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Analyzing the role of mutual guarantee societies on bank capital requirements for small and medium-sized enterprises

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This paper analyzes the impact of the guarantee provided by mutual guarantee societies (MGSs) on the risk premium that banks should charge for small- and medium-sized enterprise (SME) loans under the new Basel Capital Accords (Basel II and III). We also examine whether the foreseeable decrease in the theoretical credit risk premium would be compensated by the cost of the MGS guarantee. To do so, we develop a rating system for SMEs that uses a large sample of Spanish firms over the period from 2005 to 2009. We find that the final effect of the guarantee on the SME risk premium depends on the values taken by the credit variables of the MGS (essentially, the probability of default).

Keywords: bank capital requirements; bank financing; credit risk mitigation; mutual guarantee societies; small businesses

1. Introduction

When functioning properly, financial systems allocate risks appropriately and contribute to making economies more resilient to shocks (Chami, Fullerkamp, and Sharma 2010). In June 2004, the Basel Committee on Banking Supervision (BCBS) issued a revised framework on the international convergence of capital measurement and capital standards for banking organizations. This Accord, commonly known as Basel II, established more risk-sensitive minimum capital requirements, involving higher levels of capital for those borrowers thought to present higher levels of credit risk. The main goal behind Basel II was to promote the adequate capitalization of banks and to encourage risk management improvements, thereby strengthening the stability of the financial system. Despite this Accord, in 2010, six years after the approval of the revised capital framework, the Committee had to agree on new international banking guidelines as a response to the 2008 financial crisis. The latest Accord, known as Basel III, attempts to achieve financial stability and strengthen the solvency and liquidity of banks without diminishing the flow of money in the credit market. Basel III also aims to improve risk management and governance as well as strengthen banks' transparency and disclosures, having learned from the financial crisis. The new rules provide a more restrictive definition of capital, increase the risk weight of several assets in the banking book and incorporate capital buffers, set up a recommended and potentially obligatory leverage ratio, and outline international rules on liquidity management (Quaglia 2013).

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Because new banking regulation is more sensitive to risk, new rules could increase the interest rates that the banks charge on loans to small and medium-sized enterprises (SMEs) and, as a result, may exacerbate the SMEs' well-known financial difficulties (Cardone-Riportella and Trujillo-Ponce 2007). To avoid this, the size adjustment under the internal-ratings based (IRB) approach allows banks to reduce capital requirements for loans to SMEs (defined as companies with less than €50 million in annual sales) compared to larger firms. However, banks that manage SME loans in a similar manner to retail exposures are permitted to apply the retail IRB treatment (with lower capital requirements) to such loans, provided that the total exposure to the firm is less than €1 million. In addition to this beneficial treatment for SMEs, the Basel framework allows banking institutions to use a wide range of collateral and guarantees to moderate the credit risks to which they are exposed when lending to small businesses. Therefore, credit risk mitigation techniques are not only an important tool to solve the credit-rationing problem but also may help banks to reduce their capital requirements, which predicts that collateral and guarantees will become even more important in the future (Steijvers and Voordeckers 2009).

Guarantee societies are one of the possibilities recognized by the new banking regulation as eligible guarantors. It is well known that to reduce the problems resulting from information asymmetries, these societies mediate with banks to provide guarantees supporting the operations of SMEs. Because SMEs represent over 98% of all companies and provide a large portion of GDP and employment, guarantee institutions make a major contribution to economic growth, social cohesion and regional development in the European Union. Guarantee organizations have been instituted in nearly all European countries and are particularly widespread in Germany, France, Spain, and Italy (Columba, Gambacorta, and Mistrulli 2010). These companies typically have a cooperative or mutual statute (Mutual Guarantee Societies (MGS)). MGS members contribute to a guarantee fund, which is then used as collateral to back loans granted to the members themselves (Bartoli et al. 2013). This guarantee helps small companies to obtain financing under better conditions in terms of rate, credit amount, and term offered (Busetta and Zazzaro 2012; Camino and Cardone-Riportella 1999).[1]

