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Quantifying and Explaining Implicit Public Guarantees for European Banks

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ABSTRACT

This study provides estimations of public implicit guarantees over the period 1997 to 2012 using a rating-based model. The investigation focuses on a sample of 45 large, listed European banks. It appears that the main element for determining the value of the public subsidy is the intrinsic strength of the bank. In addition, we provide evidence on the importance of guarantor strength on the value of the implicit guarantee: a higher sovereign rating of a bank's home country leads to larger implicit subsidies for bank' debt. Our findings also suggest that the recently observed decrease in the value of implicit subsidies goes beyond the decline in European sovereigns' strength. Rather, it is consistent with the implementation of resolution regimes and practices moving from a "bail-out" resolution policy to "bail-in" recapitalizations. Bank insolvencies would be handled in a more explicit context. Therefore, expectations on implicit public support are reduced.

Keywords: banks, implicit subsidy, ratings, resolution.
JEL classification: G3, G21, G28

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Garanties publiques implicites offertes aux banques européennes : valeurs et déterminants.

Résumé

Cette étude fournit des estimations de garanties implicites publiques pour la période de 1997 à 2012 à l'aide d'un modèle basé sur les notations financières. L'analyse se focalise sur un échantillon de 45 grandes banques européennes, cotées en bourse. Nous démontrons que le principal élément déterminant de la subvention publique implicite est la solidité intrinsèque de la banque. En outre, l'analyse met en évidence l'importance de la capacité du garant à soutenir les banques: une notation souveraine de qualité supérieure est associée à de plus grandes subventions implicites pour la dette bancaire domestique. Nos résultats suggèrent également que la réduction récemment observée dans la valeur des subventions implicites va au-delà de la réduction engendrée par les dégradations des souverains européens. Les baisses récentes des valeurs des subventions implicites sont compatibles avec les régimes et les pratiques de résolution des crises bancaires qui proposent de limiter les sauvetages publiques (bail-outs) et de passer à une politique de résolution par recapitalisation interne (bail-in). Ainsi, les faillites bancaires seront traitées dans un contexte plus explicite. Par conséquent, les anticipations d'intervention publique pour éviter les faillites bancaires sont réduites.

Mots clés : garantie publique implicite, banques, régulation, résolution bancaire, rating.
Classification JEL : G3, G21, G28

1. Introduction

The financial crisis that peaked in 2008 revealed many financial system inadequacies, to be addressed by financial regulators and related academicians. In particular, it raised questions that were discussed only marginally before. Beyond the need to restructure the current regulatory framework to improve the liquidity and capital adequacy for financial institutions, governments had to approve and support large fiscal packages to prevent the risk of the run-over of banks in the distressed financial system, acting as a "guarantor of last resort". Therefore, unprecedented amounts of public money have been injected into banking systems to prevent bank' failures. This injection of money objectively highlights the importance of "implicit guarantees" given by governments for the distressed financial system.

The reaction of public authorities to the financial crisis focused on a specific characteristic of the banking system: the activity of certain banks is essential and irreplaceable for the entire economic system, mainly due to the large size and interconnections of the banks with other sectors of the economy. In other words, the estimated cost of liquidation for such "systemically important" financial institutions is so high that public authorities' cannot overlook the funding needs of such banks in times of stress. Thus, the risk of default of financial institutions considered "too-big-to-fail" or "too-interconnected-to-fail", can be reduced by the (near) certainty that the government will support these institutions to avoid their bankruptcy and greater financial and social distress.

Therefore, support activities by government authorities provide significant advantages for these beneficiary banks. First, the expectation of public guarantee leads to an increase in the value of the affected debt relative to non-beneficiary banks or corporate entities from other sectors. Second, the beneficiary banks gain access to funding markets and cheaper resources because the banks' effective risk exposure will be limited. Consequently, the risk premiums paid to investors in banks' debt do not reflect the losses they would have incurred if the bank defaults. Therefore, this results in a funding cost advantage for beneficiary banks, although the guarantee itself is "implicit".

To the extent that this subvention is tacit, there is no *ex-ante* commitment or a concrete evaluation method. Recent empirical literature focuses on American and Anglo-Saxon banks to analyze implicit subsidies for their risky debt. Differences in estimates result from the different evaluation methods used by the authors. Oxera (2011) assesses the value of implicit subsidy for the British banks using a contingent claims model. He calculates the expected amount that the government will need to inject to prevent the default of the bank as the bank's future asset value decreases beyond a given threshold. However, in a comparative study of various approaches, Noss and Sowerbutts (2012) conclude that an overestimation was made with the contingent claims model in implicit guarantee evaluation.

In our paper, we employ a rating-based approach to implement both an assessment and an empirical framework for implicit public guarantees for several reasons. First, it allows for a forward-looking estimation of government intervention that is not considered in a size-based approach. Second, compared with a contingent claims model, a rating-based approach allows

us to account only for government subsidies and exclude deposit or parental guarantees.[2] The rating-based approach avoids criticism of the dynamic modeling of the bank's future asset value and its computed statistical distribution.

The rating data issued by Moody's is matched with annual balance -sheet and income -statement data from Bankscope. The paper quantifies the value of implicit guarantees for a sample of 45 large, listed European banks from 17 countries from 1997 to 2012. Since the start of the financial crisis and, more precisely, from 2007 to 2009, huge amounts of public money have been injected into European banking systems. Our estimations confirm historical values of the implicit guarantees calculated as a spread between an intrinsic rating and a global rating (including government support) during these years. Therefore, as the first step of our empirical analysis, the paper explains why some banks receive greater implicit subsidies compared to others.

In the second step of our empirical analysis, we test to what extent the financial strength of the guarantor (government) affects the value of implicit guarantees. This test results from recent tensions over sovereign debt markets that are consistent with the reduction in the value of implicit subsidy. We quantify this as a "supply" effect for public subsidies. Furthermore, the recent decrease in the value of implicit subsidies for banks' risky debt is consistent with new regulatory and resolution practices that are to be implemented in European countries. These coordination efforts anticipate the development of a cross-border resolution mechanism for bank failure within the European Banking Union. According to these practices, unsecured debt holders will incur losses in case of bank failures. Thus, such debt holders anticipate decreased intervention and willingness from governments to support the risky debt of distressed banks. As a result, the value of implicit guarantees as well as banking system distortions are reduced.

This paper is organized as follows: Section 2 provides background information concerning implicit public guarantees. Section 3 describes the dataset and the methodology employed. Section 4 presents the empirical analysis and the main results. Section 5 concludes the paper.

2. Implicit public guarantees

In general, guarantees can be considered "strategic" instruments because they provide consumer protection and stability, and facilitate access to market funds. If the pricing is appropriate, guarantees can be efficient; thus, their existence does not induce a moral hazard problem. Moreover, for explicit guarantees, the insurer can elaborate transparent and equilibrated contracts.

[2] The predicted value of the government intervention is calculated as the amount needed to insure the value of all liabilities of a bank. Thus, the predicted value can also capture the explicit guarantees of the deposits. Another constraint of the contingent claims approach is modeling of the total assets value, which assumes an estimation of the correlation between the assets of individual banks. However, this dataset is not available for academic studies.

We cannot say the same regarding "implicit" guarantees. As the name indicates, there is no ex-ante legal and explicit commitment for these guarantees, and in most of the cases, the amount is not made public. Therefore, there are no premiums paid in return. From an economic point of view, the fact that a bank can benefit from government support without actually paying any corresponding fees allows us to analyze this "government protection" as a subvention.

More explicitly, the implicit guarantees can be defined by the expectation that the government will provide a bailout in case of financial distress. Hence, implicit public guarantees represent a transfer of resources from the government for the benefit of the banking sector in order to avoid bankruptcies. Public support can be materialized by liquidity injections or the repurchase of banks' risky assets. The crisis highlighted that there was a public willingness to support "too-big-to-fail" (TBTF) or "too-interconnected-to-fail" financial institutions.

Although costly for governments and taxpayers, banks' public recapitalizations could be explained by a simple (and 'rational') calculation. In the case of a crisis, bank losses in bankruptcy would most likely be higher than the cost of ex-ante public punctual support. Based on the doctrine that the government will not allow large banks to fail because their failure would significantly disrupt the entire economy, implicit guarantees become a real source of moral hazard. The crisis demonstrated that several categories of investors benefitted from the public guarantee, from low-risk debt-holders (senior debt-holders) to subordinated debt-holders. This distortion affects market discipline, as investors would no longer have the incentive to supervise the risk-taking behavior of banks. Moreover, after the crisis, an even larger problem emerged. Banks that benefitted from public subsidies became "too-systemically important-to-fail". The main source of this distortion originates from the funding cost advantage induced by the reduced probability of default and lower risk premiums paid to investors for the beneficiary banks relative to non-beneficiary banks.

Therefore, market participants no longer view this implicit government guarantee phenomenon as a myth but as a reality. It is essential to quantify and analyze these distortions for future policy implications.

3. Quantifying implicit public guarantees

As the word "implicit" indicates, there is no established measure of public implicit guarantees. Empirical studies and methodological reflection for quantifying implicit guarantees for banks' debt experienced a new dimension after Lehman Brothers defaulted in 2008, with most of the following literature focusing on British and US banks. The early literature measured implicit guarantees as a funding cost difference between a privileged bank and a non-privileged bank or financial corporation (Kwast and Passmore (2000), Soussa (2000), Baker and McArthur (2009)). Subsequent literature both quantifies the value of implicit guarantees and analyzes their effects on funding cost.

