International evidence on government support and risk-taking in the banking sector.*

Luis Brandao-Marques, Ricardo Correa and Horacio Sapriza†

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Abstract

Government support to banks through the provision of explicit or implicit guarantees can affect the willingness of banks to take on risk by reducing market discipline or by increasing charter value. We use an international sample of bank data and government support to banks for the periods 2003-2004 and 2009-2010. We find that more government support is associated with more risk-taking by banks, especially during the financial crisis (2009-10), even after controlling for several bank-specific and country-level factors. We use several measures of government support and bank risk-taking, and the results are robust to various possible misspecification issues. We also find that restricting banks' range of activities ameliorates the moral hazard problem. We conclude that policy measures to counteract this moral hazard problem should be geared towards strengthening market discipline in the banking sector.

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†Brandao-Marques is from the International Monetary Fund and Correa and Sapriza are from the Board of Governors of the Federal Reserve System. The views expressed herein are those of the authors and should not attributed to the International Monetary Fund, its Executive Board, or its management or interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System.

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. This in turn 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?[1] We have two main findings.

First, after controlling for a number of factors, including bank size and liquidity, the level of bank regulations, banks'ownership structure, the degree of market concentration in the bank sector, and country-specific macroeconomic conditions, 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. This result is also robust to

[1]Ratings-based measures of support have been used to assess the implicit benefit of government support on bank debt (Schich and Lindh, 2012), equity returns (Correa et al., 2012), and bank competition (Gropp et al., 2011).

several other checks, including the possible endogeneity of government support. Thus, in our sample, market discipline is the dominant factor in 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 they were allowed to perform were less likely to take on more risk.

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 (Demirgurc-Kunt and Detragiache, 2002, and Gropp and Vesala, 2004) 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, Forssbæck (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, finds no support to the proposition that the market discipline channel becomes more important during crises. Dam and Koetter (2012) also find support for the market discipline channel for the 1995-2006 period but their study is restricted to German banks and they derive a measure of probability of support from actual bailouts. In related work, other authors have found a positive effect of actual government support on bank risk-taking (see Black and Hazelwood, 2012, for the effect of TARP on U.S. banks and Duchin and Sosyura (2011) for a broader sample of U.S.publicly traded financial firms). We instead focus on *expected*, not actually received, government support and use a sample of banks from many countries.

Unlike the previously mentioned studies and using a large cross-section of banks across

many countries, Gropp et al. (2011) find that a measure of expected government support to a given bank induces more risk-taking by the bank's competitors.[2] They do not find however a consistent relationship between support and risk-taking by protected banks. In fact, their study suggests that protected banks take on less risk, which is consistent with the charter value channel being dominant. Our conclusions on the moral hazard effects of government support to banks are opposite to those of Gropp et al. (2011). The different findings can be explained by our use of a different measure of risk[3] and of additional bank and country-specific controls. 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 in turn are associated with sharp recessions, large drops in asset prices, protracted recoveries and big increases in government debt (Reinhart and Rogoff, 2009). In addition, banks subject to lower default frequency 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.[4] 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 impacts on bank's risk taking is by increasing the charter value of guaranteed banks then it makes sense to apply a capital surcharge

[2]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).

[3]While we use the z-Score (return on assets plus capital to asset ratio, normalized by the standard deviation of return on assets; see 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).

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

on protected banks to decrease their rents and their (unprotected) competitors' incentives to take on more risk (Gropp et al., 2011).[5] If however, as we find, the dominating channel is the "market-discipline" one, 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 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 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. We then discuss our hypothesis and methods after which, in Section 4, we present our results. Section 5 concludes.

2 Data

2.1 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.

[5]This would also reduce gambling incentives by putting more bank equity at risk. 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.

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 Services (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.

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) for 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 methods, and focus on cross-sections of results.[6] The accounting data on banks are from Bankscope, a commercial database on major international 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

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

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.

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 for the degree to which contracts are effectively enforced in a country (data from the World Bank's "Doing Business"' Project).

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 (Keeley, 1990, and Hellmann et al., 2000, and Repullo, 2004). 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 by 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 authority 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

A final issue to settle is which measures of government support - Moody's or Fitch's - should one use for the baseline regressions. In Table 3 we can see that Moody's and Fitch's probability-based measures of support were mildly correlated before the crisis and become 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.[7] 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. Therefore, we use Moody's measure in our baseline empirical specifications.