Credit guarantee schemes have been an instrument of choice for policy makers to improve SMEs and entrepreneurs' access to finance in the recent global economic crisis, while limiting the burden on public finances. Government financial support usually comes in the form of counter-guarantees.[2] This counter-guarantee increases the number of viable but credit-constrained SMEs that can access bank loans as well as enhances the scheme's credibility and reputation. Some regulations also support MGSs by granting tax reductions, as in the case of Spain's *Sociedades de Garantía Recíproca*. Spanish MGSs are exempt from taxes on public subsidies and the returns gained from their investment, which are allocated to the Technical Reserve Fund, intended to increase MGS solvency (Pia 2008).

The aim of this work is to analyze the impact of the guarantee provided by MGSs on the bank capital requirements for SMEs under the new banking regulation. This paper also examines whether the foreseeable decrease in the theoretical credit risk premium, as a result of lower capital requirements for guaranteed SME loans, would be offset by the cost of the MGS guarantee. To do so, we develop a rating system for SMEs that uses a large sample of Spanish firms extracted from the SABI (*Sistema de Análisis de Balances Ibéricos*) database.[3] We also consider a relevant period, from 2005 to 2009, which contemplates the deep economic crisis after 2007 in Spain, and include in the analysis the more recent proposals on capital requirements contained in the Basel III Capital Accord.

The paper is structured as follows. Following this introduction, section 2 presents a review of the research literature. Section 3 develops a model to predict the one-year SME defaults among Spanish firms and derives the capital requirements for banks if the IRB approach is used. Section 4 examines the effect of the MGS guarantee on the credit risk premium applicable to SMEs and compares it with the cost of the MGS guarantee. Section 5 presents the main conclusions.

2. Review of research literature

Empirical evidence regarding the impact of the new Basel Accords on bank capital requirements for SMEs is still very scarce. Significant studies on this topic include the works of Altman and Sabato (2005, 2007); Berger (2006); and Saurina and Trucharte (2004). Altman and Sabato (2005) examine the effects of the Basel II Accord on the bank capital requirements for SMEs using data from the USA, Italy, and Australia. The authors conclude that banks would have significant profits, in terms of lower capital requirements, when considering SMEs as retail customers, provided that the IRB approach is applied. However, for SMEs treated as corporate entities, the capital requirements would be slightly higher than under the 1988 Accord (Basel I). Through a breakeven analysis, the authors observe that banks would be obliged to classify at least 20% of their SME portfolio as retail entities to maintain unalterable their capital requirements. Altman and Sabato (2007) show that modeling credit risk, particularly for SMEs, results in slightly lower capital requirements (approximately 0.5%) for banks under the advanced IRB approach. Berger (2006) examines the competitive effects of the implementation of Basel II on banks in the market for credit to SMEs. He finds that the adoption of the advanced IRB approach by large banking organizations in the USA may not imply a reduction in the interest rates applied to SME loans, thus not significantly affecting the competitive positions of other smaller banks. Finally, Saurina and Trucharte (2004) use information from the Spanish Credit Register over the 1994–2001 period to investigate the repercussions of the Basel II Accord on the minimum capital requirements for Spanish SMEs. The authors find that there are no reasons for a change in the pattern of bank financing to SMEs. Nevertheless, the final effect depends on the percentage of exposures to SMEs susceptible to inclusion in the retail asset class. The authors also conclude that, on average, there are no significant incentives for Spanish banks to move from the standardized approach (SA) to the IRB approach. It is worth emphasizing that these results do not consider the latest modifications prior to the definitive approval of the Agreement in June 2004.[4]

