loan loss provisions is that it provides a very incomplete measure of risks taken. Specifically, loan loss provisions (imperfectly) cover risks associated with loan portfolios and disregard other types of credit risks, let alone market risks which affect a broader set of assets held by banks and were more important during the recent financial crisis. Preliminary findings seem to confirm this and are available upon request.

and significantly related to the volatility of ROA. In the crisis sample, government support was negatively and significantly related to the capital to assets ratio. We interpret these findings as follows. Before the crisis, support tended to encourage riskier bets by banks which translated into more volatile returns. After the crisis, two additional interpretations arise. On the one hand, it is possible that banks took more risk by increasing leverage. On the other hand, it could also be the case that banks took more risks, which led to more losses and lower capital buffers to withstand shocks.

Interestingly, in contrast to what we find for the z-Score itself, size matters for each individual component of the z-Score, particularly for the second time period. In fact, larger banks tend to be more leveraged - "too-big-to-fail" effect - but also to have less volatile returns on assets - diversification effect. The combination of the two countervailing two effects in the z-Score explains why, in the benchmark specification, bank size does not significantly impact bank risk.

In our second robustness test we replace our accounting-based measure of the z-score for a market-based version. Moreover, we use the volatility of banks stock returns and the ratio of loan loss provisions over banks average assets as additional measures of risk. The advantage of these measures over the accounting based z-score is that they are forward looking or calculated with data for just one year. This allows us to run panel regressions with bank-level fixed effects. As noted before, the inclusion of fixed effects control for unobservable bank characteristics that may be correlated with risk taking and invariable in the short run. For example, the compensation structure or culture of risk in a bank may lead to more risk taking (Cheng et al., 2010). If these traits are invariant over a short period, they are captured by the fixed effects.

Table 6 shows the results of these panel estimations for the period between 2005 and 2010. All regressors enter the specifications contemporaneously with the exception of our government support measure. Columns 1, 3, and 5 report results using support lagged by one year, while the

other columns show the same specifications using support lagged by two years. As shown in the first two columns of the table, the coefficient on government support is negative and significant, when using the market-based measure of z-score as the risk proxy. This confirms the results shown with the accounting-based measure in a cross-sectional setting. The lag of the government support does not matter for the level of significance or sign of the coefficient. The next two columns show results for the estimations using stock return volatility as the risk proxy. In this case, the coefficient on government support is positive and significant, implying that more government support leads to more stock return volatility. Lastly, the last two columns show the estimated coefficients for the same specification using loan loss provisions as the risk measure. The coefficients for both specifications are positive and significant, but only the coefficient on the one-year lag support measure is statistically significant. This result confirms that risk-taking through loans was important but not the ultimate mechanism available to banks prior to the crisis.

A second robustness test requires replacing our notches-based definition of government support with one where we assign probabilities of a government bailout as in Gropp et al. (2011). We then replicate the regressions presented in Table 4: two regressions with bank controls only, one with county fixed effects, and one with country controls for both time periods. Our findings are in Table 7. Most results are qualitatively the same as the ones for the benchmark regressions. During the crisis, using our preferred specification (country fixed effects), a one standard deviation increase in the probability of a bailout led to an 8 percent increase in risk (relative to the mean).[19] This effect is significant at the 1 percent significance level.

We extend our robustness check by performing the exercise using probabilities of a government bailout derived from data collected by Fitch Ratings (the same data source used by Gropp et al., 2011, and Forssbaeck, 2011). We run the same regressions as in Table 7 and present the results in

[19]This would be equivalent to going from no support to a level slightly below the median level of support in the industry.

Table 8. The main difference in terms of results is that government support is not significant for the pre-crisis period. In fact, as in Gropp et al. (2011), we find that for that period (2003–2004), a higher probability of a government bailout is not associated with the supported bank taking on more risk.[20] However, when we look at the crisis period (2009–2010), we do find strong evidence of moral hazard in government support to banks, as we had in the regressions with the Moody's-based measures of support.

So far, we have only implicitly considered the hypothesis of bank charter value determining the link between support and risk taking. We did this by including the degree of market concentration (measured by the Hirsch-Herfindahl index) as one of the industry-country controls. Results on columns 5 through 7 and 12 through 14 in Table 4 show that market concentration is never significant.[21] This does not mean that the charter value channel is irrelevant since competition can affect charter value in more than one way (Martinez-Miera and Repullo, 2010, suggest a U-shaped relationship between competition and the risk of bank failure). For instance, competition in lending markets may be negatively related to bank risk taking, as suggested by Boyd and De Nicoló (2005).[22]

The third robustness exercise is therefore to explicitly consider the charter value channel. We do this by allowing for the joint determination of bank risk and bank valuation and then testing for the link between risk and government support independent of bank value. We expand our baseline specification with bank and country controls by including Tobin's Q as an endogenous explanatory variable. We calculate the Tobin's Q as total assets plus market value of equity (data

[20]This is probably due, at least in our study, to this probability-based measure of government support not showing enough variation in the pre-crisis sample (see Figure 1).

[21]We also tried to capture the charter value effect with variables representing barriers to entry such as Barth et al.'s (2006) index of barriers to entry and either the number or the change in the number of banks in the country (normalized by GDP). Changing the variables had no impact on our results (available from the authors upon request).

[22]Their argument is that if there is low competition among banks for loans to firms, interest rates charged will be higher and this will force entrepreneurs to choose riskier projects, thereby increasing credit risk borne by banks.

from Bankscope) minus book value of equity divided by total assets. We estimate the model using two-stage GMM and two excluded instruments in the first stage regression: a dummy variable for the bank's stock being widely held (Widely) and the number of banks normalized by the country's gross domestic product.[23] We are only able to do it for the second period due to data availability. The results in Table 9 show that when it comes to explaining bank risk taking (second stage regression), our variable of government support is still significant (albeit at the ten percent level only) but bank value is not.

4.3 Predictive Power of Government Support

The relevance of the empirical work we present in this study relies on the adequacy of our measures of government support. In addition, we assess the measure of government support from Moody's, which was adopted for the baseline regressions, against the alternative from Fitch's. In Table 3 we can see that Moody's and Fitch's probability-based measures of support were mildly correlated before the crisis and became more correlated with the crisis. For the period before the crisis we also see that Moody's measure was uncorrelated with size while Fitch's was significantly correlated with banks' total assets.[24] These two facts suggest that, for the period when the two measures were the most different from each other (before the crisis), Moody's measure was capturing, to a larger extent than Fitch's, other aspects of government support besides the "too-big-to-fail" hypothesis.

A more definitive way of settling the issue is to test whether these measures are able to predict actual bail-outs. One way of doing this is to run a probit regression of actual government interven-

[23] We tried using Laeven and Levine's (2009) excluded instruments - share of assets, being listed on the New York Stock Exchange, and the country having barriers to entry to the banking industry - but these proved to be weak instruments.

