

THE IMPACT OF M&AS ON BANK RISK IN SPAIN (1986-2007)

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Our article presents the short term changes in bank risk profiles before and after domestic banks M&As that took place before the present crisis (1986-2007) based on different *ex-ante* and *ex-post* measures of risk. Our results control for potential selection bias and show that, for acquiring banks, size and capitalization are important drivers of risk changes before and after M&As. For target banks, we find that target banks that received financial support from the government in the context of M&As showed a statistically significant increase in risk-taking immediately before but not after a deal compared to all other banks. Overall, our results indicate that bank size, leverage and government support have not caused banks to engage in additional risk-taking via M&As. However, changes to banks' funding and income mix are linked to higher risk-taking. Our results therefore emphasize the need for increased supervisory scrutiny of the sources of bank funding and income of merging banks.

1 Introduction

Our study focuses on the bank consolidation process that has taken place in Spain since the late 1980's and gathered speed at the onset of the euro. We focus on the period before the present financial crisis because due to its systemic character, some merging institutions in Spain (as in other EU countries) have received generous government support. Such support may distort financial ratios and precludes a better understanding of the risk implications of M&As under 'normal' circumstances. In light of that experience, our study aims to respond to a number of questions such as: What are the determinants of banks being targets or acquirers in M&As? Are the factors determining bank risk-taking different for banks that engage in M&As versus those that do not engage in M&As? Do risk factors change before and after the deal? Do pre-merger bank financials have any significant impact on changes in the risk profile caused by M&As? These are questions that, to the best of our knowledge, have not been thoroughly examined from the perspective of domestic banks in previous bank M&As studies.

Our study focuses on the short term (three years or shorter) in order to insulate the impact of the M&As on our study variables. The study uses information from the regulatory database of Banco de España covering a total of 209 banks and 47 deals over a 25-year period.

The decision to engage in M&As is a choice variable that may be driven by risk considerations. A frequently hypothesized relationship involving M&As and bank risk-taking is that banks may use a deal to increase their risk and to extract benefits from the financial safety net. Empirical support for this hypothesis has been offered by various studies [Penas and Unal (2004); Schmid and Walter (2009); Brewer and Jagtiani (2007); Carbó *et al.* (2012)]. However, in many cases, banks' involvement in M&As is a choice. Some of the motives behind a bank's decision to act as an acquirer may be linked to variables which also affect the risk implications of a deal. For instance, if banks with a large portfolio of bad loans and low levels of performance are more likely to engage in M&As (say, in an effort to diversify their loan portfolio and boost performance), it would not be surprising to find that M&As, by affecting loan quality and performance, also alter a bank's risk profile. However, the reasons for changes in a bank's risk profile may then be linked to and driven by motivations for why banks chose to engage in M&As, rather than by M&As. To address this selection problem, we employ a Heckman selection model which first estimates the probability that a bank engages in M&As (as an acquirer or as a target) and then documents changes in the risk profile of a bank after having corrected for potential

selection bias. Consequently, this approach allows us to separate the effects of various bank-specific factors on bank risk (before and after M&As) from a bank's decision to engage in M&As.

Our results suggest that determinants of a bank being a target or an acquirer in Spain are similar to those found in studies on EU banks involved in M&As. Also, we show that M&As impact the risk profiles of both target and acquiring banks. In the first case, M&As seem to increase the overall risk except for the large acquirers. In the case of targets, the statistical significance is sparser but also points in the same direction.

Our study contributes to the literature in various ways. We examine the changes in bank risk-taking following M&As in Spain based on different *ex-ante* and *ex-post* measures of risk. We use detailed bank-level information to analyze both acquirer and target perspectives. We insulate the economic impact of M&As on bank risk by controlling for a large number of determinants of M&As, including bank performance, institutional and environmental factors, including the possibility that target banks in crisis would receive government financial support in order to deal with potential selection and endogeneity biases.

This article is divided in four parts in addition to this introduction. The second part presents the data and briefly describes the empirical approach. Section three shows the results of the multivariate analysis. Section four summarizes and concludes.