Lately, MGSs have received renewed attention as a response to the credit crunch in Europe. More recent research includes studies by Bartoli et al. (2013); Beck, Klapper, and Mendoza (2010); Busetta and Zazzaro (2012); and Columba, Gambacorta, and Mistrulli (2010). Bartoli et al. (2013) provide empirical evidence showing that the presence of MGSs constitutes an important element of the financial system to moderate the malfunctioning of credit markets at times of systemic crises. Beck, Klapper, and Mendoza (2010) present data of credit guarantee schemes across 46 developed and developing countries. The authors find that the government plays an important role in partial credit guarantee schemes around the world but is mostly limited to funding and management and participates much less in credit risk assessment and recovery. For Busetta and Zazzaro (2012), the motivation for the existence of MGSs lies in the inefficiencies created by adverse selection when borrowers do not have enough collateralizable wealth to satisfy collateral requirements and induce self-selecting contracts. Finally, Columba, Gambacorta, and Mistrulli (2010) conclude that small firms affiliated with MGSs obtain

loans at interest rates that are significantly lower than those for unaffiliated small firms. They also find evidence that appears to support a weakening in benefits from affiliation with an MGS if the amount of public funds available to the MGSs increases, consistent with the notion that the moral hazard effect offsets part of the benefits gained from peer monitoring.

This paper adds to the literature by providing a first empirical analysis regarding the role of MGSs in the reduction of bank capital requirements under the new Basel framework and thus in the credit risk premiums that banks should charge on SME loans guaranteed by an MGS.

3. Bank capital requirements for SMEs

Under the Basel capital framework, the way in which an SME is treated differs according to the approach chosen by the bank, SA or IRB and according to whether the bank includes the SME in the corporate or the retail category. In the SA approach, banks must classify their exposures to risk according to various groups and establish weights based on the credit rating given to the SME by an external credit assessment institution. The IRB approach is based on the internal estimations made by the bank, which allow banks to calculate capital requirements that are more sensitive to risk. By aligning required capital more closely to banks' own risk estimates, the new banking regulation is supposed to decrease the gap between regulatory and market capital requirements, thus encouraging banks to improve their risk assessment methods (Drumond 2009). Under the foundation IRB approach (F-IRB), banks provide their own estimates of probability of default (PD) and rely on the supervisory estimates for other risk components: the loss given default (LGD), the exposure at default (EAD), and the effective maturity of the operation (M). However, if the advanced IRB approach (A-IRB) is used, banks must provide their own estimates of PD, LGD, EAD, and M. Regardless of the method used, foundation or advanced, banks must always use the risk-weight functions provided by the Committee to calculate the regulatory capital requirements (see Appendix 1). Therefore, the estimation of the PD is a key element of the new banking regulation when the IRB approach is used.

A model of default for Spanish SMEs

In this section, we develop a specific model to estimate the one-year PD for Spanish SMEs. To do so, we use data from the SABI database, which contains accounting and financial information for the majority of Spanish SMEs. We consider firms with sales below €50 M that defaulted in the period from 2005 to 2009. The final sample (defaulted and active firms) is obtained using a methodology similar to that used by Altman and Sabato (2007). We first assess the number of defaulted firms contained in the SABI database during the selected period and then randomly select non-defaulted firms over the same period to obtain an average default rate in our sample as close as possible to the average default rate for Spanish SMEs. In our paper, we use the default rate reported previously by Saurina and Trucharte (2004) for Spanish SMEs over the 1994–2001 period (3.07%).[5] However, because of the strong economic crisis in the last years of the time horizon considered, we adjust this estimation for these years ("crisis" period years) with the trend in bankruptcy rates taken from the Spanish National Statistics Institute (INE).[6] In 2008, the bankruptcy rate increased by 78.16% from the 2005–2007 average, and in 2009, the bankruptcy rate was 146.07%

greater than the 2005–2007 rate. Considering these calculations, we assume a default rate of 5.47% (3.07% × 1.78) for 2008 (the first year of economic crisis) and a default rate of 7.55% (3.07% × 2.46) for 2009. Table 1 shows the conformation of the final sample, based on data from SABI. The second column shows the defaulted firms for each year, whereas the third column shows the active firms. The number of active firms was randomly selected to obtain a ratio of defaulted to total firms equal to the previously estimated default rates. The 2005–2009 average default rate of the sample is 5.28%.

