Are size and location of banks related to their credit ratings? New evidence

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This version: February 2012

Abstract

This paper examines whether credit ratings of banks are related to their size and location (i.e. inside or outside the euro area). We estimate a multilevel regression model for banks' credit ratings using data retrieved from Bankscope in 2011 and find that there is a hump-shaped relationship between size and the credit ratings of both Fitch and Moody's, suggesting that both credit rating agencies incorporate that a bank may become too-big-to-fail and too-big-to-be-rescued in their ratings. Our results also suggest that, controlling for other factors, banks located in euro area member countries receive a higher credit rating from Fitch than banks located outside the euro area.

JEL classification: F30, G21.
Keywords: probability of default of banks, monetary union, too-big-to-rescue

The views expressed in this paper do not necessarily reflect the views of De Nederlandsche Bank. We thank Robert Vermeulen and Mark Mink for their comments on a previous version of the paper.

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1. Introduction

This paper examines whether credit ratings of banks in 2011 are related to their size and their location (i.e. inside or outside the euro area), thereby combining two strands of the literature that, so far, have developed quite independently, while it makes sense to combine them. For instance, the too-big-to-rescue problem may be different for countries inside and outside the euro area, depending on whether membership of the currency union will enhance or reduce governments' abilities to provide financial support to ailing banks.

As pointed out by Boyd and Runkle (1993), failure of a large bank is supposedly more feared by supervisors than failure of a small bank, since the former is more likely to result in macroeconomic externalities. Banks that are 'too big to fail' receive a *de facto* government guarantee, which will be reflected in their riskiness as perceived by creditors. Several studies have examined the relationship between size and riskiness of banks and there is some evidence for the 'too big to fail' point of view (see Poghosyan and De Haan, 2012 and references cited therein). However, recently, some studies have pointed out that banks may also be 'too big to be rescued'. If governments are fiscally constrained, they may have insufficient means to bail out a failing large bank. Demirgüç-Kunt and Huizinga (2010) find evidence for this as the governments' fiscal position affects banks' CDS spreads during times of financial upheaval.

Also the location of a bank may affect the likelihood that they receive support from the central bank or the government. However, conflicting views have been put forward as to whether banks are better off inside or outside the euro area. Buiter and Sibert (2008) argue that banks located in the euro area profit from the European Central Bank's (ECB) lender of last resort facilities. Referring to Iceland's experience, they argue that the "only way for a small country like Iceland to have a large internationally active banking sector that is immune to the risk of insolvency triggered by illiquidity caused by either traditional or modern bank runs, is for Iceland to join the EU and become a full member of the euro area" (p. 2). However, according to De Grauwe (2011, p. 2), members of a monetary union "issue debt in a currency over which they have no control. It follows that financial markets acquire the power to force default on these countries. This is not the case in countries that are not part of a monetary union, and have kept control over the currency in which they issue debt." De Grauwe illustrates this argument by comparing Spain and the UK. Even though the government debt ratio of the UK has increased more and is higher than that of Spain, financial markets have singled out Spain and not the UK as the country that could get entangled in a

government debt crisis. This reasoning implies that countries that are part of a monetary union have less ability to support ailing banks when they are fiscally constrained.

To the best of our knowledge, the only study that has dealt with similar issues as the present paper is Sironi (2003). This author has touched upon the issue of monetary union membership when studying whether bank risk is adequately reflected in subordinated notes and debts (SND) spreads of European banks in the period 1991-2000. Dividing his sample into EMU and non-EMU countries he reports that too-big-to-fail benefits were present for banks located in EMU countries in the period 1991-96 but not thereafter, while these benefits were never present for banks in non-EMU countries. He attributes this result to the loss of independent monetary policy of EMU countries and the foundation of the Stability and Growth pact. According to Sironi, both features of EMU put constraints on the capacities of governments to save an ailing bank.

We estimate a multilevel regression model using data retrieved from Bankscope in 2011 to test four hypotheses relating size and location to the probability (as perceived by rating agencies) that banks receive external support. Unfortunately, only Fitch publishes external support ratings. Therefore, we also run regressions employing overall credit ratings provided by Fitch and Moody's, controlling for the so-called standalone rating which reflects the capacity of a bank to meet its financial obligations without external support. The standalone rating captures bank-specific factors affecting the overall credit rating.

We start our analysis by examining whether there is a hump-shaped relationship between the size of a bank size and its credit rating. We find that there is a non-linear relationship between size and the credit ratings of both Fitch and Moody's, suggesting that both credit rating agencies incorporate that a bank may become too-big-to-fail and too-big-to-be-rescued in their ratings. Next, we test whether credit ratings of banks located inside the euro area are systematically higher or lower than credit ratings of banks located outside the euro area. Our results suggest that controlling for other factors, banks located in euro area member countries receive a higher credit rating from Fitch than banks located outside the euro area. Finally, we test two hypotheses that have been put forward to explain why membership of the home country of the euro area may affect a bank's credit ratings. The first hypothesis is that the home country is more fiscally constrained when it is part of the euro area, and second that the too-big-to-rescue effect will be stronger for banks located in the euro area than for banks located outside the euro area. We do not find strong evidence for both hypotheses.

The remainder of this paper is organized as follows. Section 2 outlines how our work is related to previous studies and presents our hypotheses. Section 3 describes our

methodology and data used, while section 4 presents our main results. Section 5 contains a sensitivity analysis and section 6 offers the conclusions.

2. Hypotheses

We combine two strands of literature: research focusing on the relation between bank size and the probability of receiving government support, and research focusing on the effect of membership of the Economic and Monetary Union (EMU) on governments' abilities to bail out banks. Both strands of the literature have developed quite independently, while it makes sense to combine them. For instance, the too-big-to-fail problem may be different for countries inside and outside EMU, depending on whether EMU membership will increase or reduce governments' abilities to provide financial support to ailing banks.