We focus on European banks because they compromise an interesting case study for our analysis. First, European banks are interesting because of the interactions that emerged during the financial crisis between banking and public debt. Second, European banks are interesting because of the essential role they and the entire banking sector play in European economic activity. The structure of the European banking sector represents a key element in our methodology because banks play an important role in the economic sector. Finally, the study of implicit government guarantees is essential in the context of a restructuring regulation and for the implementation of new resolution mechanisms. The issue of the creation of a banking union stimulates more interest in studying the distortions that characterize European banking systems. To our knowledge, there is no academic study that focuses on a sample of large European banks.

Two main estimation methodologies can be found in the literature. The first is a *funding advantage model* that estimates the implicit subsidy as a reduction in the cost of funding due to public protection in distress. Within this model, a size- and/or a rating-based approach is employed. Using a rating-based approach, Haldane (2009, 2010, 2012) quantifies the implicit guarantees of the world's 29 biggest banks at $700 billion between 2007 and 2009. Only six English banks received approximately $46 billion of public funds[3] in 2010. In terms of the funding cost advantage, public guarantees for TBTF banks are estimated at approximately 56 basis points (bp) during the crisis period (Li et al., Moody's 2011). In a more refined study, Ueda and di Mauro (IMF, 2012) highlight the increased advantage of public support between 2007 (60 bp) and 2009 (80 bp). With the second model, called the *contingent claims* model, the amount of public resources needed to prevent a bank failure is evaluated as the shortfall in asset value compared to a given threshold[4]. Using this approach, Oxera (2011) evaluates the annual amount of implicit government guarantees for English banks at more than $120 billion. This second method is much more complex because it requires modeling the future distribution of banks' assets. Thus, this method it is very sensitive to modeling assumptions.

3.1.Data

The main data used in our study consist of bank ratings provided by Moody's. We retain two main ratings: an "all-in" rating accounting for the global strength of the bank and a "stand-alone" rating describing the banks' intrinsic strength. Both ratings represent an assessment of banks' abilities to meet their commitments on time, but only the second rating excludes all external support. Thus, the difference between these two ratings is measured in the number of notches and represents the value of expected implicit public guarantee for banks' debt. We use ratings for a sample of 45 large, listed European banks from 16 countries to quantify the value of implicit public guarantees from 1997 to 2012.

The financial ratings assigned to banks by the three main rating agencies vary significantly. We retain Moody's ratings for reasons of data availability and rating methodology

[3] £40 billion (Noss and Sowerbutts, 2012)

[4] This threshold is given by the future value of the capital requirements ratio. A set of assumptions is made under this approach (Oxera, 2011).

transparency[5]. However, there are different starting dates on which European banks have been rated. Thus, an unbalanced panel of 627 observations will be used in this analysis.

To use the ratings described above in our empirical analysis, we assign numerical values to each qualitative assessment. The *Long-Term Deposit Rating (foreign currency)* accounts for the global rating, rated from Aaa to C3. We assign numerical values from 1 to 25, with 1 representing the highest rating (Aaa). The intrinsic rating designed by the *Bank Financial Strength Rating* excludes all external support[6]. This rating's scale runs from A to E. We assign numerical values from 1 to 14 for this rating, with 1 denoting the best quality intrinsic capacity (A). Appendix A defines and describes the main ratings for banks.

We also use sovereign ratings, again provided by Moody's. Sovereign ratings serve as an explanatory variable in our second section and represent an assessment of the sovereigns' ability to provide support to the banking sector in times of distress. Sovereign ratings also provide general control for the macroeconomic environment of our sample countries. The scale for sovereign ratings is the same as that for the global rating, varying from Aaa to C3. The numerical value of 1 is considered the best quality of public debt (Aaa), denoting a higher capacity for support.

In addition to the rating database manually collected from Moody's, accounting data are used to explain the structures and business models of banks. Balance-sheet and income statement data on an annual basis is taken from Bankscope.

3.2. Methodology

Given that our outcome variable is not directly observable, we are going to compute it using a rating-based approach. This approach has several advantages relative to other models. A size-based approach, for example, includes no relative appreciation of banks' risk besides the size effect. Thus, the size-based approach considers that only large banks can benefit from public guarantees. Contrary to this method, the rating model has the advantage of a better assessment of the risk because it is already incorporated in Moody's assessment and considers a forward-looking evaluation of the likelihood of receiving government protection. Moreover, ratings are largely used in bond pricing as an appraisal of the involved risk. Relative to a contingent claims approach, the rating model allows easier and more transparent implementation. The modeling of banks' assets is based on strong assumptions and, additionally requires the estimation of a correlation between different assets held by individual banks. Thus, such data are not publicly available.

[5] Our choice is based on studies of Van Roy and Vespro (2012) and Tarashev and Packer (2011), who analyzed different methodologies used by the three major rating agencies, Moody's, Fitch and Standard & Poor's. We exclude the larger Moody's database in favor of the two other rating agencies.

[6] For our sample of large, listed banks, external support describes governmental support. It was already empirically proven in the literature that governmental support is the most important type (Schich and Kim, 2012). Our sample of banks is composed of large institutions (holdings) for which parental support could not be considered.

In our study, we apply our analysis to a sample of large, listed European banks. Therefore, the implicit subsidy provided by government is computed as the difference in notches between the intrinsic and the global rating[7]. The calculated value of the implicit guarantee of a bank represents an assessment of the probability of receiving government support. Appendix B provides a detailed description of the evolution of implicit government guarantees. We notice a significant change in 2007 when public guarantees reached historic values. However, the value of public subsidies has decreased since 2010.

From an econometric perspective, the nature of our analysis suggests that cross-section estimations could be problematic because of endogeneity. The main sources of endogeneity that can cause bias in our estimates generally fall under three categories: omitted variables, simultaneity and measurement errors (Wooldridge, 2002). For our analysis, we consider the most disturbing source of endogeneity to be the omitted variables. We can explain this issue by the implicit nature of our dependent variable, the public subsidy. For this reason, several econometric specifications will be tested. Finally, a fixed effects panel approach toward a sample of Europeans banks corrects for the endogeneity bias. Furthermore, this econometric specification allows us to account for possible bias from correlations among unobserved effects and observed country heterogeneity.

4. Empirical analysis and main results

The main objective of our analysis is to examine to what extent implicit guarantees can be explained by the domestic economic environment of a country and by the legislation and regulatory level imposed in different countries. We first determine how banks' characteristics can explain the differences in the value of implicit guarantees received from the public authority.

4.1. Why do certain banks receive greater implicit subsidies?

In general, ratings are opinions about the creditworthiness of a corporation, reflecting both quantitative risk assessments and a subjective evaluation by a rating agency of the expected losses that the entity could incur in the future (Moody's Investors Service, 2007, 2011). However, there is no explicit rule or formally detailed methodology that can explain financial, non-financial or sovereign ratings.

A common practice of the main rating agencies is to assess quantitative coefficients to different rating criteria and thus compute an average score that serves as a rating. For example, in the case of banks, for the *Financial Strength rating*, Moody's takes into account several factors, such as risk positioning, financial fundamentals, and operating and environmental factors. However, the numerical coefficient assessed to each of these factors

[7] The notches difference is calculated in this sense according to the numerical scale. According to this, the intrinsic rating is higher than the global rating because it involves a higher risk of default. Fragile banks have higher numerical values.

can vary among banks globally in several important ways. Moreover, the analyst's interpretation of such metrics provides further insight and analysis, and places a subjective element on the rating process.

Our main belief is that this subjective evaluation of banks' strength could contain additional information about the probability of receiving public support in times of distress. Our belif also involves a subjective appreciation of the future benefit of the rated bank. In this section, the paper tries to explain why some banks receive greater implicit guarantees from public authorities and examines the non-explicit factors that cause the release of public guarantees for some banks and not for others.

For a first step, we explain to what extent the intrinsic strength of banks influence the value of implicit guarantees that the government offers to banks. Intuitively, the implicit guarantee should be a negative function of the bank capitalization, as banks with a higher loss-absorbency capacity (high capital ratio) will be more stable (Kashyap and Stein (2010)); better capitalized banks will need (ask) for weaker public intervention in times of distress (BCBS, 2011). Thus, the funding structure is essential because it represents an important source of information on the bank's stability. Nevertheless, asset structure is indispensable for bank risk assessment (Hau et al., 2012). For example, a bank's liquidity is revealed as an important factor for bank loss assessments during the crisis as it faces funding stress. The amount of liquid assets allows evaluation of a bank capacity to meet its maturities using its liquid resources (Moody's (2013)). As the intrinsic rating captures the data on banks' balance-sheet structure, considering intrinsic rating as a control variable allows us to eliminate the initial state of a bank's risk. Thus, we are going to explain the implicit guarantees by estimating the intrinsic risk of the bank. Moreover, we cannot consider a linear relationship between the values of implicit guarantee *(I_Guarantee)* and the intrinsic rating *(IR)*, as the rating spread is not the same for banks in the same rating class[8]. For this reason, we take the squared term on intrinsic rating as an explanatory variable (IR^2).

Furthermore, after regressing the implicit guarantee on "initial" risk state, we explain why the value of the implicit guarantees[9] varies within the banks in our sample. Relative to the insurance market, where we can observe the supply and demand of insurance contracts, we can consider the intrinsic risk of the bank to represent the "demand" for implicit public guarantees; therefore, the government will play the role of the "supplier" of implicit public guarantees.

Our econometric specification posits that the implicit guarantee for bank *i* at time *t* is given by:

$$I\_guarantee_{it} = \alpha_1 IR_{it} + \alpha_2 IR_{it}^2 + \alpha_3 Crisis + \alpha_4 X_{it} + v_{it} \quad (1a)$$

[8] There is no linear relationship between implicit guarantees and intrinsic rating. In 2011, for example, both BNP Paribas and Banco Bilbao Vizcaya Argentaria had an intrinsic value equal to B- (5 in numerical value). However, the implicit guarantee varies for these two banks: BNP Paribas has an implicit guarantee estimated at 2 notches, and Banco Bilbao Vizcaya Argentaria has only one notch.