2 Data and brief description of the empirical approach

2.1 SAMPLE SELECTION

Our study encompasses all banks and savings banks in Spain over the 1988-2010 period. Table 1 shows the total number of banks per year as well as the M&As that have taken place over that study period, as well as the number of bidders and targets per year. The period around the launching of the Euro (1998) was the most active for M&As (16 deals took place within two years of the inception of the Euro) in parallel with similar developments in other EU countries, where authorities seemed to have fostered national champions [Hernando *et al.* (2009)]. We have excluded deals after 2008, which is the year of the beginning of the banking crisis in Spain when many mergers came hand in hand with generous government financial support in the context of the systemic character of the crisis. Over our study period, we observe 47 domestic deals in which an acquirer bank takes control of a target bank.¹ For our study, an exchange of control takes place when the target bank becomes part of the consolidated banking group of the acquirer as shown in the call reports filed with the Bank of Spain. In our study, the Spanish deals involve 29 banks and 18 savings banks. The sample banks exclude subsidiaries of foreign banks.

Financial ratios are calculated from non-consolidated quarterly call reports. We analyze changes in the risk profile of acquirer and target banks one year before and three years after the deal and compare with the rest of banks. $T = 0$ corresponds to the date of the completion of the deal as recorded by the Bank of Spain. Time windows around each deal could be shorter if either acquirer or target engages in other deal, which is recorded separately.²

Our empirical goals involve the selection of a number of variables showing changes in bank risk as well as a set of covariates explaining those changes. The risk variables include the so-called z-score, the volatility of ROA and changes in non-performing loans. The definitions of the variables are presented in Table 2.

¹ We have not considered simultaneous mergers between more than two institutions.

² For empirical purposes, we have also tried different time windows, in particular port-merger, with similar results. Hagendorff and Nieto (2011) also use this time window given the time that mergers need for completion.

Year	Number of banks	Number of bidding banks	Number of target banks	Number of acquisitions
1986	167	18	18	0
1987	167	18	18	0
1988	170	17	16	3
1989	173	19	16	0
1990	164	20	16	1
1991	157	20	17	3
1992	153	20	16	3
1993	150	20	17	3
1994	145	20	15	3
1995	141	20	15	1
1996	137	20	14	2
1997	133	21	15	1
1998	127	20	15	6
1999	123	19	12	4
2000	112	19	13	6
2001	110	18	12	1
2002	108	18	10	3
2003	103	18	8	2
2004	100	18	7	2
2005	100	18	7	0
2006	99	18	7	1
2007	98	19	7	1
2008	93	19	7	1
2009	91	19	7	0
2010	79	17	7	0
Total	209	23	19	47

SOURCE: Authors' elaboration.

NOTE: Figures relate to quarter 4. Completion years are used for acquisitions. Average bank enters for 57 quarters, i.e. > 14 years.

As for the z-score, it is an indicator of the distance to insolvency. It is originally based on the work of Roy (1952), who shows that the probability that current losses would exceed equity capital is less than or equal to $1/z^2$, so that a higher level of z implies lower upper bound of insolvency probability. This indicator has been widely used in recent analyses due to its suggestive distance-to-insolvency interpretation as it measures the number of standard deviations returns may drop before they exhaust bank's capital. We acknowledge the limitations of the Z-score as a risk measure, which is used, as it is the case of the majority of banks in our sample, for non listed institutions. The problems of the Z-score are particularly relevant at listed institutions where asset value and profitability may show larger variations and can be related to unspecified market and industry-specific features. However, it is worth pointing out that our results do not rely on z-scores alone, but we also use two additional risk measures as explained below.

As for the volatility of ROA, it is computed over a four-quarter rolling window. Albeit imperfect – due the limited number of data points to compute the volatility measure and the potential incidence of seasonal effects – the measure shows some significant variation across banks. While profits can be subject to a number of discretionary accounting practices, a high profit volatility can still be interpreted as a source of instability and risk for the bank. The change in non-performing loans is also considered as a measure of risk, in particular, of *ex-post* credit risk.