Several recent papers examine the too-big-to-fail and the too-big-to rescue problem of banks. Völz and Wedow (2009) find for a sample of 91 banks from 24 countries in the period 2002-2007 that large banks have lower CDS spreads: an increase in the average size of 1 percent leads to a decrease in the CDS spread of about 2 basis points.[1] Völz and Wedow (2009) also find that banks' CDS spreads first decline in bank size, but when a bank's market capitalization ratio to GDP exceeds 10 percent, CDS spreads rise. This U-shaped relationship between size and CDS spreads suggests that some banks have grown so large that they are too-big-to-be-rescued. Following Völz and Wedow (2009), we have as our first hypothesis:

H1: There is a hump-shaped relationship between bank size and credit ratings.

Demirgüç-Kunt and Huizinga (2010) examine the too-big-to-be-rescued issue by relating banks' CDS spreads and market valuations to the home government's fiscal position, arguing that a too-big-to-rescue status of banks depends on the government's fiscal means for a bail out. These authors relate the market valuations of 717 banks in the period of 1991-2008 and CDS spreads of 59 banks in the period of 2001-2008 to the home country's public debt and fiscal deficit positions. For the overall sample, they do not find any significant effects of the home countries' fiscal position on CDS spreads or the valuation of banks. However, for

[1] Likewise, for a sample of banks from 21 countries in the period of 1999-2003, Rime (2005) reports that two proxies for too-big-to-fail guarantees, i.e. an individual bank's total assets and a bank's assets relative to the assets of the country's banking sector, have a positive and significant effect on banks' credit ratings issued by Moody's and Fitch.

the period 2007-2008 Demirgüç-Kunt and Huizinga (2010) report that the increase of banks' CDS spreads is related to the worsening of the home country government's fiscal position.

Demirgüç-Kunt and Huizinga (2010) do not consider monetary union effects. Still, membership of EMU may affect abilities to provide financial support to banks. Buiter and Sibert (2008) argue that banks in a monetary union benefit from a more effective lender of last resort. Following Buiter and Sibert (2008), we have the following hypothesis:

H2a: Banks with a home country that is part of EMU have higher credit ratings than banks located in countries with their own currency.

In contrast, De Grauwe (2011) argues that EMU countries face more liquidity constraints than countries outside the currency union. Using the example of investors who fear a default of Spain and therefore sell their Spanish bonds, he argues that "investors who have acquired euros are likely to decide to invest these euros elsewhere, say in German government bonds. As a result, the euros leave the Spanish banking system. There is no foreign exchange market, nor a flexible exchange rate to stop this. Thus the total amount of liquidity (money supply) in Spain shrinks. The Spanish government experiences a liquidity crisis, i.e. it cannot obtain funds to roll over its debt at reasonable interest rates. In addition, the Spanish government cannot force the Bank of Spain to buy government debt. The ECB can provide all the liquidity of the world, but the Spanish government does not control that institution. The liquidity crisis, if strong enough, can force the Spanish government into default." (p. 3).[2] When investors believe that a country is likely to default, they charge higher interest rates which in return leads to larger debt problems and hence to a higher probability of default (Calvo, 1988; Cole and Kehoe, 2000). A central bank that can buy up unlimited amounts of government debt lowers investors' default expectations and thus avoids debt dynamics to spiral out of control. According to De Grauwe, EMU countries cannot automatically rely on the hard-nosed ECB to act as a backstop and hence they are more prone to adverse debt dynamics and are thus limited in taking on debt to bail out banks. In addition, there are restrictions on national fiscal policies in EMU, also limiting governments' ability to rescue banks. We therefore have as an alternative hypothesis:

[2] De Grauwe (2011) also argues that when domestic liquidity dries up due to fears of a government default, it will be more difficult for the domestic banks to rollover their deposits, except by paying prohibitive interest rates.

H2b: Banks with a home country that is part of EMU have lower credit ratings than banks located in countries with their own currency.

Dieckmann and Plank (2011) provide some indirect empirical support for De Grauwe's argument. Their results suggest that spreads of EMU countries are more sensitive to changes in the stock market return of financials than the spreads of non-EMU countries, which they attribute to the lack of EMU countries' possibility of monetizing their debt.[3]

The argument of De Grauwe (2011) implies that the effect of the fiscal position of the home country on banks' credit ratings is conditional on EMU membership of the home country. We therefore have as our third hypothesis:

H3: A high public debt ratio in a bank's home country will reduce the credit ratings of banks located in countries in the euro area more than the credit ratings of banks located outside the euro area.

The bail out of very large banks may impose too heavy a burden on a country's fiscal means. Very large banks may, therefore, become too-big-to-be-rescued. Following De Grauwe's reasoning, this effect is expected to be stronger for banks located in EMU countries than for banks located outside EMU. We therefore have as our fourth hypothesis:

H4: The too-big-to-rescue effect on bank credit ratings will be stronger for banks located in the euro area than for banks located outside the euro area.

We test the third and fourth hypotheses by introducing interaction terms between an EMU-membership dummy and government debt, and between the EMU-membership dummy and our proxies for bank size in our empirical model for bank credit ratings.

[3] Acharya et al. (2011) show that the announcement of financial sector bailouts in EMU was associated with an immediate, unprecedented widening of sovereign CDS spreads and narrowing of bank CDS spreads; however, after the bailouts bank CDS and sovereign CDS spreads moved together even after controlling for banks' equity performance, the latter being consistent with an effect of the quality of sovereign guarantees on bank credit risk.