[24] After the crisis, they are both correlated with size, as expected.

tions in banks on our measures of support. To this effect we define a binary variable y_{it} which takes value 1 if bank *i* either received a capital injection by its government or was partially or totally nationalized between 2008 and 2010. We start with data on capital injections in Europe from Brei et al. (2011) and complement those with information retrieved from Laeven and Valencia (2012) and FT.com. The data include 238 banks but there is ratings information for only 137, of which roughly one third were intervened (Table 10).

We posit that the likelihood of a bank being actually rescued by its government depends on the amount of ex-ante government support and on how distressed the bank was prior to the crisis, as well as on other characteristics such as size, capital, and liquidity. We use loan loss provisions as a percentage of average assets as a measure of bank distress.[25] Since the impact of support will certainly depend how distressed the bank was to start with, we include an interaction of support with loan loss provisions. In order to make the interpretation of the effect of interacted variables easier, we replace our main variable of support by a dummy variable which takes value 1 if the Moody's-based support measure (in notches) was positive (support) and 0 otherwise (no support). We also condition for the state of the economy using the average GDP growth rate for 2007–2009. To address any concerns of endogeneity, all controls (except for GDP growth) correspond to 2007 values.

We estimate the following model:

$$y_{it}^{*} = \alpha_0 + \alpha_1 GS_{it-1} \alpha_2 LLP_{it-1} + \alpha_3 GS_{it-1} \times LLP_{it-1} + \Gamma \mathrm{z}_{it-1} + u_{it},$$

where $y_{it}^{*} > 0$ ($y_{it} = 1$) if bank *i* was the target of a government intervention between 2008 and 2010. LLP is loan loss provisions as a percentage of average total assets and z a vector with the

[25] By including these controls we are controlling for systemic importance since size, leverage, and asset risk (e.g. loan loss provisions) are the main drivers of systemic risk (Hovakimian et al., 2012).

other controls mentioned above. The estimation results are in Table 11. Estimates of coefficients in probit models do not have an economic interpretation, especially when interaction terms are present. For this reason we focus on the pairwise comparison of marginal effects. This measure estimates the average predicted probabilities of having a capital injection conditional on being in each of the two support groups (no support or some support) and unconditional on the other control variables. We find that banks who enjoyed support in 2007 were more likely to be rescued in 2008–2010 by 30 percentage points and that the difference is highly significant. We take this as strong evidence in favor of the predictive ability of our measure of support and therefore of its economic significance. The same estimation using the equivalent Fitch measure shows insignificant marginal effects of government support (available from the authors upon request). Therefore, Moody's measure is a better choice for our baseline empirical specifications.

5 Regulation and Government Support

Our research is the first attempt to explore the interactive effects of national regulations and bank-specific government support on the risk taking behavior of individual banks. We use data on regulation for 2003 and for 2008 from Barth et al. (2008). These data consider regulations emphasized by the Basel Committee and that the theoretical literature has pinned down as affecting bank behavior (Laeven and Levine, 2009). We use an index of regulatory oversight of bank capital, *capital stringency*, a measure of *official supervisory power* and a measure of *activity restrictions* (see Section 2.3 for detailed definitions).

The thoeretical underpinnings of how these regulations relate to bank risk taking and government support are complex and suggest multiple effects often with opposite consequences (see Barth et al., 2004, and references therein). The impact of regulations on capital adequacy on

bank risk taking is, in principle, ambiguous. While sticter capital adequacy requirements increase the amount of capital at risk thereby, at least in theory, counteracting the moral hazard of government support and limited liability, they may also reduce monotoring incentives. On the other hand, broader official supervisory powers may compensate for the lack of market monitoring of banks (possibly due to perceived government support), but its effectiveness will depend on how closely the supervisor can be monitored by taxpayers and their representatives. Finally, restricting the range of bank activities may decrease the number of opportunities for banks to increase risk, make them less complex and therefore easier to monitor, and act as a limit on bank size and systemic importance, thereby reducing the number of "too-big-or-too-systemic-to-fail" institutions. Alternatively, activity restrictions may hamper banks' abilities to diversify risks and decrease their charter value, which would increase risk taking.

It is crucial then to test empirically how these regulations and government support interact to shape banks' willingness to take on risk. Table 12 shows the interaction of government support with the various types of bank regulations in cross section regressions for the 2003–2004 and 2009–2010 periods. The regressions include all the bank and country level controls used in the previous tables. The results indicate that for the 2003–2004 period, seen in columns 1 to 4, *government support* was not a significant factor for bank risk taking, and regulation did not play a significant role either. In contrast, the period encompassing the recent financial crisis is associated with a stronger correlation between *government support* and risk taking. The interaction coefficient for *activity restrictions* and *government support* is positive and significant during the crisis period, indicating that limiting the scope of activities and markets where banks should be allowed to operate has limited their risk taking behavior. The magnitude of the interaction coefficient, however, suggests that activity restrictions have not fully offset the moral hazard effect from government support.

Our findings are in contrast, at least when it comes to regulations which restrict bank activities,

with what was previously found by Barth et al. (2006), especially if we consider the post-financial crisis period. In fact, while they find that activity restrictions encourage more risk taking and increase bank fragility, we find that they decrease risk taking by banks with government suport. On the other hand, Laeven and Levine (2009) find that activity restrictions encouraged risk taking in 2003-2004, while we find an insignificant effect for the same period (after controlling and interacting with support) and a significant effect (with the opposite sign) for the 2009-2010 period. Therefore, to understand the impact of these regulations on bank stability, we must pay close attention to crisis periods and to the role of governments in providing implicit or explicit bailout guarantees.

6 Conclusion

Government support to banks through the provision of explicit or implicit guarantees, in theory, has an ambiguous effect on banks' risk-taking. On the one hand, by providing support, governments can encourage banks to take more risk because of a moral hazard effect, i.e., the *market discipline* hypothesis. On the other hand, support can make banks more conservative because it increases their charter value, i.e., the *charter value* hypothesis.

We use two measures of government support to banks - in notches and in terms of probability of a bailout - from two sources (Moody's and Fitch Ratings) to capture their attitudes towards risk. After controlling for bank-level and country-specific factors, we find that the intensity of government support is positively related to our measures of bank risk taking. We find that this relationship is stronger for the 2009–2010 period relative to 2003–2004. Our results are robust to endogeneity as well as to the way we measure risk taking. We conclude that the lack of market discipline, especially during the crisis, shaped the relationship between government support and

risk in the banking industry.[26] Moreover, capital requirements regulation and enhanced supervisory powers failed to curb risk taking due to government support to banks.

Our results suggest that measures to increase the incentives by depositors, small shareholders, and subordinated creditors to monitor or influence banks' attitudes towards risks should decrease the moral hazard associated with government support to the financial system. This should start with the creation of regulatory environments which do not hinder private monitoring of banks, but could ultimately lead to limits on the amount of support that governments can pledge.[27] Alternatively, restricting banks' ability to engage in activities involving security markets, insurance, real estate, and ownership of non-financial firms weakens the link between government support and risk taking by banks. The way through which restrictions on bank activities ameliorate the problem (either by reducing banks' ability to engage in risky activities or by reducing banks' complexity and therefore facilitating monitoring by outside investors and bank supervisors) will be the subject of further research.