	Definition	N	mean	sd	p50	p5	p95
Log(z)	Z -score. $Z = (ROA + [\text{equity}/\text{total assets}]) / \sigma ROA$. Return on assets (ROA) is computed as operating income over total assets. The standard deviation (σ) of ROA is over a four-quarter rolling window	12,035	3.19	0.83	3.09	2.11	4.72
σ ROA	Profit volatility. SD of ROA over a four-quarter rolling window (%)	12,192	0.54	0.62	0.36	0.06	1.69
Δ NPL	Changes in non-performing loans (%)	12,094	-0.24	5.42	-0.01	-1.74	2.06
Size	Log (1 + total assets)	12,871	13.88	2.31	14.01	9.80	17.23
Assets	Total assets (euro 000 000s)	12,871	8,127.29	29,100.00	1,216.32	18.03	30,500.00
ROA	ROA. Operating income over total assets (%)	12,798	4.31	2.47	4.11	0.96	7.58
Loans	Loans over total assets (%)	12,871	46.94	25.67	48.91	0.06	85.13
Equity	Equity over total assets (%)	12,871	14.03	21.55	6.94	2.75	81.82
Non-interest income	Non-interest income over operating income (%)	12,760	22.85	21.84	16.92	-0.46	80.55
Non-performing loans	Non-performing loans over total assets (%)	12,343	6.89	11.46	3.73	0.00	26.20
Securitization	Financing from asset securitization over total liabilities (%)	12,871	0.70	2.54	0.00	0.00	5.02
Real estate	Real estate lending over total loans (%)	12,343	41.11	26.61	41.05	0.09	86.76
Non-deposit funding	$1 - (\text{deposits} / \text{total liabilities})$ (%)	12,761	34.89	29.36	23.17	5.55	100.00
Personnel expenses	Personnel expenses over operating income (%)	12,760	33.25	15.65	35.39	0.35	52.85
Support	Indicates that a target bank is distressed and received government financial support	12,871	0.01	0.09	0.00	0.00	0.00
GDP	Real GDP growth (%)	12,476	0.68	0.61	0.80	-0.80	1.50

SOURCE: Authors' elaboration.

The explanatory variables include size – measured by total assets both in logs and in levels to check whether ‘empire building’ (indefinitely growing simply to maintain a status of a dominant bank) has an effect on the risk profiles of merging banks –; ROA in levels – to control for the impact of the current levels of profitability on profits dispersion and the other measures or risk –; the ratio of loans over total assets – to proxy for asset specialization and focus on the traditional banking business –; equity over total assets – as a measure of the current solvency levels to cover unexpected losses –; non-interest income – controlling for earnings diversification as a potential way of diversifying risk –; securitization – which is measured as the percentage of securitization funding over total liabilities and it captures the potential impact of this alternative source of financing on bank risk –; real estate lending over total loans – as an environmental control since real estate loans are an important business activity of Spanish banks –; personnel expenses over operating income – to control for this particular aspect of bank operating efficiency before and after the M&As –; and real GDP growth – as a control for the business cycle influence. Lastly, we also control for government financial support to financially distressed targets in order to facilitate the acquisition by a healthy bank acquirer. Over our study period, such financial support encompassed the purchase of impaired assets, asset protection schemes (including also collateral), capital injections (including subordinated debt) and loans at below market rates.

2.2 EMPIRICAL APPROACH

Our empirical approach attempts to show the impact of domestic M&As on bank-risk taking and other related bank performance variables. The previous literature on M&As emphasizes the role of factors such as size and performance as motives for bank mergers. This suggests that if say targets and/or acquirers are especially large (and take additional risk as common

for large banks), changes bank risk-taking following a deal may be driven by factors that are related to the motives for why banks engaging in M&As rather than by the characteristics of a deal. This suggests we need to model a bank's propensity to engage in M&As in order to correct for potential selection bias when merging bank and non-merging banks differ in important aspects which could affect merger outcomes. Put differently, we need to isolate the influence of size and other factors related to the decision to participate in M&As for both targets and acquirers from the effects of a deal on risk-taking.

The standard way of addressing this selection bias is Heckman's procedure (1976 and 1978). This procedure introduces into the models a variable Heckman called 'Lambda.' This variable is also known as Mill's inverse odds ratio ('Mills ratio'). It measures the covariance between the error terms of the single-equation regression for an endogenous variable with the residuals from the selection equation.