3. Methodology

3.1 Data

We use bank credit ratings provided by Fitch and Moody's, reflecting how these rating agencies evaluate the likelihood that a particular bank can no longer meet its financial obligations (see Amtenbrink and De Haan (2012) for a review of the literature on credit rating agencies). Data on credit ratings were retrieved from Bankscope in August 2011. The European sovereign debt crisis, which started to unfold in 2010, has raised concerns about the capacity of governments to save their financial sector. So, if there is any suitable point in time to address our research questions it should be the year 2011. This is also confirmed by a report of Standard and Poor's, which states that the relation between the credit ratings of European banks and government support has never been more important (Standard and Poor's, 2011).

Rating agencies make a distinction between the possibility that a bank receives external support, either provided by a government or a parent bank, and the capacity of a bank to meet its financial obligations without any external support (standalone capacity). The overall rating takes into account a bank's chances to receive external support and its standalone capacity. A separate rating on a bank's standalone capacity is issued by both agencies, but only Fitch publishes a rating on the likelihood of external support as well.[4] (Fitchratings, 2011; Moody's, 2007). This study therefore uses Fitch's external support ratings as dependent variable, as well as the overall ratings provided by Fitch and Moody's. The standalone ratings are used as control variable in models for the overall ratings.

Although credit ratings are presented in an ordinal way, we follow Afonso et al. (2007) and assume that the number of categories is large enough to reflect a ratio scale. Hence, an ordered probit regression is not required, but we check whether the results obtained from OLS hold in an ordered probit model. Appendix A shows the numerical values for the letter notches for each of the rating type used. Both the overall ratings of Fitch and Moody's have 21 notches resulting in a linear scale running from 1 to 21. The scale for both standalone ratings differs. Moody's standalone rating runs from 1 to 13 and Fitch's runs from 1 to 10. Fitch's external support rating runs from 1 to 5, with 1 being the highest attainable notch meaning that a bank has a high likelihood of receiving external support. For the sake of comprehensibility, the external support scale is inverted so that a value of 5 reflects the

[4] The availability of S&P's standalone ratings is limited and therefore only the ratings of Moody's and Fitch are used in this study.

highest likelihood of support. In some of our regressions, we also use the sovereign rating, i.e. the rating of the government.

Table 1 shows the correlation of the ratings. The table shows a low correlation between Fitch's standalone and external support ratings, confirming that these ratings measure different dimensions of bank's credit risk. Likewise, the correlations between the overall ratings and the standalone ratings are not very high.

Table 1. Correlation of ratings

		Moody's		
	Overall Rating	Standalone Rating	Sovereign Rating	
Overall Rating	1.00			
Standalone Rating	0.76	1.00		
Sovereign Rating	0.63	0.44	1.00	
		Fitch		
	Overall Rating	Standalone Rating	Sovereign Rating	External Support Rating
Overall Rating	1.00			
Standalone Rating	0.76	1.00		
Sovereign Rating	0.61	0.51	1.00	
External Support Rating	0.65	0.26	0.24	1.00

This table shows the correlation of several ratings used in the paper. The upper panel shows the correlation of ratings of Moody's, while the lower panel shows the correlation of ratings of Fitch.

3.2 Model

We estimate variants of the following multilevel model:

$$Rating_i = \beta_0 + \beta_1 Stand_Alone_i + \beta_2 Monetary_Union_j + \beta_3 Systemic_Size_i + \beta_4 Monetary_Union_j * Systemic_Size_i + \beta_5 Subsidiary_i + \beta_6 State_Bank_i + \beta_7 LagPublic_Debt_j + \beta_8 Monetary_Union_j * LagPublic_Debt_j + \beta_9 GDP_per_Capita_j + \varepsilon_i$$

Where $Rating_i$ is Fitch's External Support Rating of bank *i* or Moody's and Fitch's overall credit rating of bank *i*. A multilevel regression is run, because the variables are measured at different levels (banks and countries) so that observations at the bank level cannot be treated independent of each other. Ignoring the multilevel structure of the data can potentially lead to biased standard errors of the coefficients on the country-level, as they would be based on overestimated sample sizes.

The regressions contain four bank-specific control variables taken from Bankscope.[5] The first one, $Stand_Alone_i$ measures the intrinsic capacity of a bank to honour its financial obligations. It is included (where applicable) to control for bank-specific determinants of credit ratings. The standalone ratings also pick up variation in the operating environments of banks. Moody's standalone rating, for instance, takes into account the quality of regulation and supervision, the strength and performance of the economy and the fragility of the financial system in which banks do business (Moody's, 2011, p. 34; Fitchratings, 2011, p. 25).

The second variable, $Systemic_Size_i$, is calculated as a bank's total liabilities relative to its home country's GDP. To test the first hypothesis about the nonlinear relationship between credit ratings and systemic size, a quadratic size term is included as well in the regressions (cf. Demirgüç-Kunt and Huizinga, 2010; Völz and Wedow, 2009). Following Demirgüç-Kunt and Huizinga (2010), we use the size of a bank to proxy its systemic importance. A recent survey of the Bank for International Settlements shows that all but one central bank consider size as the most important factor for determining the systemic relevance of a bank (BIS, 2009).

The third bank-specific variable, $Subsidiary_i$, is a dummy that is one for subsidiaries and that captures possible support from a mother bank. Subsidiaries often rely on lifelines from their mother bank, which decrease their credit risk. By including this control variable, we are better able to identify the potential effect on banks' credit ratings due to (implicit or explicit) guarantees by the government.

The fourth bank-specific variable, $State\ Bank_i$, is a dummy variable that is one if a bank is state owned, and zero otherwise. Being state owned probably reduces a bank's credit risk as well.

[5] Data from Bankscope refer to the situation at the end of the year. So there is a time lag of about eight months between the credit ratings, which were observed at the end of August 2011 and the balance sheet data, observed at the end of 2010. Given the reasonably short time lag, this should not be problematic.