The degree to which CEO incentives are aligned with the interests of shareholders influences the amount of risk taking in non-financial firms. However, the existing evidence on banks is still inconclusive.[28] An important extension to our paper is to investigate the role of bank governance variables besides ownership. For instance, large board sizes in banks may be optimal given the complexity of the banking business and the large size of many of these firms. This stands in sharp contrast to non-financial firms where board size is positively related to free-riding problems. Banks are also different from non-financials and other financial firms in that they have many out-

[26] In fact, one can argue that the lack of effective market discipline was one of the main triggers of the crisis. Therefore, enhancing market discipline should be an important goal for financial regulatory reforms (Levine, 2011).

[27] Nier and Baumann (2006) found that, in the 1990's, market discipline mechanisms, such as increased disclosure and uninsured funding, were effective in inducing banks to limit default risk by increasing capital buffers. However, the effect is reduced when banks enjoy a high degree of support.

[28] For instance, there is some evidence that greater reliance on option compensation or cash bonuses did not have a negative impact on bank performance during 2008-09 crisis (Fahlenbrach and Stulz, 2011) but may have led to acquisitions which increased default risk by acquiring banks (Hagendorff and Vallascas, 2011).

side investors (i.e. depositors), are highly leveraged, and are possible beneficiaries of government support. This translates into shareholders' interests being often conducive to too much risk taking, at least from a systemic risk point of view. What the optimal bank governance structure should be, given a desired level of systemic risk, is still not totally understood and will certainly be the motivation for future research.

References

Admati, A. R. and P. Pfleiderer (2010). Increased-Liability Equity: A Proposal to Improve Capital Regulation of Large Financial Institutions. Stanford University Graduate School of Business Research Paper No. 2043.

Altunbas, Y., L. Gambacorta, and D. Marques-Ibanez (2010). Bank Risk and Monetary Policy. *Journal of Financial Stability 6*(3), 121 – 129.

Anginer, D., V. V. Acharya, and A. J. Warburton (2013). The end of market discipline? investor expectations of implicit state guarantees. Unpublished manuscript.

Arteta, C., M. Carey, R. Correa, and J. Kotter (2013). Revenge of the steamroller: Abcp as a window on risk choices. Technical Report 2013-1076, Board of Governors of the Federal Reserve System.

Barth, J. R., G. Caprio, and R. Levine (2006). *Rethinking Bank Regulation*. Cambridge University Press.

Barth, J. R., G. Caprio, and R. Levine (2008). Bank Regulations are Changing: For Better or Worse. *Comparative Economic Studies 50*(4), 537–563.

Barth, J. R., G. C. Jr., and R. Levine (2004). Bank regulation and supervision: what works best? *Journal of Financial Intermediation 13*(2), 205 – 248. Bank Capital Adequacy Regulation under the New Basel Accord.

Basel Committee on Banking Supervision (2009, December). *Strengthening the Resilience of the Banking Sector*. Consultative Document. Basel: Bank of International Settlments.

Bitler, M., T. Moskowitz, and A. Vissing-Jørgensen (2005). Testing Agency Theory with Entrepreneur Effort and Wealth. *The Journal of Finance 60*(2), 539–576.

Black, L. K. and L. N. Hazelwood (2012). The Effect of TARP on Bank Risk-Taking. *Journal of Financial Stability*. Article in press.

Boyd, J. H. and G. De Nicoló (2005). The Theory of Bank Risk Taking and Competition Revisited. *The Journal of Finance 60*(3), 1329–1343.

Boyd, J. H. and D. E. Runkle (1993). Size and Performance of Banking Firms: Testing the Predictions of Theory. *Journal of Monetary Economics 31*(1), 47 – 67.

Brei, M., L. Gambacorta, and G. von Peter (2011). Rescue Packages and Bank Lending. BIS Working Papers 357, Bank for International Settlements.

Cetorelli, N., B. H. Mandel, and L. Mollineaux (2012). The evolution of banks and financial intermediation: Framing the analysis. *Federal Reserve Bank of New York Economic Policy Review 18*, 1–12.

Cheng, I.-H., H. Hong, and J. A. Scheinkman (2010, July). Yesterday's Heroes: Compensation and Creative Risk-Taking. Working Paper 16176, National Bureau of Economic Research.

Correa, R., K.-H. Lee, H. Sapriza, and G. Suarez (2013). Sovereign Credit Risk, Banks' Government Support, and Bank Stock Returns Around the World. *Journal of Money, Credit, and Banking*. Forthcoming.

Dam, L. and M. Koetter (2012). Bank Bailouts and Moral Hazard: Evidence from Germany. *Review of Financial Studies 25*(8), 2343–2380.

Damar, E., R. Gropp, and A. Mordel (2012). *The Ex-ante Versus Ex-post Effect of Public Guarantees*. Bank of Canada.

De Nicoló, G. and E. Loukoianova (2007). Bank Ownership, Market Structure and Risk. IMF Working Papers 07/215, International Monetary Fund.

Demirguc-Kunt, A. and E. Detragiache (2002). Does Deposit Insurance Increase Banking System Stability? An Empirical Investigation. *Journal of Monetary Economics 49*(7), 1373 – 1406.

Demirguc-Kunt, A., E. J. Kane, and L. Laeven (2008). Determinants of Deposit-Insurance Adoption and Design. *Journal of Financial Intermediation 17*(3). pp. 407-438.

Djankov, S., R. L. Porta, F. L. de Silanes, and A. Shleifer (2008). The Law and Economics of Self-dealing. *Journal of Financial Economics 88*(3), 430 – 465. Darden - JFE Conference Volume: Capital Raising in Emerging Economies.

European Bank Coordination Initiative (2012). *Non-Performing Loans in Central, Eastern and Southeastern Europe*. Brussels: European Bank Coordination Initiative.

Fahlenbrach, R. and R. M. Stulz (2011). Bank CEO Incentives and the Credit Crisis. *Journal of Financial Economics 99*(1), 11 – 26.

Fischer, M., C. Hainz, J. Rocholl, and S. Steffen (2012). Government guarantees and bank risk taking incentives. In *AFA 2012 Chicago Meetings Paper*.

Flannery, M. and S. Sorescu (1996). Evidence of Bank Market Discipline in Subordinated Debenture Yields: 1983-1991. *The Journal of Finance 51*(4), 1347–1377.

Forssbaeck, J. (2011). Ownership Structure, Market Discipline, and Banks' Risk-taking Incentives under Deposit Insurance. *Journal of Banking & Finance 35*(10). pp. 2666-2678.

Gropp, R., C. Gruendl, and A. Guettler (2013). The impact of public guarantees on bank risk-taking: Evidence from a natural experiment. *Review of Finance*. Forthcoming.

Gropp, R., H. Hakenes, and I. Schnabel (2011). Competition, Risk-shifting, and Public Bail-out Policies. *Review of Financial Studies 24*(6). pp. 2084-2120.

Hagendorff, J. and F. Vallascas (2011). CEO Pay Incentives and Risk-Taking: Evidence from Bank acquisitions. *Journal of Corporate Finance 17*(4), 1078 – 1095. Special Section: Managerial Compensation.