The implementation of the Heckman selection bias-correction procedure is commonly applied to cross-sectional studies, but is less frequently used in panel data estimations. In our case, the setting for the model will be as follows:

$$y_{it}^* = x_{it} \beta + \mu_i + \xi_i + e_{it} \quad [1]$$

$$d_{it}^* = z_{it} \gamma + \alpha_i + \psi_i + v_{it} \quad [2]$$

$$d_{it} = 1 \text{ if } d_{it}^* > 0 \quad [3]$$

$$y_{it} = y_{it}^* \cdot d_{it} \quad [4]$$

where y_{it}^* is a latent endogenous variable with observed counterpart y_{it} which shows the risk-taking behavior of bank i at time t ; d_{it}^* is a latent variable (merging vs. not merging; or acquirer vs. target) with the associated indicator function d_{it} , reflecting whether the primary dependent variable is observed and where the relationships, between d_{it}^* and d_{it} and y_{it} and y_{it}^* respectively, are shown in [3] and [4]. Equation [1] is of primary interest and [2] is the reduced form for the latent variable capturing sample selection; x_{it} and z_{it} are vectors of exogenous variables; β and γ are vectors of unknown parameters

The dependent variable in the primary equation is only observed for the observations satisfying the selection rule (namely, $d_{it}^* > 0$). To introduce selection bias, assume the errors for each equation can be decomposed into an individual effect (μ_i , and α_i), a time effect (ξ_i , and ψ_i), and an idiosyncratic effect (e_{it} and v_{it}), where each of the error components is assumed to be normally distributed and correlated with the component of the same dimension in other equation. As the treatment of the time effects as random increases the difficulty of estimation, in terms of computational requirements, it is simpler to treat them as fixed time effects and absorbed in, x_{it} and z_{it} .

Given the distributional assumptions, it is possible to estimate the parameters by maximum likelihood (see Annex). This is adopted, inter alia, in Hausman and Wise (1979), Keane, Moffitt and Runkle (1988) or Nijman and Verbeek (1992).

In our empirical setting, the probit equation is given by [2], where d_{it}^* is a latent variable identifying merging vs. non-merging banks or acquiring vs. target banks. Equation [1] is then estimated by maximum likelihood including the lambda correction for estimation bias. y_{it} is the bank-risk of bank performance variable. As for the probit selection equation, the

set of explanatory variables (z_{it}) include size, performance (as measured by return on assets; ROA) and cost inefficiency. Previous evidence has demonstrated that larger, more profitable and more cost efficient banks tend to engage in acquisition as acquirers, while the opposite is true for acquisition targets [see Hernando *et al.* (2009), for an overview of the determinants of bank acquisitions in European banking]. We also control for the importance of traditional banking activities (via the ratio of loans to total assets and the ratio of non-interest income to operating income), bank funding other than deposits, bank leverage and the ratio of non-performing loans to total loans. Finally, business cycles which we control for (via real GDP growth) may equally affect M&As activity as the quality of bank assets improves in periods of economic growth.

Given the bank-level aggregation of some variables, the standard errors are clustered at the bank-level.

3 Analysis of the results of our multivariate analysis

In order to identify the effects of M&As on bank risk profiles, we need to separate the effects of various bank-specific factors on bank risk (before and after M&As) from a bank's decision to engage in M&As. From here onwards we show a summary of the main empirical results of a working paper.³ To do so, we start by estimating the probability that a bank engages in M&As (as an acquirer or as a target) using a probit selection procedure as described in equations [1] to [4]. The tables for this selection equation are not shown for exposition simplicity.

3.1 PROBABILITY OF A BANK BEING AN ACQUIRER/TARGET

We find that size is to be an important identifying characteristic of acquiring banks. The other identifying factor is solvency (the ratio of equity to total assets is positively and significantly related to the probability of being an acquiring bank and negatively related to being a target bank). It is also worth noting that higher levels of inefficiency are also significantly associated with the probability of being a target bank in M&As. Lastly, the level of wholesale (non-deposit) financing is significantly associated with the probability of being a target in a Spanish M&As.

3.2 IMPACT OF M&AS IN THE RISK PROFILE OF BANKS

3.2.1 Impact on *acquirer* banks vs. other banks

Table 3 summarizes the main results for acquirer banks. All control variables in this and the following tables are lagged by one quarter. The results for the equation in which the **log of the z-score** is the dependent variable suggest that even though size is not found to be a significant driver of financial stability for acquiring banks, M&As have a marginal effect on this relationship after the merger. In particular, size is positively related to the bank's financial stability after a deal. This finding suggests that even if mergers may be potentially sought for 'empire building' purposes, M&As do reduce the overall risk profile for large acquirer banks. This is an important result, because it is not consistent with the notion that large banks engage in additional risk-taking through M&As, possibly by engineering risk-increasing deals to exploit the subsidies of the financial safety net. One explanation for this result is that supervisors are aware of large banks' systemic character and prod them to reduce their risk profile following a deal. If that is the case, Spanish bank supervisors have been effective in curbing additional risk-taking by large banks around M&As.