Furthermore, a set of country-specific variables is included as well. The first one is $Monetary_Union_j$, which is a dummy variable taking the value of 1 when a bank's home country j is an EMU member. This dummy variable picks up differences in credit ratings between banks located in EMU countries and that of banks located in non-EMU countries. It is used to test the second hypothesis.

The second country-specific variable is $LagPublic_Debt_j$, which expresses the lagged public debt value of a bank's home country. It is included as a proxy for the fiscal capacity of a country to absorb a banking crisis.[6] The reason to include a lagged value is to control for reverse causation.

Finally, the variable $GDP_per_Capita_j$ controls for different levels of economic development of countries.

In addition, several interaction terms are included to test the third and fourth hypotheses. The interaction term $Monetary_Union_i*LagPublic_Debt_i$, tests whether the effect of public debt on a bank's credit rating is different for banks located in EMU countries and banks located in non-EMU countries. The second interaction term, $Monetary_Union_j*Systemic_Size_i$ is included to capture differences with respect to the impact of size on credit ratings between banks located in EMU countries and those located in non-EMU countries. According to the hypotheses as formulated in section 2, the sign of the interaction terms is negative in both regression specifications.

Analysis based on the Variance Inflation Factor (VIF) test did not suggest the presence of multicollinearity problems (results available on request).[7]

4. Results

4.1 Ratings

Table 2 shows credit ratings for banks located in countries inside and outside EMU. The means of the overall credit ratings are higher for banks based in the euro area. As the standalone ratings of banks located in countries inside EMU and those of banks located in countries outside EMU are very similar, the difference in the overall ratings stems from the

[6] Demirgüç-Kunt and Huizinga (2010) also include the fiscal balance as explanatory variable. We have decided against this as public debt more accurately captures a country's capacity to absorb a bank bailout than the fiscal balance. We also do not include fiscal costs of past banking crises, because the effect of past crises should be reflected in a country's public debt and that variable is taken into account.

[7] The outcomes of the VIF tests to what extent the variance of a variable is inflated due to the association it has with other variables indicate that the levels of tolerance are not lower than 0.1. For an explanation of the VIF analysis see, for instance, Studenmund (2006, pp. 258-59).

difference in the support rating.[8] This is confirmed by Fitch's external support ratings. Banks in the area have an average external support rating of 3.99, whilst the figure for banks outside the euro area is 2.90. This higher support rating for EMU-banks is unlikely to be caused by a larger government support received during the crisis since bank bailouts were not unique to the euro area. The difference in the support rating must rather be sought in the varying willingness and ability of sovereigns to provide aid. Apart from EMU membership, the willingness and ability of sovereigns to support ailing banks may also depend on bank size. The average size (proxied by bank liabilities divided by GDP) for banks outside the EMU is 0.076, while the average size for banks inside the EMU is 0.034. So including size in the regression models is important to control for these differences in relative bank size.

Table 2. Credit ratings

		Outside EMU					Inside EMU				
	Scale Range	N	Mean	St. dev.	Min	Max	N	Mean	St. dev.	Min	Max
Moody's overall rating	1-21	303	13.92	4.12	5	21	142	14.62	3.69	5	21
Fitch overall rating	1-21	483	13.13	3.76	3	21	174	14.45	3.20	6	20
Fitch external support rating	1-5	616	2.90	1.65	1	5	248	3.99	1.22	1	5
Moody's stand alone rating	1-13	303	5.69	2.32	1	11	142	5.30	2.20	1	13
Fitch stand alone rating	1-10	483	5.75	1.75	1	9	174	5.42	1.71	1	9

This table presents summary statistics of the various ratings being studied in this paper for banks inside and banks outside EMU. The first column shows the scale of the ratings. The next columns show the number of banks (N), the mean rating, the standard deviation and the minimum and maximum rating for banks outside EMU. The next columns give the same statistics for banks inside EMU. Country origin of the banks is shown in Appendix C.

4.2 Results for Fitch external support ratings

Table 3 shows the estimation results using Fitch external support ratings as dependent variable. In this specification, the standalone rating is not included as an explanatory variable. The results as shown in column (1), in which only size is taken up as explanatory variable, provide support for a hump-shaped relationship between bank size and the support rating. An increase in the ratio of a bank's liabilities relative to its home country's GDP first increases the support rating, indicating a higher likelihood of support (too-big-to-fail). The negative coefficient of the quadratic term, however, implies that the positive marginal effect on the external support rating of increasing size decreases and becomes eventually negative (too-big-

[8] More than forty percent of the variation in the overall rating of both Moody's and Fitch cannot be explained by the variation in the standalone ratings, indicating that the rating agencies consider external support as an important factor influencing a bank's overall credit rating.

to-rescue). These results provide support for our first hypothesis. The estimated turning point lies at a liabilities-to-GDP ratio of 1.31. As Appendix C shows, only six banks in our sample have a liabilities-to-GDP ratio larger than 1.31. However, the non-linear relationship is not caused by these banks only.

The models in columns (2) and (3) include the EMU dummy and some other explanatory variables. Column (2) focuses on the interaction of bank size and the EMU dummy, while column (3) focuses on the interaction of government debt and the EMU dummy. The results indicate that banks in the euro area are considered by Fitch to be more likely to receive external support than banks outside the euro area. On average, banks in the euro area are assigned a support rating that is 0.77 notch higher than that of banks outside the euro area. This difference is quite considerable when one bears in mind that the scale only has five notches. Our results therefore provide support for Buiter and Sibert's (2008) view that it is beneficial for banks to be located in a country in the euro area (hypothesis 2).[9]

The interaction of bank size and the euro area dummy in the model shown in column (2) provides some evidence for a difference in the marginal effect of size on the support rating for EMU banks and non-EMU-banks. The interaction between the monetary union dummy and bank size has a negative coefficient and is significant at the 5 percent level, but the interaction with the quadratic systemic size term is not significant at the 5 percent level. The coefficients are, however, jointly significant (the F-test has a value of 4.81, which is higher than the 5 percent critical value of 3.00). These results suggest that an increase in size has a lower positive effect on the support rating for EMU banks than for banks outside the EMU. However, as we will show below, this result is not robust.