After selecting the sample, we choose five categories describing the main aspects of a company's financial profile: profitability, liquidity, leverage, activity, and growth. For each of these categories, we select several financial ratios identified in the literature as being the most successful in predicting firms' bankruptcy (see Table 2). We also consider size, firm age and time dummy variables as well as interaction terms.[7,8] We then run a weighted logistic regression to develop a default prediction model for Spanish SMEs. This statistical technique has a higher percentage of correctly predicted defaults than the traditional unweighted logit regression if the dataset is highly unbalanced: 489 defaulted firms (5.16%) vs. 8,994 active firms (94.84%). Parameter estimations from a weighted logistic regression (β) are obtained by solving the following equation:

$$0 = \sum_{i=1}^{n} w_i [Y_i - h(\beta X_i)] X_i \tag{1}$$

where i indexes firms, Y_i is a binary variable (defaulted vs. active firms), X_i is a vector of covariates, h is the inverse logit function, and w_i are the assigned weights. In our regression, to make the total weights and their importance in the estimation equal, the final weight is 19.39 (the inverse of 5.16%) for the defaulted companies and 1.05 (the inverse of 94.84%) for the active firms.

Using a stepwise variable selection, we tested several models selecting variables from the five categories of ratios and terms of interactions with the different year-dummies. We selected the final model based on goodness of fit (Wald chi-square and Pseudo R^2), percentage of correct predictions, and stability of the results (ratios with changing signs were omitted). Table 3 reports the results for the (weighted) logistic regression of Spanish

Table 1. Sample distribution.

Year	Default rate	Defaulted firms (1)	Active firms (2)	TOTAL (1+2)
2005	3.07%	9	284	293
2006	3.07%	10	316	326
2007	3.07%	88	2,779	2,867
2008	5.47%	186	3,215	3,401
2009	7.55%	196	2,400	2,596
TOTAL		489	8,994	**9,483**

Note: This table shows the sample distribution of defaulted and active firms per year with sales below €50 million (SMEs). We use the default rate reported by Saurina and Trucharte (2004) for 2005–2007 (pre-crisis period). The default rate for the years 2008 and 2009 is calculated adjusting the pre-crisis default rate by the annual bankruptcy variation rates from INE. The third column shows the number of defaulted firms found in the SABI database. Active firms are those that have not defaulted since the corresponding year up to 2010. The number of active firms was selected to obtain a ratio of defaulted to total firms equal to the previously estimated default rates.

Table 2. Explanatory variables.

Explanatory variables	Notation	Category
Added value/Total assets	AV/TA	Profitability – Performance
Return on assets	ROA	
Return on equity	ROE	
Ordinary profits/Sales	OP/S	
Extraordinary profits/Ordinary profits	EP/OP	
EBITDA/Total debt	EBITDA/TD	
Financial charges/Sales	FC/S	
(Financial profits – Financial charges)/Total debt	FR/TD	
Financial charges/Total debt	FC/TD	
Cash/Total assets	C/TA	Liquidity
Cash flow/Short-term debt	CF/STD	
Cash flow/Total assets	CF/TA	
Current assets/Short-term debt	CA/STD	
Cash/Short-term debt	C/STD	
Long-term debt/Total assets	LTD/TA	Leverage
Total debt/Equity	TD/E	
Total debt/Total assets	TD/TA	
Tangible assets/Total assets	Tan/TA	Activity
Accounts payable/Total assets	AP/TA	
Sales/Total assets	S/TA	
Sales/Current assets	S/CA	
Sales growth	Sgrowth	Growth
Asset growth	TAgrowth	
Firm age	Age	Control variables
Size	Size	
Year dummies	y200x	

SMEs. All the ratios used as independent variables entered into the regression equation staggered by one period. The final model contains variables referring to profitability, leverage, liquidity, growth, and activity, as well as firm age, time variables, and interaction terms. As can be observed, only the dummy variables for the crisis years (2008 and 2009) are relevant. The interaction terms are relevant only for the year 2009, when they interact with the FR/TD ratio and the Tan/TA ratio. The model correctly predicts 85% of defaults and 83% of non-defaults.