For banks that engage in M&As, there is no evidence that the effect of ROA on risk-taking is different either before and after the merger compare with all other Spanish banks.

We also find a negative and statistically significant impact of the solvency ratio defined as equity to total assets on the z-score (implying more risk-taking) after the M&As, as shown

³ The paper can be downloaded from http://papers.ssrn.com/abstract_id=2318142.

Acquirer overall risk variables

	Dependent variable: $\lg(z)$			Dependent variable: σROA		
	Interact: 1 year before		Interact: 3 years after	Interact: 1 year before		Interact: 3 years after
	(1)	(2)	(3)	(4)	(5)	(6)
ROA	--	-	---	++	++	+++
Equity			++	++		+
Non-interest income			+			
Securitization	+	++	++	-	-	--
Real estate	-	--	--	-		
<i>Inter x Size</i>			++			--
<i>Inter x Equity</i>			---			++
<i>Inter x Non-interest income</i>		+	---			
<i>Inter x Real estate</i>		++				
Constant	++	++	++			

Acquirer loan risk variables

	Dependent variable: $\Delta\text{Non-performing loans}$		
	(1)	(2)	(3)
Equity			--
GDP			++
Constant			++

SOURCE: Authors' elaboration.

NOTE: Only the variables which are found to be statistically significant in at least one of the equations are shown with "+" meaning a positive relationship, "-" meaning a negative relationship. One sign denotes significance at 10%, two signs denotes significance at 5% and three signs denotes significance at 1%.

by the interaction term. If only better capitalized banks engage in additional risk-taking post-M&As, this is suggestive of regulatory scrutiny preventing additional risk-taking by lesser-capitalized banks after M&As. Less capitalized banks face incentives to shift risk onto the financial safety net and risk-increasing acquisitions may be one way of achieving this. However, our results show that only higher capitalized banks engaged in additional risk taking post-M&As, which seems consistent with a more efficient use of capital.

The results also provide some evidence of a negative and statistically significant post-merger effect on the acquiring bank's stability of non-interest income, and the reliance of nontraditional sources of financing such as asset securitization. This may imply that income diversification via fees and commissions as well as reliance on funding from securitizations involve higher risk-taking for acquirer banks after the deal. Consistent with this finding is that the acquiring banks with large real estate lending portfolios, a more traditional business, show statistically significant lower risk profile before the merger, although this variable loses statistical significance after the merger possibly showing portfolio restructuring after the deal. Also, we find that personnel expenses significantly reduce the acquiring bank distance to insolvency (more risk) after the M&As, as the acquirer banks usually have to face significant restructuring costs.

The regression results where the bank risk measure is the **standard deviation of ROA** are fully consistent with those of the z-score described above. The same results on the impact of size and equity are found in both specifications (with an opposite sign given that higher value of σROA shows more risk) but no statistically significant relationship was found for securitization, non-interest income and personnel expenses.

3.2.2 Impact on *target* banks vs. other banks

The results when the (risk) dependent variable is the change in **non-performing loans (NPLs)** for acquirer banks. We use this dependent variable as a proxy for *ex-post* risk effects. Only efficiency, measured in terms of personnel expenses, seems to have a statistically significant impact on the change in NPLs of acquirer banks after the merger, suggesting that most inefficient acquirer banks have also less quality loan portfolios and become more risky after the M&As.

The results for target banks are summarized in Table 4. Overall, non traditional sources of funding and income of target banks are linked to additional risk-taking in the three years following a M&A. Thus, the results seem to indicate that target banks are characterized for showing a negative and statistically significant impact of their profitability (ROA), exposure to real estate (as shown by the real estate lending over total assets) and reliance on non-deposit funding on the distance to default in non M&As period. For target banks that heavily rely on wholesale funding, the regression results suggest an increase in the distance to default or reduction of the risk before the merger and an increase of their risk profile (as measured by the Z-Score) in the three years after the M&As. In turn, target banks that heavily rely on the non-traditional source of income (as opposed to interest income) seem to reduce their risk profile in the three-year period after the deal. Solvency, profitability and focus on real estate lending do not seem to have a statistically significant impact on merging banks' either before or after the deal.