The coefficient of the public debt ratio in column (3) is positive and significant at the 1 percent level. Furthermore, the effect of public debt on the support rating is different between EMU and non-EMU banks as shown by the negative coefficient on the interaction term between government debt and the EMU dummy (column 3). As the coefficient of the interaction term is larger than the coefficient of public debt, public debt has a negative impact on credit ratings of EMU-banks. As we will show below, this conclusion is, however, also not robust.

The coefficients of the other two bank-specific dummies are positive and significant at the 1 percent level. State owned banks have, on average, a higher chance to receive government support; their support rating is about one notch higher than the ratings of

[9] Dropping US banks yields the same qualitative results (available on request).

privately owned banks. Subsidiaries have, on average, a support rating which is 0.65 notch higher than the rating of independent banks. Finally, banks located in rich countries are associated with higher probabilities of external support. The coefficient of GDP per capita is positive and significant at the 1 percent level; a rise of 10,000 US dollars in GDP per capita is associated with an increase of 0.204 in the support rating.

Table 3. Regressions using Fitch external support ratings

Explanatory variable:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
EMU	0.924**	0.770**	1.696**	2.731*	3.457
	(0.153)	(0.167)	(0.417)	(1.176)	(2.297)
Liabilities/GDP 2010	2.650**	4.872**	2.546**	16.801*	10.887*
	(0.445)	(0.980)	(0.443)	(7.155)	(4.715)
EMU X (Liabilities/GDP 2010)		-3.431*		-13.603	
		(1.605)		(8.210)	
(Liabilities/GDP2010)^2	-1.013**	-2.302**	-0.899**	-6.021*	-3.817*
	(0.288)	(0.679)	(0.276)	(2.683)	(1.902)
EMU X (Liabilities/GDP 2010)^2		1.855		5.800	
		(1.171)		(4.806)	
GDP per capita 2009 (measured in $10.000)		0.204**	0.218**	0.346*	0.263
		(0.049)	(0.054)	(0.142)	(0.179)
Public Debt 2009		0.004*	0.007**	0.003	0.009
		(0.002)	(0.004)	(0.009)	(0.010)
EMU X Public Debt 2009			-0.015**		-0.021
			(0.005)		(0.024)
State Bank		0.974**	0.990**	2.573**	2.530**
		(0.137)	(0.140)	(0.723)	(0.724)
Subsidiary		0.652**	0.631**	1.505**	1.527**
		(0.094)	(0.097)	(0.369)	(0.381)
Constant	2.778**	1.706**	1.643**	-0.286	-0.110
	(0.137)	(0.184)	(0.201)	(1.151)	(1.110)
Number of banks	864	832	832	832	832
Number of countries	81	77	77	77	77
Multilevel/†Pseudo R-squared	0.15	0.38	0.27	†0.11	†0.10
F-test on interaction terms		4.81			
		(0.04)			

This table presents estimates of equation (1). Dependent variable: Fitch external support rating. Standard errors are given in parentheses. Columns (1)-(3) estimated by OLS; columns (4) and (5) by tobit. The p-value for the F-test is given in parentheses under the F-statistic. *, **: coefficients are statistically significant at the 5 and 1 percent level, respectively. The multilevel R-squared is based on a comparison between the residual variance in a

model without any explanatory variables and a model including explanatory variables. See Gelman and Pardoe (2006, p.241) for the calculation of the multilevel R-squared.

Some of the results in columns (1)-(3) of Table 2 change when we take into account that the Fitch's support ratings are both left and right censored. This may lead to inconsistent estimations of the parameters. A tobit regression takes the censored nature of the data into account. The results are shown in columns (4) and (5) of Table 2. Column (4) reruns the regression with the interaction between size and the EMU dummy. The two interaction terms are insignificant. Column (5) shows the results of the tobit regression with the interaction of debt and the EMU dummy. The coefficients of public debt term and its interaction with the EMU dummy are insignificant. So our results do not lend support to hypotheses 3 and 4 when the censored character of Fitch's external support ratings is taken into account.

4.3 Results for overall ratings

Table 4 presents the regression results using the overall ratings of the two rating agencies as dependent variable. In columns (1) and (2) the ratings of Moody's is the dependent variable, while in columns (3) and (4) the ratings of Fitch are used. In three of the four models, the average overall rating of a bank located in the euro area is higher than that of a bank located outside the euro area, thereby providing support for the second hypothesis. The coefficient of the monetary union dummy differs substantially across the samples of Moody's and Fitch ratings. On average, a bank receives a 'bonus' of 1.59 notches when located in the EMU according to the estimates using Fitch ratings and a bonus of 0.84 according to the estimates using Moody's ratings. This difference may be the result of differences in sample composition. We have therefore redone the regressions using banks which have a rating of both Moody's and Fitch. Limiting the sample to this set of banks does not decrease the rating gap; to the contrary, the differences increase: on average an EMU-based bank is rated 1.94 notch higher by Fitch and 0.84 notch by Moody's. The other results of these regressions (available on request) are broadly in line with the results reported in Table 4.

The interaction between public debt and EMU dummy is negative and significant at the 5 percent level in the Fitch sample as shown in column (4) of Table 4. In the Moody's sample, the interaction between debt and the EMU dummy is insignificant (column 2). The interaction terms between the EMU dummy and bank size are insignificant in both samples.