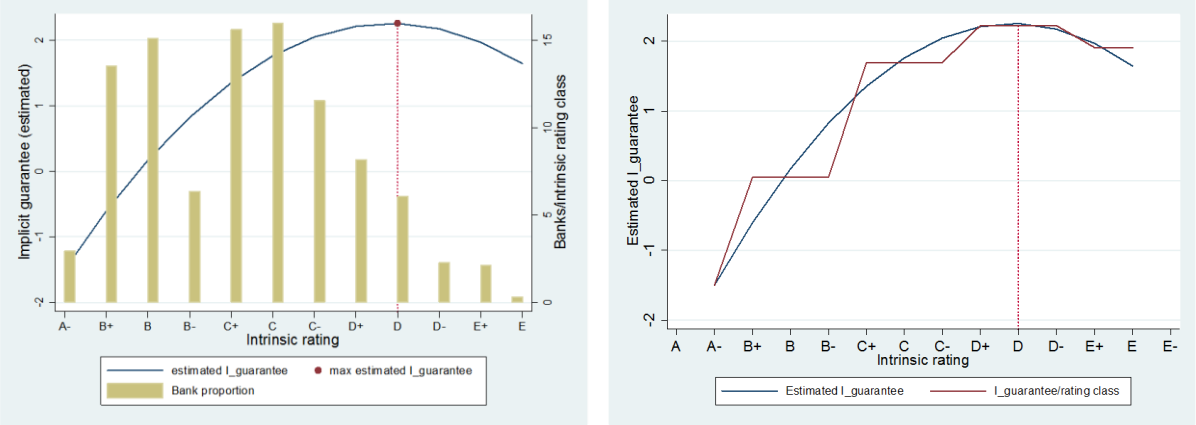
[9] After eliminating the initial state effect linked to the intrinsic risk of the bank, we can consider a "pure" government guarantee.

$$v_{it} = \alpha_i + \varepsilon_{it} \quad (1b)$$

where *Crisis* is a binary variable that controls for global crisis and/or sharp changes in the value of our explanatory variables. It takes the value 1 for the crisis period, 2007-2012 (0 otherwise). We consider X a vector of control variables that can affect the value of implicit guarantees. X accounts for other implicit factors that can have a direct effect on public guarantees for banks: balance-sheet size, the systemic importance of the bank, balance-sheet liquidity and the bank's business model. The residual term includes a time-invariant bank specific effect α_i and a random error term ε_{it}.

Table C1 in the appendix reports the results from estimating our fixed effects estimation. Column 1 reports the results from our baseline regression, explaining the implicit guarantees with the intrinsic rating of the bank. Taking into account this estimation, the implicit guarantee can be presented as follows:

Figure 1: Estimated value of implicit guarantees



Notes: 1a (left): Implicit guarantee and intrinsic ratings distribution 1b (right): Implicit guarantee by IR (blue line) and by classes of IR (red line). Source: Moody's ratings and Author's calculations.

From this estimation, we determine the direct relationship between the value of implicit guarantees and the intrinsic strength of the banks. The results highlight an increasing and concave relationship. Thus, the maximum of the estimated function corresponds to an intrinsic rating of D (i.e., numerical value of 10). This means that banks rated beyond D receive fewer public guarantees in absolute value than banks with a better intrinsic strength. This also means that the guarantor (sovereign) has no incentive to support the banks with weaker intrinsic strength because the associated risk of default is too high. The function between implicit public guarantees and the intrinsic strength of banks is confirmed by the estimation that takes into account the risk class to which each intrinsic rating belongs.

The second and third columns report the results for estimations that account for other banks' characteristics: business model and balance-sheet liquidity. While liquidity is never a significant explanatory variable for the value of the implicit guarantee, the business model is

significant only during the crisis[10]. The estimated coefficient of the interaction variable *Business model x Crisis* is negative and highly significant, showing that – during the crisis, public authorities seem to consider the commercial activity of the bank (the "traditional" activity of lending and deposit collection).

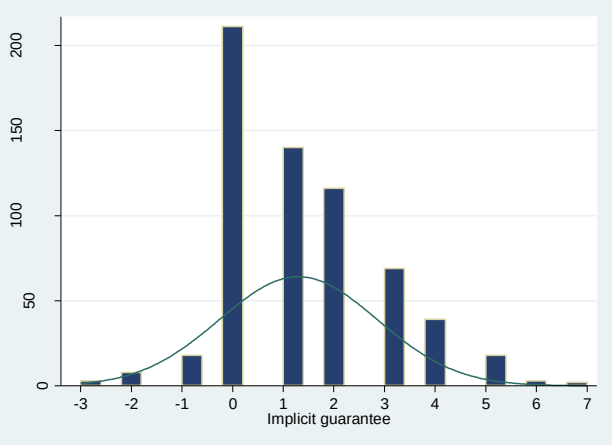
Other bank characteristics can definitively influence public authority decisions to intervene in order to avoid a bank' default. The size of the bank (column 6) and particularly its systemic importance (column 5) can be essential elements for the distribution of public implicit guarantees. Banks' interconnections proved to be a trigger point for negative shocks during the crisis. Thus, for systemically important institutions, there is a stronger probability of government support than for medium and small banks. Therefore, for banks categorized as TBTF or TITF, the default risk is reduced by the quasi-certainty that the government will support banks to avoid bankruptcy.

Finally, the results reported in column 9 emphasize that the intrinsic strength of banks is the principal factor to consider when financial executives anticipate the probability of government intervention to support banks in times of distress. When controlling for other bank characteristics, the impact of intrinsic rating on public guarantees is relatively similar.

4.2.Alternative regressions

Each point in the empirical distribution of our dependent variable (*Implicit guarantee)* is calculated as a spread of two ratings. Therefore, our data are intrinsically integer-values. In that case, it would be reasonable to use a Poisson regression for the empirical analysis of a sample of European banks.

Figure 2: Implicit guarantee frequency distribution



Notes: Implicit guarantee distribution. The *Implicit guarantee* is computed as the difference between the *Intrinsic rating* and *Global rating* (according to Appendix A numerical scale). Thus, the values recorded on the *x-axis* represent the difference in number of notches between the two ratings previously mentioned. The continuous line represents the normal distribution.

[10] Both 2007 and 2008 were tested as a breakpoint point for our main variables. The estimated coefficient is higher and strongly significant for 2007 than it is for 2008. Therefore, we consider the period from 2007 to 2012 as a period of crisis.

The Poisson regression model considers the equality between the conditional mean and conditional variance of the dependent variable. According to our model, the mean and the variance of the *Implicit guarantee* should be the same within each cluster of banks. We test this assumption using a negative binomial distribution, which allows for over-dispersion in the dependent variable.

We first implement a Poisson regression for our empirical model. Table C2 in Appendix C reports the results for the Poisson regression equivalent to the econometric specification (1a). Estimated coefficients confirm previous results on the impact of intrinsic risk of the banks on the expected public guarantee for banks' debt. The chi-squared "goodness-of-fit" tests whether the model fits our data and we conclude that the model fits our data reasonably well because the test is not statistically significant (Prob > chi2 (582) above the threshold of 0.05). In the next step, to check for over-dispersion parameter alpha, we estimate the same model using a negative binomial distribution. The results are reported in Table C3 in the appendix. The over-dispersion alpha coefficient suggests that negative binomial regression does not fit the data as well as the Poisson regression. Thus, the preferred model for the robustness check for our fixed effects model is the Poisson regression.

However, this approach will be considered as robustness check for the fixed effects model used previously for several reasons. First, *Implicit guarantee* distribution involves negative values[11]. Thus, to perform Poisson regressions for our sample, we must ignore those negative values. Thus, we prefer the fixed effects model. Second, by comparing the amount of variance of *Implicit guarantee* explained by the main predictor, the *Intrinsic rating*, we notice that the R^2 for the fixed effect model is greater than the R^2 for the Poisson model. This means that the fixed effects can better explain the variation of the implicit guarantee for each of the alternative regressions.

4.3. Interconnections between banks and sovereign debt. Implications on implicit government guarantees.

The European financial and sovereign debt crises showed that corporate ratings are influenced by sovereign ratings. Hau et al.(2012) show that the sensitivity of long-term bank ratings changes according to changes in the sovereign rating and depend on the economic cycle and countries' economic conditions.

In particular, two main sources of the interactions between risky bank debt and sovereign debt should be discussed. The first source is given by the structure of the bank's assets. In times of distress, banks tend to increase their exposure to sovereign debt in order to preserve the value and liquidity of their assets. The crisis put a sharp spotlight on banks' asset structures, especially with respect to domestic exposure but also to the debt of other European countries. The second source of interactions comes from the capacity of the public authorities to support

[11] Negative values can appear between 1998 and 2002 for banks such as Bank Polska Kasa Opieki SA (Poland), Bankinter SA (Spain), BRE Bank SA (Poland), OTP Bank Plc (Hungary). These banks are not considered systemically-important institutions. This negative difference between the two ratings can be explained by the fact that at that time, rating methodologies were not well synchronized. Thus, the intrinsic rating is lower than the global rating and there are 29 negative observations in total.

banks' risky debt. Responding to the 2007 financial crisis, governments acted as a "guarantor of last resort" of the banking system. Thus, governments' reactions to shocks boosted public debt and destabilized budgetary policy.

Our study contributes to the literature on interactions between banking and sovereign debt in that it analyzes the extent to which sovereign strength influences the value of implicit public guarantees offered to banks. For this purpose, we use country ratings to explain recent fluctuations in the value of implicit guarantees as it captures both the strength of the domestic government and the economic conditions. These factors could be essential for the "supply" effect of implicit public guarantees.