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,

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

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 $\beta_1, \beta_2,$ and β_3 are vectors of coefficient estimates. 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 interaction between national regulations and government support, and the interaction

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

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:

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

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 sup-

port 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.

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).[8] 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 (measured by the World Bank[9]), the presence of deposit insurance, the degree to which the law is effectively and fairly enforced in a country, and the Herfindahl concentration index for the banking system. The

[8]One possible 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.

[9]Using Djankov et al.'s (2008) revised anti-directors index or their anti-self-dealing index does not change the flavor of results, which are available from the authors if requested.

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 the former reflects the fact that the 2007-2009 crisis was mostly an advanced economy one.[10]

We also considered instrumental variables and additional controls in the regressions to address any possible endogeneity and omitted variables concerns (i.e. to preclude the possibility that $cov(Z_{b,c}, \varepsilon_{b,c}) \neq 0$). We use instrumental variables for each bank's government support. 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. 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), at least for privately held banks (Barry et al., 2011). 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.

[10]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.

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 decided to regress the z-Score averages on 2001 and 2007 support (using a longer lag would restrict severely our sample size). The results are on columns 7 and 14 and 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 or considering bank valuation. 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.[11]

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 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, while that is still a possible interpretation, the risk taken by banks translated into more leverage and lower capital buffers to withstand

[11] 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.

shocks.

Interestingly, opposite 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.

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 6. 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[12] led to an 8 percent increase in risk (relative to the mean). 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 Forssbæck, 2011). We run the same regressions as in Table 6 and present the results in Table 7. 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.[13] When we look at the crisis period however (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.

Up to this moment, we have only implicitly considered the alternative hypothesis of bank

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

[13]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).

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.[14] 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), and Boyd et al. (2006).[15]

The final 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 from Worldscope) 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.[16] We are only able to do it for the second period due to data availability. The results in Table 8 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.

[14]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).

[15]Their argument goes like this: 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.

[16]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.

4.3 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). This data considers 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).

Table 9 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, in the crisis period *government support* is associated with more risk taking by banks. The interaction coefficient for *activity restrictions* and *government support* is positive and significant during the period of the recent crisis, 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 evidences that activity restrictions have not fully offset the moral hazard effect from government support.

The announcement in May 2012 by J.P. Morgan that it had taken between two and three billion U.S. dollars in first and second quarter trading losses due to large bets on derivatives gone wrong, highlights the timeliness and relevance are our regulatory findings, especially when considering that the bank emerged from the financial crisis in better shape than most of its peers. The Wall Street Journal commented on May 10, 2012 on some of the implications of the announcement by J.P. Morgan.

> The news comes as large banks are fighting efforts by regulators to rein in risky

trading. J.P. Morgan Chief Executive Jamie Dimon on Thursday said "egregious and self-inflicted mistakes" were made with trades that were "poorly executed and poorly monitored." The revelations will likely provide more ammunition for proponents of the Volcker rule, to limit bank proprietary trading. Fairly or not, every big bank will be faced with questions regarding their trading practices. Mr. Dimon maintained on the call the specific trading at issue wouldn't be covered by the Volcker rule. J.P. Morgan's announcement is "just the latest evidence that what banks call 'hedges' are often risky bets that so-called 'too big to fail' banks have no business making," Senator Carl Levin (D., Mich.) said in a statement. "Today's announcement is a stark reminder of the need for regulators to establish tough, effective standards... to protect taxpayers from having to cover such high-risk bets."

5 Conclusion

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

Our results suggest that measures to increase the incentives by depositors 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 could ultimately lead to limits on the amount of support that governments can pledge. 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.[17] 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.[18] 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 outside 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 (Fahlenbrach and Stulz, 2011), 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.

[17]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).

[18]See Mehran et al. (2011) for a survey on the corporate governance of banks.

References

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

Barry, T. A., L. Lepetit, and A. Tarazi (2011). Ownership structure and risk in publicly held and privately owned banks. *Journal of Banking & Finance 35*(5), 1327 – 1340.

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

Barth, J. R., J. Caprio, Gerard, and R. Levine (2008). Bank regulations are changing: For better or worse. *Comparative Economic Studies 50*(4), 537–563.