These results imply that there is only mixed evidence for the third hypothesis, while there is no supporting evidence for the fourth hypothesis.[10]

Table 4. OLS regressions for overall credit ratings

Explanatory variable:	**Moody's**		**Fitch**	
	(1)	(2)	(3)	(4)
EMU	0.844**	1.000	1.588**	2.701**
	(0.298)	(0.731)	(0.286)	(0.684)
Liabilities/GDP 2010	2.727*	1.038	3.220**	2.251**
	(1.080)	(0.655)	(0.952)	(0.729)
EMU X	-3.169		-2.714	
(Liabilities/GDP 2010)	(1.859)		(1.667)	
(Liabilities/GDP 2010)^2	-1.481*	-0.408	-1.140*	-0.704
	(0.702)	(0.388)	(0.502)	(0.431)
EMU X	1.847		1.635	
(Liabilities/GDP 2010)^2	(1.625)		(1.268)	
Stand Alone Rating	1.008**	1.025**	1.474**	1.477**
	(0.045)	(0.046)	(0.057)	(0.056)
GDP per Capita 2009	0.697**	0.693	0.434**	0.427**
(measured in $10.000)	(0.128)	(0.129)	(0.088)	(0.089)
Public Debt 2009	0.004	0.005	0.005	0.009*
	(0.004)	(0.004)	(0.003)	(0.004)
EMU X		-0.005		-0.018*
Public Debt 2009		(0.010)		(0.009)
State Bank	1.241**	1.321**	1.668**	1.660**
	(0.217)	(0.221)	(0.252)	(0.252)
Subsidiary	0.123	0.144	0.617**	0.622**
	(0.170)	(0.175)	(0.161)	(0.162)
Constant	5.500**	5.486**	2.488**	2.388**
	(0.474)	(0.487)	(0.385)	(0.390)
Number of banks	445	445	657	657
Number of countries	59	59	74	74
Multilevel R-squared	0.72	0.70	0.72	0.83

This table presents OLS estimates of equation (1). Dependent variable: Moody's overall ratings and Fitch overall ratings. Standard errors are given in parentheses. *, **: coefficients are statistically significant at the 5 and 1 percent level, respectively. The multilevel R-squared is based on a comparison between the residual variance in a

[10] To check for possible endogeneity problems between the overall and standalone rating, we also ran a regression using the difference between the overall and the standalone rating as dependent variable. The results of this regression are broadly in line with the results of Table 4 (results available on request).

model without any explanatory variables and a model including explanatory variables. See Gelman and Pardoe (2006, p.241) for the calculation of the multilevel R-squared.

5. Sensitivity Analysis

This section presents the results of several robustness tests related to the inclusion of sovereign credit ratings, the measurement of bank size, and the estimator used.

First, sovereign credit ratings reflect a country's creditworthiness and they can serve as a proxy for a country's capacity to bail out failing banks. We have therefore redone the regressions shown in Table 3, including sovereign credit ratings. GDP per capita and the public debt ratio are excluded from this specification, because these two variables are likely to be picked up by the sovereign rating (Afonso et al., 2007). Table 5 presents the results. It turns out that the coefficient of the monetary union dummy is lower compared to the results reported in Table 4 but remains significant at the 1 percent level.

As there is no general consensus in the literature on how to measure bank size, two alternative proxies of systemic size are used. The first one is the ratio of a bank's liabilities to the liabilities of the banking sector as a whole and the second proxy is the ratio of a bank's assets relative to its home country's GDP. Table 6 shows the regressions using the Fitch external support ratings as dependent variable and these alternative proxies for systemic relevance of a bank. Model 1 has the ratio of a bank's liabilities to the liabilities of the total banking sector as a proxy for systemic size. Size is significant, but the interaction of size and the monetary union dummy is not. The coefficient of the monetary union dummy is positive and significant. Model 2 uses the ratio of a bank's assets over GDP as a proxy for systemic size and its results are consistent with the regression using the liabilities to GDP ratio. In this model the interaction effect between size and the EMU dummy is significant, but as before this result is not robust. As shown in model 3, in a tobit regression the interaction becomes insignificant.

We have also redone the regressions shown in Table 4 for the overall ratings using the two alternative systemic size proxies. The results for the asset proxy are very similar to those reported in Table 4, but the coefficients of the ratio of a bank's liabilities over liabilities of the banking sector and its quadratic term are not significant. However, all other results (available on request) are very similar to those reported in Table 4.

TABLE 5. OLS regressions adding sovereign credit ratings

Explanatory variable:	Moody's	Fitch	Fitch External Support
EMU	0.640*	1.022**	0.308*
	(0.275)	(0.242)	(0.142)
Liabilities/GDP 2010	1.668*	3.470**	3.293**
	(0.663)	(0.704)	(0.426)
(Liabilities/GDP 2010)^2	-0.630	-1.285**	-1.278**
	(0.393)	(0.419)	(0.268)
Stand Alone Rating	1.021**	1.428**	
	(0.046)	(0.055)	
State Bank	1.257**	1.714**	1.109**
	(0.222)	(0.239)	(0.135)
Subsidiary	0.128	0.557**	0.595**
	(0.176)	(0.153)	(0.094)
Sovereign Credit Rating	0.137**	0.209**	0.138**
	(0.030)	(0.025)	(0.015)
Constant	5.074**	0.668	0.266
	(0.582)	(0.439)	(0.252)
Number of banks	449	678	854
Number of countries	63	76	79
Multilevel R-squared	0.69	0.76	0.40

This table presents OLS estimates of equation (1) adding sovereign credit ratings as explanatory variable. Dependent variable: Moody's overall ratings and Fitch overall ratings. Standard errors are given in parentheses. *, **: coefficients are statistically significant at the 5 and 1 percent level, respectively.