An important breaking point can be observed in the evolution of sovereign debt rating in 2009, when several European countries were downgraded by the main rating agencies. The downward reevaluation could have induced additional risk for the banking sector and the general economy as a result of the weakened financial capacity of European governments to guarantee banks' debt. Therefore, the value of expected guarantees could be reduced.

To test this framework, we first evaluate the correlation between the *Intrinsic* and the *Sovereign ratings* to decide if they can be simultaneously estimated in the same model. Table D1 in the appendix shows the estimation details. We note that the effect of one explanatory variable does not significantly influence the effect of the second explanatory variable (column 3). Thus, we can test the weights of the two main predictors on the variation of implicit public guarantees: a "demand" effect coming from bank *i* and a "supply" effect coming from the guarantor.

Thus, the framework proposes testing the impact of sovereign strength beyond the effect that is already considered by the intrinsic rating on implicit subsidies. The econometric specification in a panel setting is:

$$I\_guarantee_{it} = \beta_1 IR_{it} + \beta_2 IR_{it}^2 + \beta_3 Soverg_{it} + \beta_4 Crisis + \beta_5 \left(Crisis_{it} * Soverg_{it}\right) + \beta_6 X_{it} + v_{it}^{'} \quad (2a)$$

$$v_{it}^{'} = \beta_i^{'} + \varepsilon_{it} \quad (2b)$$

where *Soverg* is the rating for the domestic country of bank *i* at period *t*, *X* is a matrix of control variables,[12] and v_{it} is the residual term that can be decomposed into an individual time-invariant fixed effect $\beta_i^{'}$ and a random effect ε_{it}.

Column (1) in Table D2 presents the results of estimating the *Implicit guarantee* on both *intrinsic risk of the bank (IR)* and *financial strength of the guarantor (Soverg)*. As indicated, the negative and highly significant coefficient of the sovereign rating suggests that the strength of the guarantor is an important determinant of implicit guarantees for banks' debt. The main justification for this result is that the governments under distress (corresponding to a higher numerical value associated to ratings) will have a lower capacity to support the

[12] The vector of predictors *X* contains: banks' business model, size and systemic importance. We also integrate the cross-variable Business-model *x* Crisis.

banking system. Consequently, the expected value of public support will decrease by $\beta_3 = 0.451$ notches when the sovereign rating is downgraded by one notch[13]. Moreover, the interaction variable, denoting the influence of sovereign ratings on implicit guarantees during the crisis, confirms the previous results (last column). However, following Ueda and di Mauro (2012), we control for any possible variation of the initial intrinsic value of banks' balance-sheet due to anticipation of public interventions.

The results presented in the last column in Table D2 show that, in addition to the main variables discussed above, the size of the bank's balance-sheet and the systemic importance of the bank, represent essential elements in defining the expectations of public interventions.

This empirical analysis concludes the fact that implicit public guarantees for banks' debt vary with the banks' balance-sheet structure and business model but also with the capacity of the guarantor (the government) to support banks in times of distress. The implicit guarantee for banks' debt increases with the financial strength of the government. Therefore, sovereign downgrades observed particularly in 2009 and 2010, explain the reduction of implicit government guarantees offered to the banking sector.

This result has important policy implications. The existence of such interconnections between banks and public debt represents a considerable source of contagion, especially for negative shocks. This was a key element in the European sovereign crisis when a two-way transmission channel was brought to the fore. To avoid market distortions and limit the doctrine of implicit public support in the case of financial distress, both national and supra-national efforts should be made. The first recommendation will be to make these public guarantees more explicit and to harmonize fee-setting structures across European countries. Hence, premium charges on such guarantees should take into account the borrowers' intrinsic risk and also governments' own creditworthiness. However, European banks have internationalized activity; therefore, the harmonization of such a solution should also have an across-border dimension.

Another recommendation concerns recent efforts made at the European level to move from a "bail-out" resolution policy to a "bail-in" strategy. This issue will be discussed in the next section.

4.4. New resolution regimes and their impact on implicit guarantees.

We previously showed that the value of implicit public guarantees depends on both the intrinsic risk of the banks and the support capacity of the public authority. Thus, the recent drop in the value of the implicit guarantees can be partially explained by budgetary imbalances of European countries and sovereign ratings downgrades. However, the observed decline in the value of our dependent variable could be consistent with the very recent project of resolution regimes.

[13] Thus, the numerical value of the sovereign rating is increasing by one.

"*If the crisis has taught a single lesson, it is that the too-big-to-fail problem must be resolved,"* declared the ex-U.S. Federal Reserve Chairman Ben Bernanke in 2010. European supervisory authorities became aware of this issue and of the excessive government support offered to banking systems during the crisis. Since then, both national supervisory authorities and European committees have fixed objectives on the implementation of the resolution regimes.

A resolution mechanism is supposed to establish a priority order for debt and shareholders in cases of liquidation while improving the capacity of the banking system to absorb losses and protect taxpayers. This initiative embodies the major consequences of an absence of resolution instruments for policymakers during the crisis and massive public support for their domestic banks during the financial crisis, manifested in an inefficient market discipline (Marquez et al., 2013).

Therefore, our intuition is that the reduction in the implicit government guarantees recorded from 2009 goes beyond the sovereign ratings downgrades and highlights the potentially negative impact of the current efforts of the resolution mechanisms issued within European countries. This insight is based on investors' anticipation of lower (and limited) public interventions to rescue banks in times of severe disturbances as a result of more stringent legislation.

The adopted propositions differ not only according to banking system development and its composition but also according to historical structural factors. Between 2009 and 2012, several European countries advanced the implementation of resolution regimes for the purpose of reducing the public support accorded to banks in distress through so-called "bail-outs". The countries proposed a transition from "bail-outs" (banks' recapitalization by public support) to "bail-ins" (banks' recapitalization by shareholders and creditor fund mobilization). The table in the appendix shows the major advancements of such resolution scheme implementations for European countries. To gauge the impact of resolution regimes on implicit public guarantees in our empirical framework, we introduce a dummy variable called *Resolution_mechanism*. Having a resolution regime in place or a proposal for future implementation of such a mechanism in a country *j* at the period *t* is translated into a value one for our control variable, $Resolution\_mechanism_{jt}$[14].

We propose the following equation:

$$GI_{it} = \delta_1 Y_{it} + \delta_2 Resolution\_mechanism_{jt} + \delta_3 \left(Soverg_{jt} * Resolution\_mechanism_{jt}\right) + \delta_4 Crisis + \delta_5 S_j + v_{it}^{''} \quad (3a)$$

$$v_{it}^{''} = \delta_i^{'} + \varepsilon_{it} \quad (3b)$$

[14] For Germany, for example, the variable takes the value 1 from 2010 to 2012 and 0 otherwise. For Denmark, *Resolution_mechanism* is 0 for 1997-2007 and 1 for 2008-2012, as the Danish Financial Stability Act was implemented in 2008. More details are presented in Appendix (Table E1).

where Y_{it} represents a vector of characteristics[15] of t bank i at time t, and S_j represents a vector of structural factors characterizing the supervisory and regulatory framework in country j. We added these control variables to our econometric specification to account for country-specific factors that could influence the implementation of resolution mechanisms and thus the probability of government intervention in times of stress for banks. $v_{it}^{''}$ is the error term, which includes country specific effects $\delta_i^{'}$ and random error ε_{it}.

Table E2 in the appendix presents results of our estimates. The main result of this empirical analysis is that beyond the "demand" (intrinsic strength of the bank) and "supply" effects (a public authority's capacity to support banks in distress), we measure the willingness of public authorities to support banks in distress. The estimated coefficient δ_2 displayed in column (1) highlights the negative impact of resolution regimes on the value of implicit guarantees. This means that investors expect lower public support for banks' debt in countries where efforts to implement a resolution mechanism were already made. Moreover, the results presented in column (2) indicate that potential interactions between the sovereign rating and the introduction of resolution mechanisms significantly reduced the implicit guarantees of bank debt during the crisis. Nonetheless, this could be associated with consequences, such as turbulent times, for banking as well as for sovereign debt and policy reactions.

A significant drop in the value of implicit guarantees for Danish banks is observed in 2011. This could be explained by the implementation of a system for winding up distressed banks. The Danish government decided to apply haircuts to senior creditors and thus two banks defaulted[16]. Consequently, the government decision seemed to be efficient because it reduced investors' anticipation of the amount of state support. However, the impact on implicit guarantees is conditional to a high level of transparency and credibility of public authorities' actions.

In the next step, we precisely control for the legislative and regulatory structure in each country of our panel. We intend to eliminate any confusion on the pure impact of resolution practices on implicit subsidies and to test for implicit guarantee sensitivity to the structures of national banking systems. Thus, we account for several variables, country-specific characteristics that are not considered in rating agency assessments or in resolution regimes. First, we test the impact of restrictions on bank activities (column 5),[17] as diversified and large banks are likely to enjoy more public subsidies than small banks. Second, we test if the ability of private agents to monitor and discipline banks impacts the implicit guarantees (column 6). Then, the supervisory power (column 7) effect is introduced in the regression, and finally, the level of protection on creditors is introduced[18] (column 8).

[15] The vector of banks' characteristics – *Y*, includes the banks' Intrinsic rating and its squared value as well as the banks' size and systemic importance.

[16] Amagerbanken went bankrupt on February 6 and Fjordbank Mors on June 26.

[17] *Restrictions on bank activities*, *Market discipline* and *Supervisory power* are structural indexes provided by Barth, Caprio and Levine (2001 ab, 2003).