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., G. D. Nicoló, and A. M. Jalal (2006). Bank risk-taking and competition revisited: New theory and new evidence. IMF Working Papers 06/297, International Monetary Fund.

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.

Correa, R., K.-H. Lee, H. Sapriza, and G. Suarez (2012). Sovereign credit risk, banks' government support, and bank stock returns around the world. Mimeo (March).

Dam, L. and M. Koetter (2012). Bank bailouts and moral hazard: Evidence from germany. *Review of Financial Studies 25*(8), 2343–2380.

De Nicoló, G. and E. Loukoianova (2007). Bank ownership, market structure and risk. IMF Working Papers 07/215, International Monetary Fund.

Demirguc-Kunt, A., E. J. Kane, and L. Laeven (2008). Determinants of deposit-insurance adoption and design. *Journal of Financial Intermediation 17*(3), 407 – 438.

Demirgurc-Kunt, A. and E. Detragiache (2002). Does deposit insurance increase banking system stability? an empirical investigation. *Journal of Monetary Economics 49*(7), 1373 – 1406.

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.

Duchin, R. and D. Sosyura (2011). Safer ratios, riskier portfolios: Banks response to government aid. *Ross School of Business Paper* (1165).

Fahlenbrach, R. and R. M. Stulz (2011). Bank ceo incentives and the credit crisis. *Journal of Financial Economics 99*(1), 11 – 26.

Flannery, M. J. and S. M. Sorescu (1996). Evidence of bank market discipline in subordinated debenture yields: 1983- 1991. *The Journal of Finance 51*(4), pp. 1347–1377.

Forssbæck, J. (2011). Ownership structure, market discipline, and banks risk-taking incentives under deposit insurance. *Journal of Banking & Finance 35*(10), 2666 – 2678.

Gropp, R., H. Hakenes, and I. Schnabel (2011). Competition, risk-shifting, and public bail-out policies. *Review of Financial Studies 24*(6), 2084–2120.

Gropp, R. and J. Vesala (2004). Deposit insurance, moral hazard and market monitoring. *Review of Finance 8*(4), 571–602.

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), 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.

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.

Martinez-Miera, D. and R. Repullo (2010). Does competition reduce the risk of bank failure? *Review of Financial Studies 23*(10), 3638–3664.

Mehran, H., A. Morrison, and J. D. Shapiro (2011). Corporate Governance and Banks: What Have We Learned from the Financial Crisis? Staff Report 502, Federal Reserve Bank of New York.

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 & 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.

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), pp. 1587–1600.

Reinhart, C. M. and K. S. Rogoff (2009). The aftermath of financial crises. *The American Economic Review 99*(2), 466–472.

Repullo, R. (2004). Capital requirements, market power, and risk-taking in banking. *Journal of Financial Intermediation 13*(2), 156 – 182. Special Issue: Bank Capital Adequacy Regulation under the New Basel Accord.

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.

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.