Table 6. OLS and tobit regressions using different bank size variables

Explanatory variable:	(1) OLS	(2) OLS	(3) tobit
EMU	0.695** (0.157)	0.852** (0.173)	2.600* (1.154)
Bank liabilities/ Liabilities Banking Sector	5.372** (1.225)		
EMU X (Bank liabilities/ Liabilities Banking Sector)	-1.038 (3.393)		
(Bank liabilities/ Liabilities Banking Sector)^2	-4.526** (1.751)		
EMU X (Bank liabilities/ Liabilities Banking Sector)^2	-3.452 (10.383)		
Assets/GDP 2010		3.420** (0.529)	14.096* (5.809)
EMU X (Assets/GDP 2010)		-2.188* (0. 962)	-10.258 (7.043)
(Assets/GDP2010)^2		-1.192** (0.233)	-4.385* (1.922)
EMU X (Assets/GDP 2010)^2		0.630 (0.723)	3.215 (3.644)
GDP per capita 2009 (measured in $10.000)	0.249** (0.049)	0.199** (0.054)	0.325* (0.139)
Public Debt 2009	0.004 (0.003)	0.002 (0.002)	0.004 (0.009)
State Bank	0.923** (0.124)	0.976** (0.140)	2.556** (0.762)
Subsidiary	0.605** (0.089)	0.584** (0.097)	1.275** (0.363)
Constant	1.821** (0.191)	1.714** (0.194)	-0.261 (1.166)
Number of banks	1007	823	823
Number of countries	90	75	75
Multilevel/†Pseudo R-squared	0.28	0.29	†0.10
F-test on interaction terms		11.95 (0.002)	

This table presents estimates of equation (1) using different indicators of bank size. Dependent variable: Fitch external support ratings. Standard errors are given in parentheses. *, **: coefficients are statistically significant at the 5 and 1 percent level, respectively.

Finally, Table 7 shows the outcomes of an ordered probit multilevel regression using the overall credit ratings. For the notches at the lower and upper end in the overall ratings of Moody's and Fitch few observations are available. We therefore follow Afonso et al. (2007) and group the lower end observations and give them the same numeric value of 1. Moody's upper two categories and Fitch's upper three categories are also grouped (see appendix A). This is necessary as otherwise the threshold points in the lower and upper end would be difficult to estimate efficiently in an ordered probit regression. It turns out that the results hardly differ from the findings based on the OLS regression. In line with regressions reported in other tables, public debt is insignificant if Fitch ratings are used as dependent variable. In addition, the EMU dummy becomes insignificant if Moody's overall rating is used as dependent variable.

TABLE 7. Ordered probit regressions

Explanatory variable:	Moody's	Fitch	Fitch External Support Rating
EMU	0.277 (0.166)	0.835** (0.129)	0.591** (0.152)
Liabilities/GDP 2010	1.134* (0.474)	1.871** (0.427)	3.414** (0.505)
(Liabilities/GDP 2010)^2	-0.445 (0.301)	-0.661** (0.252)	-1.156** (0.325)
Stand Alone Rating	0.798** (0.043)	0.861** (0.041)	
GDP per Capita 2009 (measured in $10.000)	0.048** (0.005)	0.270** (0.044)	0.287** (0.036)
Public Debt 2009	0.003 (0.002)	0.002 (0.002)	0.002 (0.003)
State Bank	0.902** (0.167)	0.928** (0.151)	0.917** (0.139)
Subsidiary	-0.017 (0.131)	0.391** (0.093)	0.681** (0.096)
Number of banks	444	657	832
Number of countries	59	74	77

This table presents ordered probit estimates of equation (1). Dependent variables: Moody's overall ratings and Fitch overall ratings. Standard errors are given in parentheses. *, **: coefficients show marginal effects and are statistically significant at the 5 and 1 percent level, respectively.

6. Concluding comments

Our results suggest that rating agencies Fitch and Moody's incorporate the risks that a bank can become too-big-to-fail and too-big-to-rescued by its home country. Both the coefficients of bank size and the quadratic term of bank size turn out to be significant in most regressions explaining credit ratings of both rating agencies. As the coefficient of bank size is positive while the coefficient of the quadratic term is negative, there is a hump-shaped relationship between size and credit rating. An increase in size is at first beneficial as the bank attains a too-big-to-fail status resulting in a higher credit rating, but at some point credit ratings decrease as the bank becomes too-big-to-be-rescued.

Our results are broadly in line with Buiter and Sibert's (2008) argument that banks located in the euro area are better off as they receive a higher credit rating, when controlling for systemic relevance and other bank-specific factors and characteristics of the home country. The monetary union effect on banks' credit ratings may be affected by the period under investigation. Our ratings refer to August 2011, when the European sovereign debt crisis was at its height. This implies that, if anything, the EMU effect is underestimated. At the time, several countries in the euro area saw their borrowing conditions worsening rapidly, making it less likely that banks located in these countries would receive support from their government.

Little support has been found for De Grauwe's (2011) conjecture that monetary union members have a more limited capacity than countries outside EMU to bail out banks. The impact of the public debt-to-GDP ratio on credit ratings is not different for banks located inside and those located outside the euro area. In most regressions the public debt variable turns out to be insignificant, suggesting that the fiscal capacity of countries to support ailing banks has only limited impact on banks credit ratings. Our results also suggest that the impact of size is also not different across EMU-based banks and banks based outside EMU.