[18] This index, issued by La Porta et al. (1997, 1998), aggregates different creditor rights: protection of existing creditors in case of reorganization, hierarchy in distribution of rights in case of bankruptcy, restrictions imposed on creditors, etc. It is scored on a scale from zero to four.

Of these four main structural and legislative factors, only *Market discipline* and *Supervisory power* are econometrically significant in explaining the variation in public guarantees. Weaker values of *Market discipline* indicate better transparency and private monitoring. Thus, the positive highly significant estimated coefficient indicates that weaker public support for banking systems is granted in times of financial stress in countries with improved transparency and a better capacity for private monitoring. The estimated coefficient for *Supervisory power* predicts that powerful supervisory national systems reduce implicit public interventions and impose bail-in practices through shareholder and creditor mobilization. Higher values for this variable suggest greater intervention and sanctioning power of the supervisor, reducing the expectation that public authorities will bail-out banks in distress. Each of these factors does not interfere with the effect of public effort to implement a resolution scheme, as shown by the estimated coefficients in each alternative regression.

To conclude this last section of our empirical analysis, the willingness of European governments seems to significantly affect the amount of implicit guarantees for banks' debt. This imposes an additional effect on the banks' demand for financial support and the guarantor capacity to provide this support. The historical structure of each national banking system also accounts for the distribution of public guarantees. However, it does not fit into the effects of resolution practices, which cannot be questioned.

The issue presented in this section has received interest under the current circumstances of coordination and harmonization of national supervisory authorities at the European level. As the first pillar of the future banking union, the European Central Bank should be the unique supervisor of European banks. New stress tests and regulatory standards should be implemented to ensure better capitalization and liquidity for the banking and financial system. The main objective is to definitively protect governments from bank risks. In this way, the cost of rescuing will affect investors and in a lesser extent taxpayers. The implementation of resolution mechanism is unfinished, thus it could weigh heavily on the willingness of European governments to support their banking systems when they are under high stress. For instance, regulatory mechanisms are not permanently defined[19], but public guarantees persist. However, their value is continuously decreasing.

The institutional advances at a European level should be based on a sure and credible national background to be productive. Without strict national legislation that gives priority to bail-ins and limits governments' willingness to support their national banking system, public guarantees, system distortions and the moral hazard phenomenon may persist.

[19] In the UK reform progress, called Vickers, and at the European level, the ongoing project is Liikanen (2012).

5. Conclusion

The increased interest in implicit public guarantees for risky bank debt emerged from the reaction of governments to the financial stress starting in 2007. Massive amounts of public resources were "offered" to banking systems to avoid spillovers and the degradation of banks' funding structures and the economy as a whole.

Our study quantifies the value of public subsidies for a sample of large, listed European banks using a rating-based approach. Using Moody's ratings, we evaluate the government intervention expectations to support banks in distress as notches saving, which is a better rating than the one corresponding to banks' intrinsic strength. For our sample of European banks, the implicit guarantee represents, on average, two notches saving for the period 1997 to 2012. During the crisis, the average advantage is assessed at 2.5 notches. This value is the difference between the intrinsic and global (including government support) rating.

In the first section of the empirical analysis, we analyze to what extent certain banks receive more public support than others. We notice that implicit guarantees are not a linear function of the intrinsic risk of the bank. Moreover, for banks with a weaker intrinsic strength (worse than a rating of D on the scale proposed by Moody's for the BFSR), the government no longer has an incentive to intervene because the banks are too risky. Additional factors that could influence the government intervention to save banks in distress are the balance-sheet size, the systemic importance of the bank and, during the crisis, the bank's business model. Thus, during the crisis, even banks with lower shares of commercial activity, the so-called investment banks-oriented universal banks, received important amounts of public support. This distortion had important policy and regulatory implications.

Higher amounts of public resources were injected into European banking systems from 2007 to 2009. However, beginning in 2010, the estimated value of implicit guarantees has become weaker. In the second section, we prove that the value of implicit guarantees depends on the characteristics of the guarantor (government). The reduction in the value of implicit guarantees matches the decreasing strength of European governments during the sovereign crisis that began in 2010. We thus conclude that the value of implicit public guarantees decreases with the strength of the bank and increases with the strength of the guarantor.

Beyond the direct impact of the financial strength of the guarantor (sovereign) to support bank debt, there is a new dimension of the "supply" of implicit guarantees related to the willingness of the government to intervene in order to save banks from bankruptcy. We demonstrate that new regulatory and resolution schemes proposed by the national European supervisors and by the European Commission go beyond the declining financial strength of the sovereign and significantly reduce the probability of future bail-outs for banks.

These regulatory measures being implemented could weigh heavily on the willingness of European governments to support their banking systems in cases of high stress. Moreover, the removal of implicit subsidies will help restore market discipline by aligning bank funding costs more closely with risks. Finally, the resolution mechanism could break the observed loop between bank and sovereign debt.

It may be long before public implicit subsidies will be eliminated, although turning them into more explicit guarantees can reduce distortions and moral hazard and also improve market discipline. To provide more relevant values for implicit guarantee, they should be "converted" to funding interest rate advantages. However, bond rates for each bank in our sample are not available; only aggregated indexes for European banks are available, which are irrelevant (or less relevant than our rating-based measure). We hope that future research will develop and use more appropriate data to estimate the debt funding rate advantage due to implicit guarantees and thus, elucidate this issue.

Appendix A

Table A1: Description of variables

Variables	Definition
Intrinsic rating (IR)	"Stand-alone" rating; it corresponds to the intrinsic risk of the bank. It excludes all external support (Source: Moody's BFSR; Moody's (2010)).
Global rating (GR)	Also called "all-in" rating, it accounts for the global strength of the bank, including the expected punctual support for the government (source: Moody's Long-term Rating (in foreign currency)).
Business model	Ratio (Total customer loans+Total customer deposits)/Total assets (Martel and al. (2012), Gambacorta and van Rixtel (BIS, 2013) (source: Bankscope).
Liquidity	Ratio of Liquid assets to Short-term borrowings (source: Bankscope).
Crisis	Binary variable (1 for crisis period from 2007 to 2012 and 0 otherwise).
Size	Log (total assets).
Systemic banks	Binary variable (1 if the bank is G-SIBs and 0 otherwise) (G-SIB classification cf. Financial Stability Board (FSB, 2012)).
Sovereign rating (SR)	The government rating evaluating the strength of public debt (source Moody's; Moody's (2012)).
Resolution mechanism	Binary variable (1 if there is already a proposition or a resolution mechanism in the country and 0 otherwise).
Supervisory power	Structural index evaluating the supervisor's intervention and sanction power (Barth, Caprio and Levine, 2001 ab, 2003). In our sample, values between -1.8 and 1 are used, with higher values indicating greater power.
Market discipline	Measures the ability of private agents to supervise the banking sector. It assesses the quality of information provided by the banks, the deposit insurance scheme and the role of subordinated debt in the bank funding structure (Barth, Caprio and Levine, 2003). It takes values between -0.43 and 1.46. Lower values correspond to greater transparency of the activity.
Creditors rights	Structural index for each European country that aggregates different creditor rights (rights in a bankruptcy situation or in a business reorganization, etc.). It ranges from 0 to 4.

Appendix B

Ratings definition

Global rating: Moody's Long-Term Deposit rating (foreign currency)

Bank Long-term Deposit ratings represent Moody's forward-looking opinion on a bank's ability to repay punctually its foreign currency deposit obligations. This rating also reflects the expected

financial loss in the case of default. Bank Deposit ratings do not apply to deposits that are subject to a public or private insurance scheme. Rather, the ratings apply to uninsured deposits, but in certain cases, they may incorporate the possibility that official support might extend to uninsured as well as insured deposits (Moody's Investors Service, 2013).

Global long-term ratings scale provides 25 alpha-numerical values ranging from Aaa (highest quality) to C3 (lowest rating) (cf table).

Table B1: Global Long-Term Rating Scale

Rating	Numerical value	Rating Class	Description
Aaa	1	High Grade	Obligations rated Aaa are judged to be of the highest quality and are subject to the lowest level of credit risk.
Aa1	2	High Grade	Obligations rated Aa are judged to be of high quality and are subject to very low credit risk.
Aa2	3		
Aa3	4		
A1	5	Upper medium grade	Obligations rated A are judged to be upper-medium grade and are subject to low credit risk.
A2	6		
A3	7		
Baa1	8	Lower medium grade	Obligations rated Baa are judged to be medium-grade and subject to moderate credit risk and, as such, may possess certain speculative characteristics.
Baa2	9		
Baa3	10		
Ba1	11	Non-investment grade (speculative)	Obligations rated Ba are judged to be speculative and are subject to substantial credit risk.
Ba2	12		
Ba3	13		
B1	14	Highly speculative	Obligations rated B are considered speculative and are subject to high credit risk.
B2	15		
B3	16		
Caa1	17	Substantial risks	Obligations rated Caa are judged to be speculative of poor standing and are subject to very high credit risk.
Caa2	18		
Caa3	19		
Ca1	20	Extremely speculative	Obligations rated Ca are highly speculative and are likely in, or very near, default, with some prospect of recovery of principal and interest.
Ca2	21		
Ca3	22		
C1	23	In default	Obligations rated C are the lowest rated and are typically in default, with little prospect for recovery of principal or interest.
C2	24		
C3	25		

Notes: Moody's appends numerical modifiers 1, 2, and 3 to each generic rating classification from Aa through Caa. The modifier 1 indicates that the obligation ranks in the higher end of its generic rating category. Modifier 2 indicates a mid-range ranking and modifier 3 indicates a ranking in the lower end of that generic rating category.

Intrinsic rating: Moody's Bank Financial Strength rating (BFSR)

Moody's Bank Financial Strength Ratings (BFSRs) represent Moody's opinion of a bank's intrinsic safety and soundness. It does not take into account the probability that the bank will receive external support. Thus, there is no extraordinary support from public authorities.