To obtain the predicted probability of default (PPD) for the i^{th} case, we use the following link function:

Table 3. Default Model for Spanish SMEs.

Variable	Coefficient
TD/TA	3.987***
ROA	–7.457***
FR/TD	–21.929***
S/TA	–0.183***
Tan/TA	–2.508***
CF/TA	–6.706***
TAgrowth	0.218**
Age	–0.028***
y2008	0.839***
y2009	0.513*
FR/TD · y2009	10.845**
Tan/TA · y2009	2.606***
N defaulted (N not defaulted): 489 (8,994)	
Log pseudo-likelihood: −3,585.57	
Wald statistic: 294.55***	
Pseudo-R^2: 0.45	

Note: This table shows the model developed using a (weighted) logistic regression to predict the probability of the firm being bankrupt (*PPD*) for Spanish SMEs. Significance levels are indicated as follows: ***= significant at the 1% level, **= significant at the 5% level, and *= significant at the 10% level.

$$PPD_i = \frac{e^{\beta X_i}}{1 + e^{\beta X_i}} \tag{2}$$

A rating system to calculate the bank capital requirements

We now calculate the bank capital requirements under the IRB approach. To do so, we must first create a rating system for our SME sample using the model derived in the preceding section. This rating system allows us to determine the observed (real) PDs to compute in the Basel capital equations presented in Appendix 1. Similar to Altman and Sabato (2007), we rank the firms in our sample by their PPDs (Equation (2)) and then divide the number of defaulted firms by the total number of firms in each group (observed PDs). Rating classes are created to obtain the value of the observed PD closest to that showed by bond-equivalent PD distributions derived from Standard & Poor's (2010) (see Appendix 2 for details). After obtaining the PDs, we use the percentage of firms in each rating class as a weight to derive the bank capital requirements of the entire SME portfolio.

Note that PDs and weights vary between SMEs considered to be retail and those considered to be corporate. Loans extended to SMEs are eligible for retail treatment provided that the total exposure of the banking group to a small business borrower (on a consolidated basis where applicable) is less than €1 million. In this case, the logit model creates seven rating classes. If the SME portfolio is treated as corporate, the sample is divided into two groups: small firms (sales below €25 million) and medium-sized firms

(sales between €25 and 50 million).[9] The sample contains 8,046 (84.8%) small firms and 1,437 (15.2%) medium-sized firms. The logit model creates seven rating classes for small firms and six rating classes for medium-sized firms. With this classification, we obtain a weighted average PD of 5.26% for small firms and 4.59% for medium-sized firms. As expected, smaller firms are riskier.

Finally, we make some specific assumptions: (i) We use a fixed LGD of 45% (percentage suggested in the F-IRB approach for senior, unsecured loan exposures). (ii) Following Altman and Sabato (2007) we select maturities of three years for smaller firms and five years for medium-sized firms if the SMEs are treated as corporate. (iii) For size adjustment, we use the sample average amount of sales for each group: €12.1 million (small firms) and €33.4 million (medium-sized firms).

Tables 4 and 5 show the results of our calculations for bank capital requirements in an SME portfolio. Under Basel II, for SMEs classified as retail, the bank capital requirements are 3.926%. If SMEs are considered corporate, using the participation as weights of each size group in the sample (84.8% for small-sized and 15.2% for medium-sized firms), the resulting bank capital requirements are 7.36% (0.848 × 7.054% + 0.152 × 9.063%). With the new banking rules agreed upon in 2010 (Basel III), these requirements increase to 5.152% if the SMEs are considered to be retail and up to 9.66% (0.848 × 9.259% + 0.152 × 11.895%) if banks classify their SME portfolio as corporate. As expected, our results show that banks will face higher capital requirements with the Basel III Accord than under the previous one.