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APPENDIX A

Overall Rating

	Moody's	(N)	Fitch	(N)	Numeric Value OLS	Numeric Value Ordered Probit
Investment Grade	Aaa	(7)	AAA	(5)	21	16/15*
	Aa1	(13)	AA+	(1)	20	16/15*
	Aa2	(34)	AA	(19)	19	15
	Aa3	(49)	AA-	(62)	18	14
	A1	(55)	A+	(64)	17	13
	A2	(42)	A	(72)	16	12
	A3	(42)	A-	(77)	15	11
	Baa1	(27)	BBB+	(57)	14	10
	Baa2	(25)	BBB	(70)	13	9
	Baa3	(32)	BBB-	(60)	12	8
Speculative Grade	Ba1	(18)	BB+	(37)	11	7
	Ba2	(32)	BB	(27)	10	6
	Ba3	(31)	BB-	(17)	9	5
	B1	(10)	B+	(23)	8	4
	B2	(5)	B	(32)	7	3
	B3	(15)	B-	(28)	6	2
	Caa1	(7)	CCC+	(0)	5	1
	Caa2	(0)	CCC	(5)	4	1
	Caa3	(0)	CCC-	(1)	3	1
Default Grade	Ca	(0)	CC	(0)	2	1
	C	(1)	C	(0)	1	1

*The three highest categories are merged for Fitch and the highest two for Moody's

Stand Alone Rating

Moody's	(N)	Numeric Value	Fitch	(N)	Numeric Value
A	(1)	13	A	(0)	10
A-	(0)	12	A/B	(16)	9
B+	(10)	11	B	(76)	8
B	(11)	10	B/C	(148)	7
B-	(23)	9	C	(146)	6
C+	(42)	8	C/D	(89)	5
C	(57)	7	D	(99)	4
C-	(90)	6	D/E	(58)	3
D+	(71)	5	E	(18)	2
D	(45)	4	F	(7)	1
D-	(53)	3			
E+	(36)	2			
E	(8)	1			

APPENDIX B

VARIABLE NAME	DESCRIPTION	DATA SOURCE
Dependent variables		
Overall Credit Rating	Rating that assesses both a bank's standing alone capacity and the likelihood of external support	Bankscope
External Support Rating	Fitch's support rating which reflects the likelihood of receiving external support	Bankscope
Explanatory variables		
Monetary Union	Dummy variable that is one when a country is member of EMU and zero when it is not	
Systemic size	Ratio of bank liabilities to GDP of the bank's home country	Bankscope, World Development Indicators (WDI)
Control Variables		
Public Debt	Central government nominal debt relative to nominal GDP	Bankscope
GDP per capita	GDP per capita in thousands of current (2010) US dollars	WDI
Stand Alone Rating	Intrinsic capacity of a bank to meet its financial obligations	Bankscope
Assets	Total amount of bank assets	Bankscope
Bank liabilities/ Banking Sector Liabilities	Liabilities of a bank divided by the total amount of liabilities of a banking sector	Bankscope

APPENDIX C

Overview 30 Biggest Banks

Rank	Bank Name	Country	Liabilities to GDP Ratio in 2010
1	UBS AG	Switzerland	2.571
2	Credit Suisse AG	Switzerland	1.970
3	Danske Bank A/S	Denmark	1.784
4	Nordea Bank	Sweden	1.623
5	Dexia	Belgium	1.589
6	ING Bank NV	the Netherlands	1.532
7	Banco Santander	Spain	1.079
8	Bank of Ireland	Ireland	1.048
9	Rabobank	the Netherlands	1.044
10	Dexia Credit Local	Belgium	1.031
11	BNP Paribas	France	0.998
12	Arab Bank plc	Jordan	0.997
13	Barclays Bank	United Kingdom	0.995
14	Fortis Bank	Belgium	0.939
15	Allied Irish Banks	Ireland	0.923
16	DBS Bank	Singapore	0.882
17	Royal Bank of Sc	United Kingdom	0.871
18	KBC Bank	Belgium	0.751
19	Deutsche Bank	Germany	0.748
20	Oversea-Chinese Banking Corporation	Singapore	0.717
21	Caixa Geral de Depositos	Portugal	0.690
22	United Overseas Bank	Singapore	0.670
23	Bank Audi Sal	Lebanon	0.670
24	Skandinaviska Enskilda Banken AB	Sweden	0.670
25	Lloyds TSB Bank	United Kingdom	0.669
26	DnB NOR Bank	Norway	0.634
27	Société Générale	France	0.564
28	UniCredit Spa	Italy	0.561
29	Banco Comercial Português	Portugal	0.542
30	HSBC Bank	United Kingdom	0.533

Overview Bank Origin

Country	Number of Banks	Country	Number of Banks
Armenia	1	Lebanon	3
Argentina	3	Sri Lanka	1
Austria	12	Morocco	3
Australia	16	Mexico	11
Azerbaijan	2	Malaysia	11
Belgium	15	Niger	1
Bulgaria	2	Nigeria	7
Brazil	25	The Netherlands	14
Belarus	2	Norway	11
Canada	15	Panama	6
Switzerland	8	Peru	2
Chile	3	Philippines	6
China	21	Poland	4
Colombia	3	Portugal	8
Costa Rica	2	Romania	2
Czech Republic	1	Russia	35
Germany	44	Sweden	12
Denmark	2	Singapore	7
Dominican Republic	3	Slovenia	5
Egypt	3	El Salvador	1
Spain	45	Thailand	12
Finland	1	Tunisia	3
France	39	Turkey	16
United Kingdom	50	Taiwan	1
Georgia	2	Ukraine	4
Greece	9	United States	177
Guatemala	1	Uruguay	3
Hong Kong	2	Venezuela	3
Hungary	2	Vietnam	2
Indonesia	6	South Africa	9
Ireland	9		
Israel	3		
India	10		
Italy	46		
Jordan	5		
Japan	19		
Kenya	1		
South Korea	12		
Kazakhstan	7		

The numbers of banks in each country is calculated by counting the number of global ultimate owner country codes. The list is based on the largest sample; Fitch support rating.