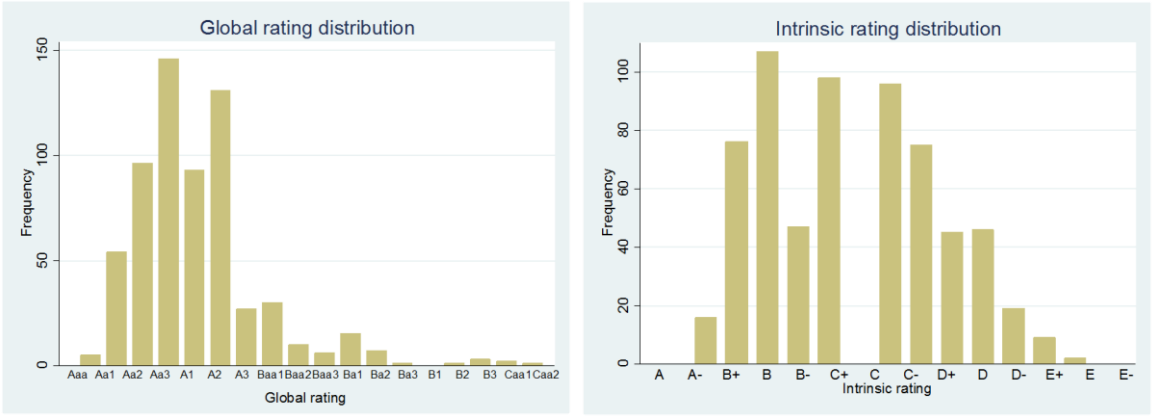
Factors considered in the assignment of Bank Financial Strength Ratings include bank-specific elements, such as financial fundamentals, franchise value, and business and asset diversification (Moody's Investors Service, 2013). Although Bank Financial Strength Ratings exclude the external factors specified above, they can take into account other risk factors in the bank's operating environment (for example, the strength and prospective performance of the economy – and the anticipated fragility of the financial system). Bank Financial Strength Ratings are expressed on an A to E scale, and where appropriate, a "+" or "-" specifies the intensity of the rating.

Table B2: Bank Financial Strength rating scale

Rating	Numerical value	Description
A	1	Banks rated A possess superior intrinsic financial strength.
A-	2	
B+	3	
B	4	Banks rated B possess strong intrinsic financial strength.
B-	5	
C+	6	
C	7	Banks rated C possess adequate intrinsic financial strength.
C-	8	
D+	9	Banks rated D display modest intrinsic financial strength. Banks from this category may require exceptional external support.
D	10	
D-	11	
E+	12	Banks rated E display very modest intrinsic financial strength. There is a strong probability that these banks will ask for an external support to avoid bankruptcy.
E	13	
E-	14	

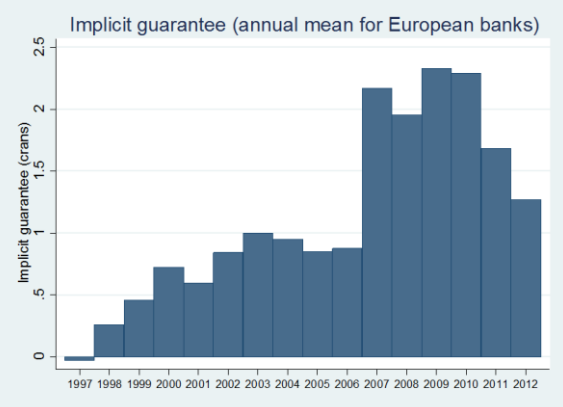
Notes: Where appropriate, a "+" modifier will be appended to ratings below the "A" category and a "-" modifier will be appended to ratings above the "E" category to distinguish those banks that fall into intermediate categories.

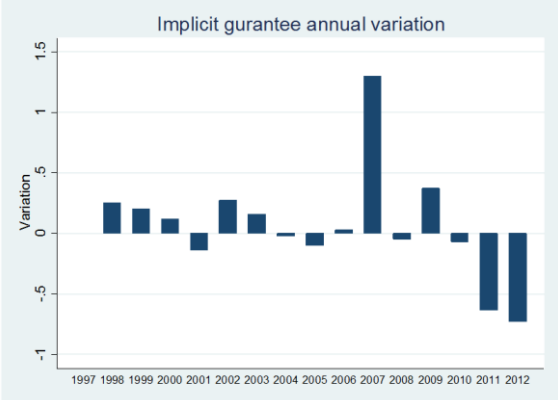
Figure B1: Ratings distribution



Notes: a (left) Global rating (Moody's Long term Deposit rating) frequency distribution. b (right) Intrinsic rating (Moody's Bank Financial Strength Rating) frequency distribution.

Figure B2: Implicit guarantees for European banks





Notes: a (left) Average implicit guarantee for European banks. Annual mean values. b (right) Implicit guarantee annual variation. Average values for European banks.

Appendix C

Table C1: Why some banks benefit from greater implicit guarantees?

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intrinsic rating	1.204***	1.465***	1.486***	1.467***	1.224***	1.543***	0.826***	1.109***	1.119***
	(9.433)	(10.76)	(9.819)	(9.662)	(9.587)	(11.50)	(6.523)	(8.512)	(8.512)
IR^2	-	-	-	-	-	-	-	-	-
	0.0612***	0.0842***	0.0870***	0.0857***	0.0618***	0.0891***	0.0423***	0.0690***	0.0690***
	(-6.749)	(-8.474)	(-7.755)	(-7.626)	(-6.835)	(-9.083)	(-4.849)	(-7.449)	(-7.449)
Business model		-0.178		-0.0698				0.633	0.650*
		(-0.658)		(-0.204)				(1.601)	(1.64)
Liquidity			0.0507	0.0484					
			(1.443)	(1.342)					
Systemic importance					0.998**				
					(2.024)				
Size						0.0894*			0.486
						(1.834)			(0.980)
Crisis							0.997***	2.043***	2.043***
							(9.213)	(4.454)	(4.454)
Business model x crisis								-1.025**	-1.025**
								(-2.145)	(-2.145)
Constant	-3.667***	-4.032***	-4.114***	-3.986***	-3.964***	-5.524***	-2.589***	-3.812***	-3.812***
	(-7.966)	(-7.880)	(-8.283)	(-7.088)	(-8.223)	(-6.779)	(-5.712)	(-6.919)	(-6.919)
Observations	627	627	627	627	627	627	627	627	627
R-sq (within)	0.465	0.512	0.476	0.508	0.485	0.482	0.577	0.616	0.623

Notes: This table reports results for the regression of implicit guarantee on intrinsic strength of the bank and other banks' business model characteristics. We use a bank fixed effects model. The sample covers the period of 1997-2012 for 45 European banks. *Systemic importance* takes the value 1 of the bank is G-SIB our D-SIB (Tables D2 and D3 in Appendix). t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table C2: Alternative Poisson regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES									
Intrinsic rating	0.828***	0.839***	0.890***	0.863***	0.976***	0.865***	0.603***	0.641***	0.720***
	(8.725)	(7.767)	(7.312)	(7.042)	(9.733)	(8.161)	(6.308)	(5.966)	(6.359)
IR^2	-0.0362***	-0.0360***	-0.0399***	-0.0375***	-0.0433***	-0.0381***	-0.0223***	-0.0255***	-0.0292***
	(-5.858)	(-4.888)	(-4.845)	(-4.491)	(-6.765)	(-5.265)	(-3.593)	(-3.529)	(-3.906)
Business model		-0.584***		-0.578***				-1.374***	-1.303***
		(-4.570)		(-3.814)				(-4.914)	(-4.624)
Liquidity			-0.00546	-0.0166					
			(-0.281)	(-0.859)					
Systemic importance					0.637***				0.309***
					(5.928)				(2.644)
Size						0.0584**			0.0175
						(2.287)			(0.662)
Crisis							0.688***	-0.175	-0.211
							(9.162)	(-0.612)	(-0.740)
Business model x crisis								1.060***	1.060***
								(3.380)	(3.390)
Constant	-3.457***	-2.975***	-3.632***	-3.042***	-4.225***	-4.251***	-3.010***	-1.939***	-2.599***
	(-9.827)	(-7.318)	(-8.327)	(-6.571)	(-10.93)	(-8.555)	(-8.698)	(-4.352)	(-4.368)
Observations	582	582	582	582	582	582	582	582	582
Pseudo R-sq	0.219	0.243	0.231	0.242	0.235	0.228	0.264	0.295	0.299

Notes: This table reports results for the Poisson regression of the implicit guarantee on intrinsic strength of the bank and other banks' business model characteristics. The sample covers the period of 1997-2012 for 45 European banks. t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table C3: Alternative Negative binomial regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES							
Intrinsic rating	0.828***	0.839***	0.890***	0.976***	0.865***	0.603***	0.641***
	(8.725)	(7.767)	(7.312)	(9.733)	(8.161)	(6.308)	(5.966)
IR^2	-0.0362***	-0.0360***	-0.0399***	-0.0433***	-0.0381***	-0.0223***	-0.0255***
	(-5.858)	(-4.888)	(-4.845)	(-6.765)	(-5.265)	(-3.593)	(-3.530)
Business model		-0.584***		-.582***			-1.374***
		(-4.570)		(-3.831)			(-4.914)
Liquidity			-.00190	0.637***			
			(-0.10)	(5.928)			
Systemic importance					0.0584**		
					(2.287)		
Size						0.688***	-0.175
						(9.162)	(-0.613)
Crisis							1.060***
							(3.380)
Constant	-3.457***	-2.975***	-3.632***	-4.225***	-4.251***	-3.010***	-1.939***
	(-9.827)	(-7.318)	(-8.327)	(-10.93)	(-8.555)	(-8.698)	(-4.352)
Observations	582	582	582	582	582	582	582
lnalpha	-18.98	-16.37	-15.76	-16.73	-27.90	-32.23	-16.55
	(-0.0714)	(-0.0473)	(-0.0422)	(-0.0438)	.	.	(-0.0486)
Pseudo R-sq	0.192	0.212	0.199	0.209	0.198	0.239	0.266