Hakenes, H. and I. Schnabel (2010). Banks without Parachutes: Competitive Effects of Government Bail-out Policies. *Journal of Financial Stability 6*(3). pp. 156-168.

Haldane, A. G. (2012). The Dog and the Frisbee. Speech given at the Federal Reserve Bank of Kansas City's 36th economic Policy symposium, "The Changing Policy Landscape", Jackson Hole, Wyoming (August).

Hellmann, T. F., K. C. Murdock, and J. E. Stiglitz (2000). Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough? *The American Economic Review 90*(1), pp. 147–165.

Hovakimian, A., E. J. Kane, and L. Laeven (2012, May). Variation in Systemic Risk at US Banks During 1974-2010. Working Paper 18043, National Bureau of Economic Research.

Ioannidou, V. P. and M. F. Penas (2010). Deposit insurance and bank risk-taking: Evidence from internal loan ratings. *Journal of Financial Intermediation 19*(1), 95 – 115.

Keeley, M. C. (1990). Deposit Insurance, Risk, and Market Power in Banking. *The American Economic Review 80*(5), pp. 1183–1200.

Laeven, L. and R. Levine (2009). Bank Governance, Regulation and Risk Taking. *Journal of Financial Economics 93*(2), 259 – 275.

Laeven, L. and F. Valencia (2012, June). Systemic Banking Crises Database: An Update. IMF Working Papers 12/163, International Monetary Fund.

Levine, R. (2011). Regulating finance and regulators to promote growth. In *Achieving Maximum Long-run Growth*, Volume 26 of *Proceedings of the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole*, pp. 271–311.

Martinez-Miera, D. and R. Repullo (2010). Does Competition Reduce the Risk of Bank Failure? *Review of Financial Studies 23*(10), 3638–3664.

Merton, R. C. (1977). An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees: An Application of Modern Option Pricing Theory. *Journal of Banking and Finance 1*(1), 3 – 11.

Moody's Investors Service (2007). *Bank Financial Strength Ratings: Global Methodology*. Moody's Investors Service, Global Credit Research. Report Number: 102151.

Moody's Investors Service (2012). Banking System Outlook: United States of America.

Nier, E. and U. Baumann (2006). Market Discipline, Disclosure and Moral Hazard in Banking. *Journal of Financial Intermediation 15*(3), 332–361.

O'Hara, M. and W. Shaw (1990). Deposit Insurance and Wealth Effects: The Value of Being "Too Big to Fail". *The Journal of Finance 45*(5), 1587–1600.

Ongena, S., A. Popov, and G. F. Udell (2013). when the cat's away the mice will play: Does regulation at home affect bank risk-taking abroad? *Journal of Financial Economics 108*(3), 727 – 750.

Reinhart, C. M. and K. S. Rogoff (2009). The Aftermath of Financial Crises. *The American Economic Review 99*(2), 466–472.

Rochet, J.-C. (2005). Prudential Policy. *Monetary and Economic Studies 23*(S1), 93–119.

Schich, S. and S. Lindh (2012). Implicit Guarantees for Bank Debt: Where Do We Stand? *OECD Journal: Financial Market Trends 2012*(1), 1–22.

Schnabel, I. and T. Krner (2012). Abolishing public guarantees in the absence of market discipline. Working Paper, University of Mainz.

Tarullo, D. K. (2013). Evaluating progress in regulatory reforms to promote financial stability. Speech at the Peterson Institute for International Economics, Washington, D.C.

Figure 1: Government Support, 1995–2011

The blue line represents median government support (by year) measured by the difference between a bank's BFSR and its long-term foreign currency deposit rating, as measured by Moody's. The red line (right scale) represents the median of the same measure converted to probabilities of default as in Gropp et al. (2011). The green line is the equivalent measure of probability of government support but using data from Fitch Ratings.

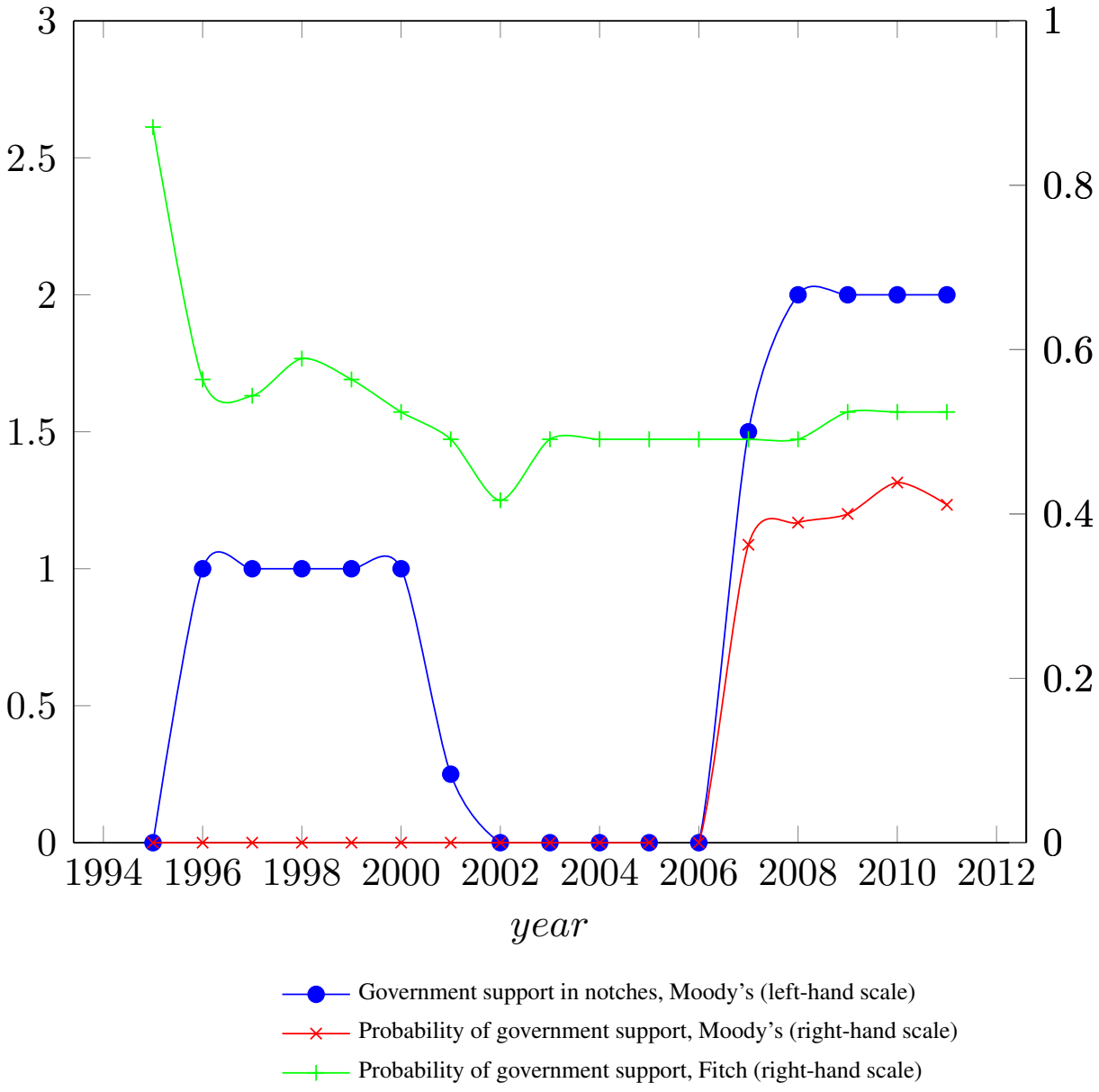

Table 1: Sample by Country and Period

This table shows the number of banks in our sample, by country and period. The sample is restricted to bank holding companies or banks who are heads of banking groups with BFSR and deposit ratings from Moody's available.