4. MGSs and credit risk premiums for SMEs

After deriving the capital requirements with the latest banking rules (see Tables 4 and 5), we measure the theoretical credit risk premium that banks should charge on SME loans if (i) SMEs are not guaranteed by an MGS and if (ii) SMEs are guaranteed by an MGS. Following Liebig et al. (2007) and Martín and Trujillo-Ponce (2004), among others, we determine the credit risk premium for commercial loans as the sum of two components: the expected loss (EL) and the opportunity cost of the regulatory capital.[10] The EL is estimated as the product of three variables that are already known: EAD, PD, and LGD. Banks regard EL as a cost component of doing business, included through the pricing of credit exposures and provisioning. The amount imputable to the borrower in terms of "foreseen loss," as a percentage of the exposure to the risk, would be equal to PDx LGD. However, the bank must also consider the possibility of an unexpected loss (UL), derived from the volatility associated with the PD. This UL will be reflected in the assignment of own funds constituting the regulatory capital. Capital is needed to cover the risks of such losses and thus has a loss-absorbing function. Interest rates, including the credit risk premium, charged on credit exposures should absorb the cost of these capital requirements. The cost of the regulatory capital that the loan in question "consumes" is obtained by multiplying this capital requirement by a variable representative of the return required from it (e.g., by the ROE ratio). Therefore, we calculate the credit risk premium (CRP) as follows:

$$\mathrm{CRP}\ (\%) = \mathrm{PD}\ \cdot\ \mathrm{LGD} + \mathrm{ROE} \cdot\ \mathrm{CR} \tag{3}$$

Table 4. Capital requirements for SMEs classified as retail.

			Basel II		Basel III	
Rating	**PD**	**Weight**	**CR**	**Cum. weight**	**CR**	**Cum. weight**
A	0.107%	0.0984	0.0100	0.098%	0.0131	0.129%
BBB+	0.174%	0.1823	0.0140	0.354%	0.0184	0.464%
BBB	0.244%	0.1726	0.0177	0.659%	0.0232	0.865%
BB	0.823%	0.1409	0.0356	1.160%	0.0467	1.522%
B+	2.436%	0.1818	0.0514	2.094%	0.0674	2.748%
B	5.927%	0.0836	0.0573	2.573%	0.0753	3.378%
CCC	28.625%	0.1404	0.0963	**3.926%**	0.1264	**5.152%**

Note: This table shows the capital requirements, in percentages, if all SMEs are included in the retail category. *PD* is the probability of default; *LGD* (loss given default) is assumed to be 45%; *CR* is the capital requirement or regulatory capital, calculated according to the equations presented in Appendix 1. In the third column, the weights are assigned using the percentage of firms in each rating class. In the *Cum. weight* column, the product of the *CR* and the weight is cumulated to obtain the total capital requirement (as a percentage of the EAD).

Credit risk premiums for SMEs not guaranteed by an MGS

Based on our previous calculations from Tables 4 and 5, we quantify the components of the credit risk premium for SMEs without guarantees, as shown in Table 6. According to data from the Spanish Association of Banks, the average return on equity (ROE) for Spanish banks during the period 2000–2009 was 14.6%, with the LGD again assumed to be 45%. We observe that a higher PD implies a higher CRP and that higher interest rates should be charged to loan operations with SMEs. At a similar PD, the SME borrowers with lower annual sales will benefit more in terms of the interest differential. As such, banking regulations attempt to alleviate as much as possible the burden represented by the new capital requirements for companies of small size.

Credit risk premiums for SMEs guaranteed by an MGS

We now analyze the impact of the MGS guarantee on the credit risk premium previously calculated. The specific treatment given to each of the various types of credit-risk mitigation techniques and hence to the eligible assets or guarantors differs according to the approach employed by the bank (SA, F-IRB, and A-IRB), although there are features common to all three approaches. Only guarantees issued by entities with a lower risk weight than the counterparty will lead to reduced capital charges because the protected portion of the counterparty exposure is assigned the risk weight of the guarantor or protection provider (substitution approach). However, credit risk mitigation in the form of guarantees must not reflect the effect of double default; i.e., the adjusted risk weight must not be less than that of a comparable direct exposure to the guarantor.