Notes: This alternative regression test the same econometric specification as the Poisson test (1a). *lnalpha* represents the dispersion coefficient for the predictive variables. The probability being above the cutoff (0.05), it means that there is no significant over dispersion and we should be using Poisson model rather than Negative binomial. t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix D

Table D1: Testing the impact of the *Intrinsic rating* and the *Sovereign rating* on *Implicit guarantees*

VARIABLES	(1)	(2)	(3)
Intrinsic rating	1.204***		1.002***
	(9.433)		(8.659)
IR^2	-0.0612***		-0.0338***
	(-6.749)		(-4.004)
Sovereign rating		-0.217***	-0.451***
		(-5.631)	(-12.46)
Constant	-3.667***	1.727***	-2.498***
	(-7.966)	(8.222)	(-6.003)
Observations	627	627	627
Number of countries	16	16	16

Notes: .t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table D2: Global Systemically Important Banks - G-SIBs

Bank	Domestic country
BNP Paribas	France
Crédit Agricole S.A.	France
Société Générale	France
Deutsche Bank AG	Germany
UniCredit SpA	Italy
ING Groep NV	Netherlands
Banco Santander SA	Spain
Nordea Bank AB (publ)	Sweden
Barclays Bank plc	United kingdom
HSBC Holdings Plc	United kingdom
Royal Bank of Scotland Group Plc (The)	United kingdom
Standard Chartered Plc	United kingdom

*This table shows systemically important banks from our sample. We count 12 G-SIBs from 28 publised by FSB (2012).
Source: FSB, "Update of group of global systemically important banks", Nov 2012

Table D3: Domestic Systemically Important Banks - D-SIBs

Bank	Domestic country
Erste Group Bank AG	Austria
Raiffeisen Bank International AG	Austria
Dexia	Belgium
Danske Bank A/S	Denmark
BNP Paribas	France
Crédit Agricole S.A.	France
Société Générale	France
Deutsche Bank AG	Germany
Commerzbank AG	Germany
Alpha Bank AE	Greece
National Bank of Greece SA	Greece
OTP Bank Plc	Hungary
Allied Irish Banks plc	Ireland
Bank of Ireland-Governor and Company of the Bank of Ireland	Ireland
UniCredit SpA	Italy
Intesa Sanpaolo	Italy
ING Groep NV	Netherlands
Banco Bilbao Vizcaya Argentaria SA	Spain
Banco Santander SA	Spain
Nordea Bank AB (publ)	Sweden
Skandinaviska Enskilda Banken AB	Sweden
Svenska Handelsbanken	Sweden

Swedbank AB	Sweden
Lloyds Banking Group Plc	United kingdom
Barclays Bank plc	United kingdom
HSBC Holdings Plc	United kingdom
Royal Bank of Scotland Group Plc (The)	United kingdom

Note : We count 27 from 39 Domestically-important banks published by EBA (European Banking Authority) in January 2013. Source: The EBA, "Recommendation on the development of recovery plans", Jan 2013

Table D4: Interconnections between banks and sovereign's debt - implications on public guarantees.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intrinsic rating	1.204***		0.753***	0.444***	0.639***	0.614***	0.651***
	(9.433)		(6.625)	(4.072)	(5.795)	(5.475)	(5.835)
IR^2	-0.0612***		-0.0203**	-0.00464	-0.0187**	-0.0166**	-0.0205**
	(-6.749)		(-2.409)	(-0.585)	(-2.274)	(-1.990)	(-2.478)
Sovereign rating		-0.222***	-0.436***	-0.444***	-0.521***	-0.525***	-0.429***
		(-5.038)	(-10.92)	(-7.133)	(-15.02)	(-14.96)	(-6.221)
Crisis				1.386***	1.251***	1.301***	1.431***
				(8.521)	(12.13)	(3.213)	(8.624)
Business model						-0.293	
						(-0.811)	
Business model x crisis						-0.0706	
						(-0.168)	
Size					0.143***	0.144***	0.154***
					(3.853)	(3.776)	(4.097)
Systemic importance					0.181	0.138	0.158
					(1.423)	(1.058)	(1.227)
Sovereign rating x crisis				-0.0801			-0.0856
				(-1.544)			(-1.488)
Constant	-3.667***	1.648***	-1.663***	-0.816**	-3.036***	-2.675***	-3.340***
	(-7.966)	(4.315)	(-3.469)	(-2.194)	(-4.800)	(-3.624)	(-5.203)
Observations	627	627	627	627	627	627	627
R-sq (within)	0.250	0.032	0.368	0.504	0.560	0.554	0.559
Number of countries	16	16	16	16	16	16	16

Notes: .t-statistics in parentheses. The dependent variable is the implicit guarantee. Estimations include bank fixed effects. *** p<0.01, ** p<0.05, * p<0.1

Appendix E

Table E1: Overview of resolution regimes in European countries

Country	Legislation/Year	Administrative Authority Responsible for Restructuring	Comments
Austria	Supervisory Guidelines, 2012		Consultative document reports proposals to strengthen resolution powers. It focuses on large, internationally active banks.
Belgium	Financial Crisis Law, 2010		New resolution tools, such as transfer of part or all of the bank's rights and obligations, introduced.
Denmark	Danish Financial Stability Act, 2008		A government-owned winding-up company was established to acquire failed banks. Full guarantee to unsecured creditors and depositors.
	Amendment, 2011		Denmark was the first country to apply a haircut to senior creditors. Above-mentioned guarantee withdrawn. Separate fund called 'Winding Up Fund' established to fund resolution.
France	Financial and Monetary Code	Autorité de Contrôle Prudentiel	Power to operate a bank in resolution exercised through administrator appointed by ACP, which may exercise all powers of management.
Germany	Bank Restructuring Act, 2010 (entered into force on January 1, 2011)	Federal Financial Supervisory Authority (BaFin) and Financial Market Stabilisation Authority (FMSA)	Two new procedures were introduced for distressed institutions: a restructuring procedure and a reorganization procedure. BaFin's preventative prudential instruments were strengthened and extended. For example, BaFin was given the power to appoint a special representative to an institution during the early stages of a crisis. The assets and liabilities of a failed bank can be transferred to a bridge bank by the supervisor if voluntary restructuring and reorganization not expected to be successful.
Greece	Amendment of the Banking Act, 2011	Banque of Greece (BoG)	Comprehensive resolution tools such as bridge bank and purchase and assumption introduced. Resolution fund established within the Deposit and Insurance Guarantee Fund for funding resolution. In urgent cases, the procedure for submitting offers, the determination of the remuneration to be paid to the transferee credit institution and the transfer will be based on a temporary assessment by the BoG.
Ireland	Credit Institutions (Stabilization) Act, 2010		Various new resolution tools for Ministry of Finance with regard to banks receiving government support. Contract terms on subordinated bonds can be modified by Ministry of Finance.
	Central Bank and Credit Institutions (Resolution) Act, 2011. Amendment, 2013.		Resolution powers transferred from Ministry of Finance to the Central Bank. Credit institutions' resolution fund to be introduced.
Italy	Consolidated Banking Law BL	Bank of Italy	Regime based on special administration and compulsory administrative liquidation through appointment and supervision by the BoI of special administrator or liquidator. Shareholders can only be overridden under compulsory administrative liquidation.

Netherlands	Act on Special Measures for Financial Institutions, 2012	Dutch Central Bank (DNB) and Dutch Ministry of Finance (MoF)	The Dutch resolution framework was broadened to address the risks posed by systemically relevant banks. The resolution powers of the DNB are limited to licensed banks and do not apply to foreign branches of European Economic Area banks. The Dutch Intervention Act for Financial Institutions authorizes the DNB to adopt a Transfer Plan for the transfer of bank deposits, (other) assets and liabilities of a bank when the bank faces difficulties relating to solvency, liquidity or compliance with regulatory 'technical provisions' that cannot be reversed in a timely manner. However, the scope of application is not limited by an institution's size or systemic importance.
Portugal	Amendments to the resolution regime for credit and financial institutions, 2012		Resolution mechanisms for the orderly winding-down of banks, including early intervention and comprehensive tools, introduced, including total or partial sale of business and the setting up of a bridge bank. Resolution fund within the Banco de Portugal established, to be funded by the industry.
Spain	Law on Bank Restructuring and Credit Institution Equity Reinforcement, 2009		Fund for Orderly Bank Restructuring (FROB) established in June 2009 to facilitate bank restructuring. It is able to provide temporary financial support for the restructuring and resolution of banks in difficulties including partial transfer of assets of failed banks to a bridge bank.
	Royal Decree-law 24/2012	Bank of Spain and Bank Resolution Authority (FROB)	A new legal framework for bank resolution entered into force on August 31, 2012. The framework aims to improve the regime that had been in force since 2009, and takes into account the EU legislative proposal on the recovery and resolution of banks and investment firms. Support during the restructuring period may take the form of guarantees, loans, subordinated debt, or acquisition of assets or capital injections.
United Kingdom	Banking Act, 2009	BoE and HMT	Special Resolution Regime introduced in 2009. Comprehensive resolution tools such as temporary public ownership transfer to bridge bank, and insolvency procedure provided to the authorities. The Financial Services Act from 2010 asks banks to provide recovery and resolution plans. Under the Banking Act, the Financial Services Authority, in consultation with the BoE and the Treasury, makes the decision to put a bank into the SRR. The Treasury decides whether to put a bank into temporary public ownership, and the BoE, in consultation with the other authorities, decides which of the tools to use and implements the resolution.
Europe	Bank Recovery and Resolution Directive, 2013	European Central Bank	In June 2012, the European Commission published a draft Directive on recovery and resolution of credit institutions and investment firms. Within the EU, the recovery and resolution framework prioritizes resolution at group level under the leadership of a group resolution authority with strong coordination in the resolution college. Implementation of a Single Resolution Mechanism (SRM) at the European level.