	2003–2004	**2009–2010**		**2003–2004**	**2009–2010**
Argentina	5	5	Kuwait	5	6
Australia	8	9	Malaysia	4	5
Austria	8	9	Morocco	1	1
Bahrain	5	6	Netherlands	7	7
Belgium	3	3	Norway	6	5
Brazil	1	6	Pakistan	3	3
Canada	6	6	Panama	1	1
Chile	3	2	Peru	2	2
China	7	7	Philippines	5	5
Colombia	4	2	Poland	9	9
Czech Republic	1	1	Portugal	2	2
Denmark	3	8	Qatar	2	2
Egypt	4	2	Russian Federation	2	6
Finland	1	1	Saudi Arabia	9	9
France	10	9	Singapore	2	2
Germany	24	21	Slovakia	1	2
Greece	7	8	Slovenia	1	2
Hong Kong	6	7	South Africa	1	1
Hungary	1	1	Spain	9	12
Iceland	2	3	Sweden	3	5
India	9	13	Switzerland	4	8
Indonesia	3	4	Taiwan	2	3
Ireland	6	5	Thailand	8	8
Israel	5	5	Turkey	8	10
Italy	20	18	United Arab Emirates	4	7
Japan	30	19	United Kingdom	14	12
Jordan	3	3	United States Of America	24	23
Korea Republic Of	5	6	Venezuela	1	0
			Total	330	347

Table 2: Summary Statistics

Sample statistics for main variables of interest. N refers to number of banks, countries, or bank-sector pairs in sample for bank, country, or country and sector-specific variables, respectively. z-Score is the ROA plus Capital-Asset ratio divided by the standard deviation of ROA. Revenue growth is the annual growth rate of gross revenues. Size is total assets in billions of U.S. dollars. Liquidity is ratio of liquid assets to liquid liabilities. Moody's support (in rating notches) is the difference in notches between Moody's foreign currency deposit rating and Moody's BFSR. Moody's support (in probability) is the conversion of Moody's support (in rating notches) into probabilities of support as in Gropp et al. (2011).

	2003–2004				2009–2010			
	N	Mean	Median	Std. dev.	N	Mean	Median	Std. dev.
Bank-specific variables								
z-Score	286	3.30	3.41	1.14	321	3.02	3.17	0.94
Return on Assets (in %)	313	0.99	0.81	1.03	332	0.66	0.56	2.44
Std. Dev. Return on Assets	288	0.68	0.27	1.67	323	1.06	0.38	6.94
Equity to Assets Ratio (in %)	313	7.53	6.48	5.94	332	8.29	7.43	15.88
z-Score (market-based)					257	-0.11	0.00	0.79
Average stock return					260	0.02	0.01	0.05
Stock return volatility					260	0.12	0.11	0.08
Loan Loss Provisions (in %)	311	0.48	0.32	0.56	324	0.81	0.52	0.97
Revenue growth	311	0.20	0.18	1.00	329	-0.07	0.11	4.70
Size (in $ billions)	313	128.6	32.5	240.6	332	225.0	49.3	456.0
Liquidity	314	18.02	11.23	20.05	332	32.96	20.09	65.23
Moody's support (in ratings notches)	331	1.03	0.00	2.60	348	1.66	2.00	2.64
Moody's support (in probability)	331	0.26	0.00	0.36	348	0.42	0.40	0.36
Fitch support (in probability)	137	0.54	0.62	0.39	205	0.55	0.61	0.37
Country-specific variables								
Per capita income	61	9.51	9.88	1.02	61	9.82	10.12	0.92
Inflation	62	4.79	3.24	6.19	62	1.31	1.95	7.33
Inflation volatility	62	3.74	1.82	4.5	62	3.52	1.73	4.2
Capital requirements	54	0.09	0.08	0.01	63	0.09	0.08	0.01
Investor protection index	63	5.74	5.62	1.5	63	5.74	5.62	1.5
Deposit insurance	63	0.78	1	0.42	63	0.84	1	0.37
Enforce	63	69.49	60	53.34	63	69.49	60	53.34
Cash flow rights	54	34	35.26	24.8	57	42.23	41.83	22.82
Government ownership	54	0.14	0.00	0.22	57	0.17	0.11	0.21
Institutional ownership	54	0.1	0.00	0.15	57	0.14	0.09	0.19
Individual ownership	54	0.05	0.00	0.13	57	0.06	0.00	0.17
Country and sector-specific variables								
Herfindahl index	177	0.36	0.27	0.29	177	0.38	0.36	0.27

Table 3: Correlations

Correlations among main variables of interest. z-Score is the ROA plus Capital-Asset ratio divided by the standard error of ROA (in logs). Revenue growth is the annual growth rate of gross revenues. Size is the logarithm of total assets. Liquidity is ratio of liquid assets to liquid liabilities. Moody's support (in rating notches) is the difference in notches between Moody's foreign currency deposit rating and Moody's BFSR. Moody's support (in probability) is the conversion of Moody's support (in rating notches) into probabilities of support as in Gropp et al. (2011).

	Size	Liquidity	Moody's support (notches)	Moody's support (probability)	Fitch support (probability)
Panel A: 2003–2004					
Size	1				
Liquidity	-0.034	1			
Moody's support (notches)	0.153***	-0.003	1		
Moody's support (probability)	0.030	0.007	0.843***	1	
Fitch support (probability)	0.289***	0.030	0.439***	0.270***	1
Panel B: 2009–2010					
Size	1				
Liquidity	-0.019	1			
Moody's support (notches)	0.306***	0.023	1		
Moody's support (probability)	0.413***	0.097*	0.714***	1	
Fitch support (probability)	0.184***	0.027	0.521***	0.371***	1

Robust standard errors in brackets: * p<0.10, ** p<0.05, *** p<0.01

Table 4: Bank Risk Taking and Government Support (Notches): z-Scores

Dependent variable for all cross-section regressions is the natural logarithm of each bank's individual z-Score. z-Score is ROA plus Capital-Asset ratio divided by the standard deviation of ROA. Revenue growth is the annual growth rate of gross revenues. Size is the logarithm of total assets. Liquidity is ratio of liquid assets to liquid liabilities. Government support is the difference in notches between Moody's foreign currency deposit rating and Moody's BFSR. Standard errors corrected for country-level clustering.