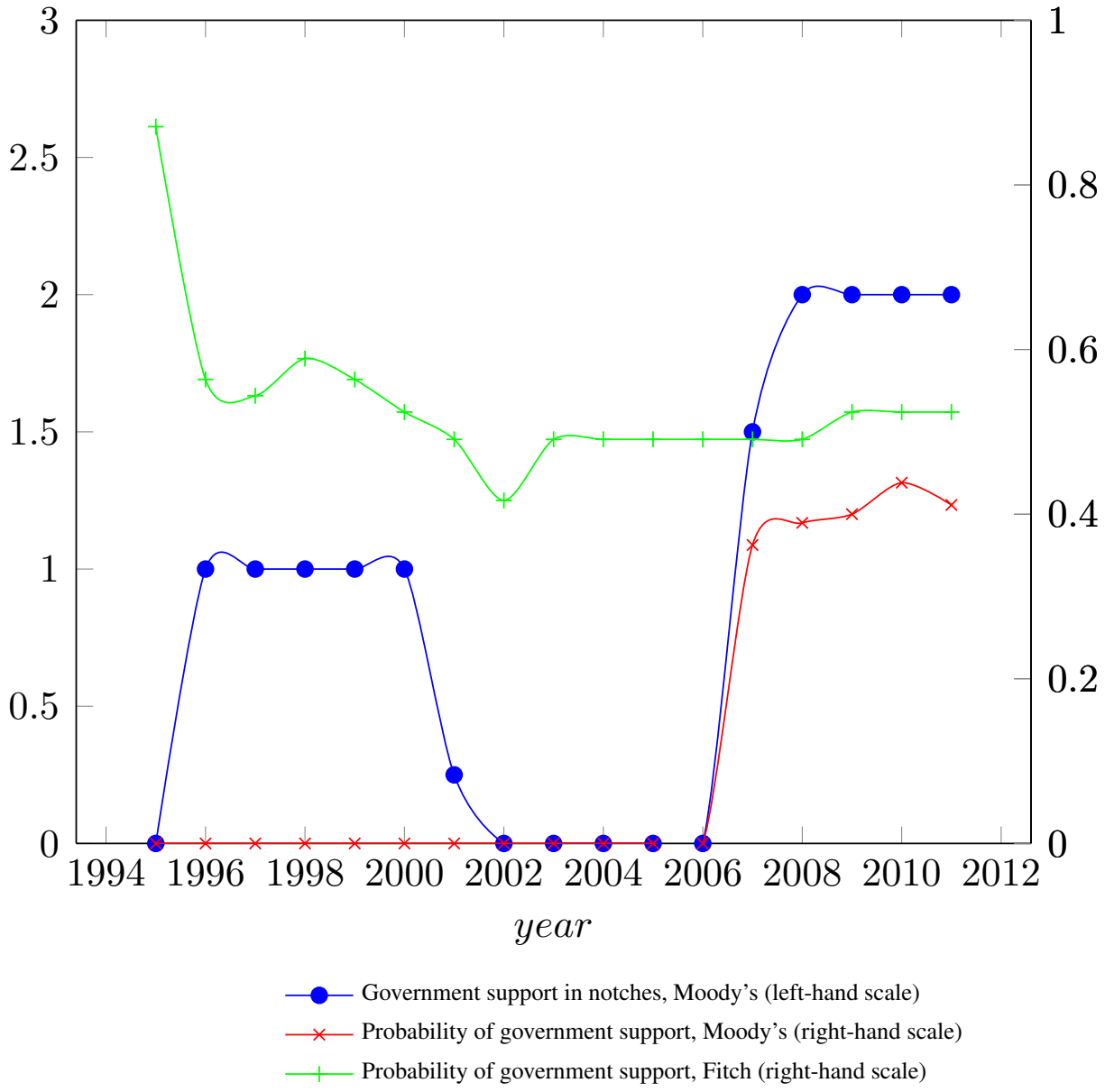

Table 1: Sample by Country and Period

	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	
			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
Revenue growth	311	0.20	0.18	1.00	329	-0.07	0.11	4.70
Size (in $ billions)	313	128.61	32.49	240.61	332	225.02	49.29	456.03
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						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables		Bank controls	Instrumental variables	Fixed effects	Country controls	Ownership controls	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 probability 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 7: Bank risk-taking and probability 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			
Variables	(1)	(2) Bank controls	(3) Fixed effects	(4) Country controls	(5)	(6) Bank controls	(7) Fixed effects	(8) Country controls
Government support	0.095	-0.304*	-0.134	-0.105	-0.026	-0.416***	-0.425***	-0.432***
	[0.127]	[0.169]	[0.169]	[0.156]	[0.091]	[0.126]	[0.075]	[0.145]
Capital stringency	0.121*			0.023	0.065			0.076
	[0.070]			[0.069]	[0.055]			[0.060]
Support x Capital stringency	-0.047			-0.011	-0.016			-0.018
	[0.031]			[0.027]	[0.023]			[0.018]
Official supervisory power		0.014		0.04		0.008		0.005
		[0.044]		[0.031]		[0.041]		[0.041]
Support x Official supervisory power		0.021		0.005		0.032***		0.014
		[0.016]		[0.012]		[0.011]		[0.012]
Activity restrictions			-0.096	-0.079			0.063**	0.073**
			[0.062]	[0.048]			[0.026]	[0.031]
Support x Activity restrictions			0.01	-0.002			0.034***	0.026***
			[0.018]	[0.018]			[0.008]	[0.010]
Observations	250	250	250	250	266	266	266	266
R-squared	0.3	0.29	0.3	0.4	0.15	0.18	0.23	0.25
Countries	43	43	43	39	50	50	50	49

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

Table 8: 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 9: 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