Sources: FSB-"*Resolution of Systemically Important Financial Institutions –Progress Report", 2012;* FSB-"Thematic Review on Resolution Regimes", 2013; Schich and Kim (2012); European Council (2013); ECB (2011); EBA (2013); public information from central bank websites.

Table E2: The impact of resolution mechanisms on implicit public guarantees in European countries.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intrinsic rating	1.055***	0.999***	0.542***	0.782***	0.791***	0.738***	0.695***	0.657***
	(9.005)	(8.235)	(4.906)	(7.085)	(7.076)	(6.736)	(6.346)	(6.118)
IR^2	-0.0357***	-0.0322***	-0.00631	-0.0263***	-0.0316***	-0.0261***	-0.0236***	-0.0195**
	(-4.232)	(-3.714)	(-0.815)	(-3.242)	(-3.667)	(-3.094)	(-2.809)	(-2.414)
Sovereign rating	-0.438***	-0.388***	-0.455***	-0.420***	-0.638***	-0.592***	-0.532***	-0.354***
	(-11.98)	(-8.560)	(-11.22)	(-11.17)	(-15.83)	(-15.21)	(-12.23)	(-8.202)
Resolution mechanism	-0.525**	-0.260	-0.817***	-0.693***	-0.636**	-0.711***	-0.606**	-0.575**
	(-2.469)	(-1.001)	(-3.587)	(-3.347)	(-2.569)	(-2.947)	(-2.535)	(-2.565)
Resolution mech x Sovereign		-0.0991*	-0.0716	-0.0752*	0.0688	0.0505	0.00116	-0.129**
		(-1.809)	(-1.498)	(-1.748)	(1.008)	(0.762)	(0.0176)	(-2.512)
Crisis			1.301***	1.301***	1.287***	1.313***	1.307***	1.315***
			(14.12)	(14.09)	(11.00)	(11.74)	(11.96)	(11.56)
Size				0.127***	0.134***	0.133***	0.129***	0.0617*
				(3.447)	(3.800)	(3.821)	(3.615)	(1.702)
Systemic importance				0.280	0.204*	0.135	0.188	0.0907
				(0.668)	(1.657)	(1.136)	(1.592)	(0.753)
Restrictions on bank activities					0.129***			
					(3.200)			
Market discipline						0.807***		
						(4.798)		
Supervisory power							-0.375**	
							(-2.474)	
Creditors rights								-0.0367
								(-0.554)
Constant	-2.748***	-2.681***	-1.367***	-3.618***	-3.512***	-3.871***	-3.472***	-2.316***
	(-6.431)	(-6.237)	(-3.456)	(-5.767)	(-5.992)	(-6.553)	(-5.833)	(-3.708)
Observations	627	627	627	627	627	627	627	587
R-sq (within)	0.371	0.380	0.526	0.577	0.581	0.595	0.603	0.648
Number of countries	16	16	16	16	16	16	16	16

Notes: The dependent variable is the implicit guarantee. Estimations include bank fixed effects. t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

References

Alessandri, P. and Haldane, A., "Banking on the state", based on a presentation delivered at the Federal Reserve Bank of Chicago twelfth annual International Banking Conference on 'The international financial crisis: have the rules of finance changed?', 2009.

Baker, D. and McArthur, T., "The value of the 'too big to fail' big bank subsidy", CEPR Reports and Issue Briefs 2009-36, Center for Economic and Policy Research, 2009.

Barth, J., Caprio, G. and Levine, R., "The regulation and supervision of banks around the world - a new database", World Bank Policy Research Working Paper 2588, April 2001.

Barth, J., Caprio, G. and Levine, R., "Bank regulation and supervision: what works best?", World Bank Policy Research Working Paper 2725, November 2001.

Barth, J., Caprio, G. and Levine, R., "Rethinking Bank Regulations: Till Angels Govern", World Bank, 2003.

Basel Committee on banking Supervision (BCBS), "Bank Failures in Mature Economies", BIS Working paper no.13, April 2004.

Basel Committee on Banking Supervision (BCBS), “Resolution policies and frameworks – progress so far”, BIS, July 2011.

Basel Committee on Banking Supervision (BCBS), “Global systemically important banks: assessment methodology and the additional loss absorbency requirement”, BIS, November 2011.

European Banking Authority (EBA), “Recommendation on the development of recovery plans”, January 2013.

European Central Bank (ECB), Amendments to the resolution regime for credit institutions, CON/2011/107, December 2011.

European Council, Proposal for a Directive of the European Parliament and of the Council, 11228/13 PRESSE 270, 2012/0150 (COD), Brussels, June 2013.

Estrella, A. and Schich, S., “Sovereign and banking sector debt: Interconnections through implicit guarantees”, OECD Financial Market Trends, vol.2011/2, October 2011.

Financial Stability Board (FSB),“Update of group of global systemically important banks”, November 2012.

Financial Stability Board (FSB),“Thematic Review on Resolution Regimes”, Peer Review Report, April 2013.

Gambacorta, L. and Van Rixtel, A., "Structural bank regulation initiatives: approaches and implications," BIS Working Papers 412, Bank for International Settlements, 2013.

Haldane, A., “On being the right size”, BIS speech, October 2012.

Haldane, A., “The $100 billion question”, March 2010.

Haldane, A., “The dog and the Frisbee”, August 2012.

Hau, H., Langfield, S. and Marquez-Ibanez, D., “Bank ratings: What determines their quality?”, European Central Bank, 2012.

Kashyap, A. and Stein, J., “An Analysis of the Impact of ‘Substantially Heightened’ Capital Requirements on Large Financial Institutions”, University of Chicago and Harvard Working paper, 2010.

Kwast, M. and Passmore, S. W., “The Subsidy Provided by the Federal Safety Net: Theory and Evidence”, Journal of Financial Services Research, 2000.

La Porta, R., Lopez-de-Silanes, F., Shlfeifer, A. and Vishny, R., “Legal Determinants of External Finance”, The Journal of Finance, vol. LII, no. 3, July 1997.

La Porta, R., Lopez-de-Silanes, F. and A. Schleifer, “Law and finance”, *Journal of Political Economy*, vol. 106, no. 6, 1998.

Li, Z, Qu, S and Zhang, J, “Quantifying the value of implicit government guarantees for large financial institutions”, Moody’s Analytics Quantitative Research group, January 2011.

Liikanen group, “High-level Expert Group on Reforming the structure of the EU banking sector”, Final Report, Brussels, October 2012.

Marquez, L., Correa, R. and Sapriza, H., “International Evidence on Government Support and Risk taking in the Banking Sector”, IMF Working paper, 13/94, May 2013.

Martel, M., van Rixtel, A. and González Mota, E., “Business models of international banks in the wake of the 2007–2009 global financial crisis”, Bank of Spain, Revista de Estabilidad Financiera, no 22, pp 99–121, 2012.

Moody’s, “Quantifying the Value of Implicit Government Guarantees for Large Financial Institutions”, Analytics Report, January 2011.

Moody’s, “Status Report on Systemic Support Incorporated in Moody’s Bank Debt Ratings Globally”, November 2011.

Moody’s, “Supported Bank Debt Ratings at Risk of Downgrade Due to New Approaches to Bank Resolution”, February 2011.

Moody’s Investors Service, “Incorporation of joint default analysis into Moody’s bank ratings: a redefined methodology”, 2007.

Moody’s Investors Service, “How Sovereign Credit Quality May Affect Other Ratings”, February 2012.

Moody’s Investors Service, “Global Banks”, May 2013.

Noss, J. and Sowerbutts, R., “The implicit subsidy of banks”, Bank of England, Financial Stability Paper no.15, May 2012.

Oxera. 2011. - Assessing state support to the UK banking sector”, mimeo, 2011.

Packer, F. and Tarashev, N., “Rating Methodologies for Banks”, Bank of International Settlements BIS Quarterly Review, June 2011.

Schich, S. and Kim, B-H., “Developments in the Value of Implicit Guarantees for Bank Debt: The Role of Resolution Regimes and Practices”, OECD Journal: Financial Market Trends, vol. 2012, Issue 2, 2012.

Schich, S. and Lindh, S., “Implicit Guarantees for Bank Debt: Where do we stand?”, OECD Journal: Financial Market Trends, vol.2012, issue 1, 2012.

Soussa, F. “Too Big to Fail: Moral Hazard and Unfair Competition?”, Chapter 1 in collective volume, Financial Stability and Central Banks: Selected Issues for Financial Safety Nets and Market Discipline, Bank of England (London), 2000.

Ueda, K and di Mauro, B, “Too-Big-to-Fail Subsidy: Event Study”, The IMF’s Report to the G-20 and Background Material, IMF, 2010.

Ueda, K and di Mauro, B, “Quantifying structural subsidy values for systemically important financial institutions”, IMF Working Paper No. 128, 2012.

Van Roy, P. and Vespro, C., "The Role and Impact of External Support in Bank Credit Ratings", Financial Stability Review, vol. 10, Issue 1, p.109-119, 2012.

Wooldridge, J.M., "Econometric Analysis of Cross-Section and Panel Data", MIT Press, Cambridge, MA, 2002.