	2003–2004						
Variables	(1)	(2) Bank controls	(3) Instrumental variables	(4) Fixed effects	(5) Country controls	(6) Ownership controls	(7) Support in 2001
Government support	-0.048	-0.068	0.003	-0.133***	-0.127***	-0.123***	-0.101***
	[0.052]	[0.051]	[0.094]	[0.034]	[0.028]	[0.031]	[0.036]
Revenue growth	0.101	0.227	0.292	0.686**	0.806***	0.264	0.263
	[0.668]	[0.600]	[0.607]	[0.329]	[0.294]	[0.556]	[0.578]
Size		0.156**	0.127*	-0.008	0.029	0.033	0.035
		[0.064]	[0.069]	[0.053]	[0.044]	[0.076]	[0.084]
Liquidity		-0.011***	-0.011***	-0.017***	-0.008**	-0.008**	-0.008**
		[0.003]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]
Per capita income					0.691***	0.632***	0.658***
					[0.176]	[0.178]	[0.180]
Inflation					-0.002	0.003	0.004
					[0.021]	[0.034]	[0.036]
Inflation volatility					-0.131***	-0.139**	-0.144**
					[0.041]	[0.060]	[0.065]
Capital requirements					22.177**	15.804	13.367
					[8.745]	[11.320]	[11.695]
Investor protection index					-0.017	-0.013	0.020
					[0.079]	[0.090]	[0.091]
Deposit insurance					-0.427**	-0.395**	-0.410**
					[0.167]	[0.193]	[0.198]
Enforce					0.003**	0.004*	0.005**
					[0.001]	[0.002]	[0.002]
Herfindahl index					-0.379	-0.226	0.000
					[0.247]	[0.339]	[0.361]
Cash flow rights						-0.001	-0.002
						[0.003]	[0.003]
Government ownership						0.416	0.528
						[0.312]	[0.345]
Institutional ownership						0.152	0.323
						[0.247]	[0.265]
Individual ownership						0.442	0.446
						[0.408]	[0.382]
Observations	286	286	275	286	250	183	177
R-squared	0.01	0.1	0.06	0.58	0.38	0.34	0.34
Countries	54	54	44	54	49	44	44

Robust standard errors in brackets; * p<0.10, ** p<0.05, *** p<0.01

Table 4 (continued). Bank Risk Taking and government support (notches): z-Scores

	2009–2010						
Variables	(8)	(9) Bank controls	(10) Instrumental variables	(11) Fixed effects	(12) Country controls	(13) Ownership controls	(14) Support in 2007
Government support	-0.081***	-0.080***	-0.082**	-0.134***	-0.079***	-0.068**	-0.046*
	[0.030]	[0.028]	[0.038]	[0.037]	[0.028]	[0.027]	[0.027]
Revenue growth	0.017***	0.018***	0.018***	0.013***	0.018***	0.018***	0.018***
	[0.005]	[0.004]	[0.004]	[0.004]	[0.004]	[0.005]	[0.005]
Size		-0.002	-0.004	0.004	-0.011	-0.035	-0.049
		[0.043]	[0.044]	[0.044]	[0.043]	[0.049]	[0.048]
Liquidity		-0.002**	-0.002**	-0.001**	-0.001*	-0.001**	-0.001**
		[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]
Per capita income					-0.341***	-0.366***	-0.376***
					[0.112]	[0.126]	[0.121]
Inflation					-0.044*	-0.043**	-0.035*
					[0.023]	[0.021]	[0.020]
Inflation volatility					-0.071*	-0.066*	-0.054
					[0.041]	[0.037]	[0.035]
Capital requirements					-4.927	-6.712	-7.757
					[8.608]	[8.423]	[8.262]
Investor protection index					-0.002	-0.013	-0.008
					[0.052]	[0.050]	[0.051]
Deposit insurance					-0.183	-0.168	-0.095
					[0.212]	[0.209]	[0.200]
Enforce					0.000	-0.000	-0.000
					[0.002]	[0.002]	[0.002]
Herfindahl index					-0.115	-0.150	-0.135
					[0.248]	[0.274]	[0.284]
Cash flow rights						-0.005**	-0.005**
						[0.002]	[0.002]
Government ownership						0.052	0.044
						[0.169]	[0.169]
Institutional ownership						0.359**	0.335**
						[0.146]	[0.147]
Individual ownership						-0.266	-0.267
						[0.172]	[0.170]
Observations	321	320	310	320	317	305	302
R-squared	0.06	0.07	0.08	0.4	0.13	0.17	0.17
Countries	54	54	48	54	53	53	53

Robust standard errors in brackets: * p<0.10, ** p<0.05, *** p<0.01

Table 5: Bank Risk Taking and Government Support (Notches): z-Score Components

Dependent variable for each regression defined at top of each column. Revenue growth is the annual growth rate of gross revenues. Size is the logarithm of total assets. Liquidity is ratio of liquid assets to liquid liabilities. Government support is the difference in notches between Moody's foreign currency deposit rating and Moody's BFSR. Standard errors corrected for country-level clustering.

	(1)	(2)	(3)	(4)	(5)	(6)
		2003–2004			2009–2010	
Variables	ROA	Std. ROA	Equity /Assets	ROA	Std. ROA	Equity /Assets
Government support	-0.087***	0.050**	-0.075	-0.119**	-0.001	-0.495***
	[0.027]	[0.020]	[0.094]	[0.054]	[0.026]	[0.152]
Revenue growth	0.049	0.838	-3.334**	0.006**	-0.002	0.014
	[0.147]	[0.515]	[1.416]	[0.003]	[0.004]	[0.027]
Size	-0.173**	-0.027	-1.625***	-0.150*	-0.170***	-1.972***
	[0.076]	[0.036]	[0.524]	[0.083]	[0.045]	[0.516]
Liquidity	0.001	-0.001	-0.014	0.011**	0.009**	0.079***
	[0.004]	[0.003]	[0.014]	[0.004]	[0.003]	[0.015]
Per capita income	0.129	-0.578***	0.883*	-0.382**	0.154	0.047
	[0.143]	[0.163]	[0.510]	[0.160]	[0.101]	[0.640]
Inflation	0.04	-0.033	0.178	0.006	-0.002	-0.092
	[0.026]	[0.023]	[0.119]	[0.034]	[0.017]	[0.103]
Inflation volatility	-0.002	0.204***	0.114	0.066	0.029	0.113
	[0.065]	[0.048]	[0.211]	[0.056]	[0.033]	[0.232]
Capital requirements	-3.916	-7.469	79.866**	-18.600*	3.39	-29.972
	[14.395]	[10.929]	[38.889]	[9.722]	[6.480]	[34.843]
Investor protection index	0.041	-0.065	0.083	-0.013	0.104*	0.467
	[0.060]	[0.050]	[0.196]	[0.127]	[0.055]	[0.412]
Deposit insurance	-0.638*	0.299	-0.794	-0.577	0.07	-1.364
	[0.318]	[0.211]	[1.040]	[0.345]	[0.226]	[1.447]
Enforce	0.002	-0.003*	-0.002	-0.002	-0.001	-0.01
	[0.002]	[0.002]	[0.007]	[0.002]	[0.001]	[0.009]
Herfindahl index	0.42	0.261	1.799	0.138	-0.028	0.878
	[0.404]	[0.338]	[1.610]	[0.347]	[0.280]	[2.148]
Cash flow rights	-0.002	-0.001	-0.025**	-0.004	0.003	-0.01
	[0.002]	[0.002]	[0.010]	[0.003]	[0.002]	[0.011]
Government ownership	0.288	-0.129	1.818	-0.014	0.402	1.336
	[0.230]	[0.181]	[1.226]	[0.460]	[0.269]	[1.376]
Institutional ownership	-0.006	-0.159	2.229*	0.218	-0.035	1.659
	[0.176]	[0.156]	[1.280]	[0.177]	[0.100]	[1.459]
Individual ownership	0.739*	-0.307	1.776	0.677**	0.711**	4.105*
	[0.418]	[0.328]	[1.365]	[0.279]	[0.308]	[2.357]
Observations	198	183	198	312	306	312
R-squared	0.43	0.55	0.65	0.32	0.41	0.61
Countries	45	44	45	53	53	53