Banks using the F-IRB approach for calculating their regulatory capital recognize the guarantees by taking the risk-weighting function appropriate to the MGS and its PD.[11] However, banks using the A-IRB may reflect the risk-mitigating effect of guarantees by adjusting either PD or LGD estimates. The same treatment is proposed for mitigating retail risks: banks can incorporate the risk-reducing effects of guarantees, either in support of an individual obligation or a pool of exposures, through an adjustment of either the PD or LGD estimate.

Table 5. Capital requirements for SMEs classified as corporate.

				Basel II		Basel III	
Sales	**Rating**	**PD**	**Weight**	**CR**	**Cum. weight**	**CR**	**Cum. weight**
⩽ €25 mill.	A	0.126%	0.0986	0.02477	0.244%	0.0325	0.320%
	BBB+	0.180%	0.1382	0.03003	0.659%	0.0394	0.865%
	BBB	0.256%	0.2910	0.03613	1.710%	0.0474	2.245%
	BB+	1.113%	0.0782	0.06734	2.237%	0.0884	2.936%
	BB	1.820%	0.1298	0.07749	3.242%	0.1017	4.256%
	BB-	4.705%	0.1136	0.09890	4.366%	0.1298	5.730%
	CCC	28.442%	0.1508	0.17832	**7.054%**	0.2340	**9.259%**
				Basel II		**Basel III**	
Sales	**Rating**	**PD**	**Weight**	**CR**	**Cum weight**	**CR**	**Cum weight**
> €25 mill. ⩽ €50 mill.	BBB+	0.183%	0.3800	0.04021	1.528%	0.0528	2.005%
	BB	1.042%	0.0668	0.07885	2.055%	0.1035	2.697%
	BB-	1.852%	0.0752	0.09198	2.746%	0.1207	3.604%
	B+	2.335%	0.1788	0.09715	4.483%	0.1275	5.884%
	B	7.071%	0.2067	0.13327	7.238%	0.1749	9.500%
	CCC	26.316%	0.0926	0.19717	**9.063%**	0.2588	**11.895%**

Note: This table shows the capital requirements, in percentages, if all SMEs are considered to be corporate. We split the SME population into two groups: one group with sales below €25 million (small-sized) (8,046 firms) and the other group with sales between 25 and €50 million (medium-sized) (1,437 firms). *PD* is the probability of default; *LGD* (loss given default) is assumed to be 45%; the maturity of the operation is assumed to be 3 years (small-sized) or 5 years (medium-sized); *CR* is the capital requirement or regulatory capital, calculated according to the equations presented in Appendix 1. In the *Weight* column, these are assigned using the percentage of firms in each rating class. In the *Cum. weight* column, the product of the *CR* and the *weight* is cumulated to obtain the total capital requirement (as a percentage of the EAD).

Therefore, in the IRB approach, the precise quantification of the risk premium for guaranteed SME loans will depend on the variables that determine the credit risk of the MGS (mainly the PD). It is almost certain that the PD of the MGS will be lower than that of the SME borrower; therefore, the credit risk reduction, as a consequence of the existence of the MGS guarantee, should be translated into reduced capital requirements and, ultimately, into lower risk premiums (interest rates) chargeable to the SMEs. If the possible existence of counter-guarantees were considered, the credit risk premiums would be even lower.

Table 7 shows the risk premiums for SME loans guaranteed by MGSs whose probabilities of default rank from 0.03% up to 1%.[12] We find that, under Basel II guidelines, in the best possible case (when the PD of the MGS equals 0.03%), the risk premium is 0.221%. However, when the soundness of the MGS worsens, the risk premiums increase, reaching approximately 2% in the worst case considered in our study (PD of the MGS equal to 1%). Under the new banking rules proposed in Basel III, these percentages would be higher: 0.285% (best-case scenario) and 2.053% (worst-case scenario).

Finally, if we compare Tables 6 and 7, we can see the differences of the estimated risk premiums for SME loans guaranteed by an MGS compared to the credit risk

Table 6. Credit risk premiums for SMEs not guaranteed by an MGS.