The variable support identifies target banks that have received government support for the M&As in the context of a bank restructuring process that involved an acquisition by other bank. The interactions show that target banks have taken on additional risk measured by log Z score or σ ROA before they received government support, but, interestingly, supported banks have not engaged in additional risk taking relative to other non merging banks in the same time period following the M&As. The result that targets which received government support are not significantly prone to additional risk taking is interesting, because it shows that Spanish banks that benefitted from government financial support have not exploited the safety net through higher risk taking after completion of a M&As, probably because supervisors did not allow that to happen.

The results when the (risk) dependent variable is the change in **non-performing loans (NPLs)** for target banks show that largest target banks experience increases of risk measured by Δ NPLs premerger but size has no impact on this risk metric after the deal. The results also suggest that the solvency ratio of target banks seems to significantly reduce the targets' post-merger risk profile measured by Δ NPLs, which seems consistent with the restructuring of the NPL portfolio after the deal. Before the merger, the impact is positive and statistically significant indicating an increase in targets' risk during the year previous to the merger. The weight of real estate loans in the asset portfolio and personnel expenses over operating income seem to be a distinctive risk-generating feature of target banks as shown by the Δ NPLs before the deal. However, their impact is not statistically significant after the M&As.

As with the Z-Score and σ ROA regressions, the interaction between Δ NPLs and the support indicator confirms that target banks that were in crisis and received financial support from the government have highly statistically significant Δ NPLs before M&As but the interaction of support is not statistically significant after M&As. That is, targets in financial distress increase their risk profile proxy by Δ NPLs before the M&As but not after. Again, this is not consistent with the moral hazard hypothesis according to which Spanish banks that received government support have exploited the financial safety net post M&As relative to target banks which have not received financial support of government.

Target overall risk variables

	Dependent variable: lg(z)			Dependent variable: σ ROA		
	Interact: 1 year before		Interact: 3 years after	Interact: 1 year before		Interact: 3 years after
	(1)	(2)	(3)	(4)	(5)	(6)
Size					---	
ROA	---	--	-			
Equity	++	+	++			
Real estate	--	--	--			
Non-deposit funding	---	---	---			
Support	-	-			+++	
<i>Inter x</i> Non-interest income		-	++			
<i>Inter x</i> Non-deposit funding		+++	---			
<i>Inter x</i> Support		---			-	

Target loan risk variables

	Dependent variable: Δ Non-performing loans		
	(1)	(2)	(3)
Size	--	--	-
GDP	+++	+++	+++
Real estate	+	+	+
Support			-
<i>Inter x</i> Size		++	
<i>Inter x</i> Equity		++	---
<i>Inter x</i> Real estate		---	
<i>Inter x</i> Personnel expenses		--	
<i>Inter x</i> Support		+++	
Constant	++	++	+

SOURCE: Authors' elaboration.

NOTE: Only the variables which are found to be statistically significant in at least one of the equations are shown with "+" meaning a positive relationship, "-" meaning a negative relationship. One sign denotes significance at 10%, two signs denotes significance at 5% and three signs denotes significance at 1%.

4 Conclusions

Our study shows how domestic M&As affect the risk-taking profile of Spanish banks in the years immediately before and after the deal. Our most relevant findings are as follows: Size and solvency are found to be positively and significantly related to the probability of being an acquiring bank and negatively to the probability of being a target bank in Spain. While higher levels of inefficiency are also significantly associated with the probability of being a target bank. This empirical evidence is in line with that for the average European bank engaged in a domestic M&As. Lastly, the level of wholesale funding (proxied by non deposit financing) is significantly associated with the probability of being a target bank in Spain.

For acquiring banks, the short term key drivers of risk changes before and after the deal are size and capitalization (measured in terms of capital over total assets). The regression results of two of our selection variables indicating changes in banks' *ex-ante* risk profile (log Z-Score and σ ROA) show that size is the only of our selected explanatory variables that it is positively related to the reduction of acquiring banks' risk profile after the M&As. This outcome seems to explain supervisors' objective of building national champions to reduce banks' risk profile.

In turn, highly capitalized acquirers increase their risk profile after the deal in what it seems an attempt to a more efficient use of capital.