Robust standard errors in brackets: * p<0.10, ** p<0.05, *** p<0.01

Table 6: Bank Risk Taking and Government Support: Panel Regressions and Market-Based Z-Scores

This table presents panel regressions of bank risk taking on government support and a set of controls, as well as bank-level fixed effects. Dependent variable for all panel regressions is the natural logarithm of each bank's individual market-based z-Score. The market-based z-Score is market ROE plus Capital to Market Value of Equity ratio divided by the standard deviation of market ROE. Government support is measured as probability of bailout (Gropp et al., 2011) using data from Moody's. Odd-numbered columns use government support lagged by one period while even-numbered columns use government support lagged by two years. LLP stands for Loan Loss Provisions. A lower z-score implies higher risk taking while the opposite is true for Stock Return Volatitility and LLP. Standard errors corrected for bank-level clustering.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Market z-score		Stock return volatility		LLP over avg. assets	
Government support	-0.087***	-0.097***	0.010***	0.008***	0.059***	0.024
	[0.027]	[0.031]	[0.003]	[0.003]	[0.020]	[0.017]
Revenue growth	0.057*	0.070**	-0.003	-0.004*	-0.001	-0.002
	[0.034]	[0.033]	[0.002]	[0.002]	[0.001]	[0.001]
Size	-0.372**	-0.222	0.000	-0.007	0.150	0.088
	[0.150]	[0.217]	[0.021]	[0.029]	[0.094]	[0.124]
Liquidity	0.001*	0.001	-0.000	0.000	-0.003**	-0.005**
	[0.001]	[0.001]	[0.000]	[0.000]	[0.002]	[0.002]
Per capita income	-1.406***	-1.100*	0.056	0.088	0.559*	0.482
	[0.445]	[0.590]	[0.054]	[0.059]	[0.335]	[0.475]
Inflation	0.004	0.006	-0.002***	-0.002***	-0.017***	-0.017***
	[0.005]	[0.006]	[0.000]	[0.000]	[0.004]	[0.004]
Inflation volatility	0.045**	0.064***	-0.005**	-0.006***	0.019**	0.029***
	[0.019]	[0.020]	[0.002]	[0.002]	[0.009]	[0.010]
Herfindahl index	0.108	0.336	-0.009	0.003	-0.403***	-0.396***
	[0.302]	[0.315]	[0.028]	[0.017]	[0.142]	[0.152]
Cash flow rights	-0.000	-0.003	0.000	0.001***	0.005	0.005
	[0.003]	[0.003]	[0.000]	[0.000]	[0.005]	[0.006]
Observations	1,169	1,006	1,283	1,117	1,684	1,436
R-squared	0.07	0.05	0.02	0.03	0.09	0.07
Number of banks	280	276	281	278	358	343
Government support (t)	1 year lag	2 year lag	1 year lag	2 year lag	1 year lag	2 year lag

Table 7: Bank Risk Taking and Probability of Government Support Measured by Moody's

Dependent variable for all cross-section regressions is the natural logarithm of each bank's individual z-Score. The z-Score is ROA plus Capital-Asset ratio divided by the standard deviation of ROA. Government support is measured as probability of bailout (Gropp et al., 2011) using data from Moody's. Standard errors corrected for country-level clustering.

	2003–2004				2009–2010			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables		Bank controls	Fixed effects	Country controls		Bank controls	Fixed effects	Country controls
Government support	-0.468*	-0.499**	-0.522**	-0.494***	-0.448***	-0.434***	-0.474**	-0.314**
	[0.245]	[0.214]	[0.222]	[0.182]	[0.160]	[0.154]	[0.192]	[0.147]
Revenue growth	0.127	0.252	0.620*	0.796**	0.019***	0.019***	0.012**	0.019***
	[0.678]	[0.610]	[0.343]	[0.314]	[0.005]	[0.005]	[0.005]	[0.004]
Size		0.144**	-0.01	0.031		0.004	0.039	0.006
		[0.065]	[0.058]	[0.047]		[0.045]	[0.049]	[0.042]
Liquidity		-0.011***	-0.018***	-0.009**		-0.002**	-0.001*	-0.001
		[0.003]	[0.003]	[0.003]		[0.001]	[0.000]	[0.001]
Per capita income				0.608***				-0.353***
				[0.176]				[0.105]
Inflation				0.02				-0.023
				[0.019]				[0.020]
Inflation volatility				-0.133***				-0.035
				[0.041]				[0.038]
Capital requirements				19.277**				-4.757
				[9.304]				[8.684]
Investor protection				-0.006				0.003
				[0.080]				[0.056]
Deposit insurance				-0.518***				0.025
				[0.182]				[0.188]
Enforce				0.003*				0.0000
				[0.001]				[0.002]
Herfindahl index				-0.345				-0.107
				[0.253]				[0.249]
Observations	286	286	286	250	321	320	320	317
R-squared	0.02	0.1	0.56	0.35	0.04	0.05	0.39	0.11
Countries	54	54	54	49	54	54	54	53

Robust standard errors in brackets: * p<0.10, ** p<0.05, *** p<0.01

Table 8: Bank Risk Taking and Probability of Government Support Measured by Fitch Ratings

Dependent variable for all cross-section regressions is the natural logarithm of each bank's individual z-Score. The z-Score is ROA plus Capital-Asset ratio divided by the standard deviation of ROA. Government support is measured as probability of bailout (Gropp et al., 2011) using data from Fitch Ratings. Standard errors corrected for country-level clustering.

	2003–2004				2009–2010			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables		Bank controls	Fixed effects	Country controls		Bank controls	Fixed effects	Country controls
Government support	-0.213	-0.372*	-0.260	-0.092	-0.274	-0.234	-0.458***	-0.277*
	[0.240]	[0.198]	[0.172]	[0.195]	[0.199]	[0.174]	[0.159]	[0.165]
Revenue growth	-0.056	0.076	0.992	1.110*	0.024***	0.024***	0.010**	0.023***
	[0.765]	[0.714]	[0.710]	[0.568]	[0.004]	[0.004]	[0.004]	[0.005]
Size		0.107	0.014	0.138**		-0.011	0.075	-0.013
		[0.073]	[0.105]	[0.058]		[0.041]	[0.054]	[0.038]
Liquidity		-0.006**	-0.005**	-0.015***		-0.004	-0.001	-0.003
		[0.002]	[0.002]	[0.004]		[0.004]	[0.001]	[0.003]
Per capita income				0.639***				-0.375***
				[0.170]				[0.128]
Inflation				0.017				-0.030
				[0.019]				[0.034]
Inflation volatility				-0.082***				-0.061
				[0.024]				[0.061]
Capital requirements				26.458***				6.139
				[8.456]				[8.006]
Investor protection index				0.002				-0.011
				[0.103]				[0.081]
Deposit insurance				-0.363**				-0.084
				[0.176]				[0.203]
Enforce				0.004*				0.000
				[0.002]				[0.002]
Herfindahl index				0.446				0.147
				[0.390]				[0.418]
Observations	175	175	175	127	269	268	268	261
R-squared	0.01	0.06	0.57	0.38	0.03	0.05	0.44	0.11
Countries	43	43	43	39	50	50	50	49

Robust standard errors in brackets: * p<0.10, ** p<0.05, *** p<0.01

Table 9: Bank Risk, Valuation, and Government Support

z-Score is ROA plus Capital-Asset ratio divided by the standard deviation of ROA. Tobin's Q is total assets plus market value of equity minus book value of equity divided by total assets. Government support is the difference in notches between Moody's foreign currency deposit rating and Moody's BFSR. Widely takes value one if there is no single shareholder with at least 25% of the voting shares and zero otherwise. Number of banks is the number of banks in the country divided by the country's GDP in U.S. dollars. Standard errors corrected for country-level clustering.

	Second stage		First stage	
Dependent variable	z-Score		Tobin's Q	
Tobin's Q	-1.078			
	[3.258]			
Government support	-0.062	*	-0.006	*
	[0.036]		[0.003]	
Revenue growth	-0.006		0.002	
	[0.098]		[0.004]	
Size	0.015		0.005	
	[0.047]		[0.005]	
Liquidity	-0.001		0.000	*
	[0.001]		[0.000]	
Per capita income	-0.327	*	-0.011	
	[0.140]		[0.010]	
Inflation	-0.025		0.001	
	[0.018]		[0.002]	
Inflation volatility	-0.041		0.011	*
	[0.050]		[0.003]	
Capital requirements	-5.605		0.014	
	[8.992]		[0.921]	
Investor protection index	0.029		0.006	*
	[0.060]		[0.003]	
Deposit insurance	-0.073		0.017	
	[0.196]		[0.022]	
Enforce	0.001		0.000	
	[0.002]		[0.000]	
Herfindahl index	-0.162		0.084	*
	[0.332]		[0.050]	
Widely			-0.019	
			[0.013]	
Number of Banks			-0.047	*
			[0.016]	
Observations	244		244	
Hansen's J statistic for over-identification			1.364	
Angrist-Pischke multivariate F test of excluded instruments			3.84	**

Robust standard errors in brackets": * p<0.10, ** p<0.05, *** p<0.01

Table 10: Government Interventions in Banks in 2008–2010 in Europe, by Country

This table shows the number of intervened and not intervened banks for which there is ratings data available. $Y_i = 1$ if bank *i* was intervened and 0 otherwise. Data is from Brei et al. (2011), Laeven and Valencia (2012), and FT.com.

Country	Not intervened	Intervened	Total
Austria	3	4	7
Belgium	1	2	3
Denmark	3	3	6
Finland	1	0	1
France	5	4	9
Germany	19	3	22
Greece	1	6	7
Iceland	0	3	3
Ireland	1	4	5
Italy	15	6	21
Netherlands	5	2	7
Norway	6	0	6
Portugal	2	0	2
Spain	9	2	11
Sweden	4	1	5
Switzerland	7	1	8
United Kingdom	11	3	14
Total	93	44	137

Table 11: Government Support and Intervention in Banks

This table shows the results of a probit regression where the limited dependent variable is $Y_i = 1$ if bank *i* was intervened and 0 otherwise. Data on interventions is from Brei et al. (2011), Laeven and Valencia (2012), and FT.com. Size is the logarithm of total assets. Liquidity is ratio of liquid assets to liquid liabilities. Output growth is the average GDP growth in 2007–2009. Loan loss provisions is expressed as percentage of total average assets. Government support is 1 if the difference in notches between Moody's foreign currency deposit rating and Moody's BFSR is positive and zero otherwise. Standard errors corrected for country-level clustering.

Variables	Intervention	
Size	0.327***	[0.112]
Liquidity	-0.000	[0.005]
Equity to assets	1.630	[4.933]
Output growth	-0.141	[0.175]
Government support in 2007	22.694*	[13.423]
Loan loss provisions	3,865.50	[2,351.445]
Support in 2007 X Loan loss provisions	-3,798.37	[2,370.847]
Observations	123	
Countries	17	
Marginal effect of government support	0.273***	[0.0735]
Robust standard errors in brackets: *** p<0.01, ** p<0.05, * p<0.1		

Table 12: Bank Risk Taking, Government Support, Bank Supervision and Regulation

Cross-section regressions with bank-specific, control-specific controls, and variables for country-level banking regulation and supervision (from Barth et al., 2006, 2008). Government support is measured as probability of bailout (Gropp et al., 2011). z-Score is the ROA plus Capital-Asset ratio divided by the standard deviation of ROA. Standard errors corrected for country-level clustering.

	2003–2004				2009–2010			
Variables	(1) Capital stringency	(2) Official supervisory powers	(3) Activity restrictions	(4) All	(5) Capital stringency	(6) Official supervisory powers	(7) Activity restrictions	(8) All
Government support	0.031	-0.338	-0.118	-0.093	-0.017	-0.373*	-0.432***	-0.481**
	[0.083]	[0.301]	[0.215]	[0.413]	[0.103]	[0.186]	[0.082]	[0.183]
Capital stringency	-0.020			-0.016	-0.000			0.022
	[0.087]			[0.088]	[0.041]			[0.050]
Support x Capital stringency	-0.039			-0.038	-0.013			-0.002
	[0.024]			[0.023]	[0.027]			[0.020]
Official supervisory power		0.026		0.043		-0.026		-0.013
		[0.069]		[0.072]		[0.041]		[0.045]
Support x Official supervisory power		0.020		0.015		0.029*		0.006
		[0.024]		[0.025]		[0.016]		[0.014]
Activity restrictions			-0.057	-0.061			0.034	0.037
			[0.074]	[0.084]			[0.023]	[0.028]
Support x Activity restrictions			0.002	-0.004			0.035***	0.033***
			[0.023]	[0.022]			[0.007]	[0.009]
Observations	148	148	148	148	246	246	246	246
R-squared	0.43	0.43	0.42	0.45	0.15	0.17	0.25	0.26
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	41	41	41	41	48	48	48	48

Robust standard errors in brackets: * p<0.10, ** p<0.05, *** p<0.01