Regarding target banks, the regression results of all our selection variables indicate changes in banks' *ex-ante* and *ex-post* risk show that target banks in financial distress that received financial support from the government in the context of the M&As did not increase their risk profile in the period immediately after the deal as compared to all other banks.

Our results suggests that Spanish supervisors prevented large and poorly capitalized bank acquirers from taking additional risk via M&As. Equally, Spanish supervisors prevented targets which received government financial support from taking additional risk during time period following M&As. In many ways our results are reassuring, because they appear to indicate that supervisors have remained vigilant and effective in terms of reigning in risk taking in the context of M&As related to bank size, leverage and government support. However, our results also show that supervisors were less effective in preventing risk taking of banks that rely on non-traditional funding and income. Acquirers which rely on non-interest income and non-deposit funding take more risk post-M&As. Similarly, target banks that rely on wholesale funding are associated with more risk-taking post-M&As.

REFERENCES

- BREWER, E., and J. A. JAGTIANI (2007). *How much would banks be willing to pay to become 'Too-Big-to-Fail' and to capture other benefits?*, Federal Reserve Bank of Kansas City Research Working Paper RWP 07-05.
- CARBÓ-VALVERDE, S., E. KANE and F. RODRÍGUEZ FERNÁNDEZ (2012). "Safety-net benefits conferred on difficult-to-fail-and-unwind banks in the US and EU before and during the Great Recession", *Journal of Banking and Finance*, 37, pp. 1845-1859.
- HAGENDORFF, J., I. HERNANDO, M. J. NIETO and L. D. WALL (2011). "What do premiums paid for bank M&As reflect? The case of the European Union", *Journal of Banking and Finance*, 36, pp. 749-759.
- HAGENDORFF J., and M. J. NIETO (2011). "The Safety and Soundness Effects of Bank M&A in the EU: Does Prudential Regulation Have any Impact?", *European Financial Management*.
- HAUSMAN, J. A., and D. A. WISE (1979). "Attrition bias in experimental and panel data: The Gary income maintenance experiment", *Econometrica*, 47, pp. 455-473.
- HECKMAN, J. J. (1976). "The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models", *Annals of Economic and Social Measurement*, 5, pp. 475-492.
- (1978). "Dummy endogenous variables in a simultaneous equation system", *Econometrica*, 46, pp. 931-959.
- HERNANDO, I., M. J. NIETO and L. D. WALL (2009). "Determinants of domestic and cross-border bank acquisitions in the European Union", *Journal of Banking and Finance*, 33, pp. 1022-1032.
- KEANE, M., R. MOFFITT and D. RUNKLE (1988). "Real wages over the business cycle: estimating the impact of heterogeneity with micro data", *Journal of Political Economy*, 96, pp. 1232-1266.
- NIJMAN, T., and M. VERBEEK (1992). "Non-response in panel data: the impact on estimates of a life cycle consumption function", *Journal of Applied Econometrics*, 7, pp. 243-257.
- PENAS, M. F., and H. UNAL (2004). "Gains in bank mergers: evidence from the bond market", *Journal of Financial Economics*, 74, pp. 149-179.
- ROY, A. D. (1952). "Safety First and the Holding of Assets", *Econometrica*, 3, pp. 431-449.
- SCHMID, M. M., and I. WALTER (2009). "Do financial conglomerates create or destroy economic value?", *Journal of Financial Intermediation*, 18, pp. 193-216.

The marginal likelihood of an individual is given by:

$$\ell_i^m = \{d_{it}^* \geq 0, t \in T_i, d_{it}^* < 0, t \in T_i \mid \tilde{y}_i\} f(\tilde{y}_i) \quad [5]$$

where $T_i = \{t \in \{1, \dots, T\}; d_{it} = 1\}$, $i = 1, \dots, N$

is the set of time indices for the periods in which individual i is observed and denotes deviations from the observed individual means:

$$\tilde{y}_{it} = y_{it} - \frac{1}{T_i} \sum_{t \in T_i} y_{it} = y_{it} - \bar{y}_{it} \quad t \in T_i \quad [6]$$

where T_i denotes the number of elements in T_i ; \tilde{y}_{it} denotes the T_i -vector of observed \tilde{y}_{it} 's. By maximizing the maximum likelihood function (the product of all ℓ_i^m) we will obtain consistent and asymptotically normally distributed estimators for β and γ .