Retail								
			Basel II			Basel III		
Rating	PD	EL	CR	ROE x CR	CRP	CR	ROE x CR	CRP
A	0.107%	0.048%	0.996%	0.145%	0.194%	1.307%	0.191%	0.239%
BBB+	0.174%	0.078%	1.402%	0.205%	0.283%	1.840%	0.269%	0.347%
BBB	0.244%	0.110%	1.767%	0.258%	0.368%	2.319%	0.339%	0.449%
BB	0.823%	0.371%	3.556%	0.519%	0.890%	4.668%	0.681%	1.052%
B+	2.436%	1.096%	5.138%	0.750%	1.846%	6.744%	0.985%	2.081%
B	5.927%	2.667%	5.735%	0.837%	3.504%	7.527%	1.099%	3.766%
CCC	28.625%	12.881%	9.634%	1.407%	14.288%	12.645%	1.846%	14.727%
Corporate (sales less than €25 mill.)								
			Basel II			Basel III		
Rating	PD	EL	CR	ROE x CR	CRP	CR	ROE x CR	CRP
A	0.126%	0.057%	2.477%	0.362%	0.418%	3.251%	0.475%	0.531%
BBB+	0.180%	0.081%	3.003%	0.439%	0.519%	3.942%	0.576%	0.656%
BBB	0.256%	0.115%	3.613%	0.527%	0.643%	4.742%	0.692%	0.808%
BB+	1.113%	0.501%	6.734%	0.983%	1.484%	8.838%	1.290%	1.791%
BB	1.820%	0.819%	7.749%	1.131%	1.950%	10.171%	1.485%	2.304%
BB-	4.705%	2.117%	9.890%	1.444%	3.561%	12.981%	1.895%	4.012%
CCC	28.442%	12.799%	17.832%	2.603%	15.402%	23.404%	3.417%	16.216%
Corporate (sales between €25 mill. and €50 mill.)								
			Basel II			Basel III		
Rating	PD	EL	CR	ROE x CR	CRP	CR	ROE x CR	CRP
BBB+	0.183%	0.082%	4.021%	0.587%	0.670%	5.278%	0.771%	0.853%
BB	1.042%	0.469%	7.885%	1.151%	1.620%	10.348%	1.511%	1.980%
BB-	1.852%	0.833%	9.198%	1.343%	2.176%	12.072%	1.762%	2.596%
B+	2.335%	1.051%	9.715%	1.418%	2.469%	12.750%	1.862%	2.912%
B	7.071%	3.182%	13.327%	1.946%	5.128%	17.492%	2.554%	5.736%
CCC	26.316%	11.842%	19.717%	2.879%	14.721%	25.879%	3.778%	15.620%

Note: This table shows the credit risk premiums (*CRPs*) for SMEs (as a percentage of the *EAD*) for the IRB approach. *PD* is the probability of default from Tables 4 and 5; *LGD* is assumed to be 45%; *EL* denotes the expected loss as a percentage of the exposure to risk, which is estimated as the product of both *PD* and the *LGD*; *ROE* is the average return on equity for Spanish banks during the period 2000–2009; *CR* is the capital requirement or regulatory capital as a percentage of the *EAD* (data from Tables 4 and 5); $ROE \times CR$ refers to the opportunity cost of the regulatory capital; *CRP* is the sum of two components: the *EL* and the opportunity cost of the regulatory capital.

premium for loans without an MGS guarantee. These differences always favor operations supported by an MGS if its PD equals 0.03%, with the sole exception of the lowest risk category (rating A) of firms treated as retail. Also note that these divergences are greater

as the SME rating decreases or under Basel III standards. However, because risk premiums of MGSs are much higher in the worst-case scenario (PD equal to 1%), only SMEs in the lower rating categories could take advantage from this MGS guarantee.

Because the MGS suffers a loss in case of default, members have strong incentives to closely monitor their peers, which may prevent borrowers from excessively risky behavior. This peer review process acts as a powerful mechanism for controlling risk and limiting opportunistic behavior. Additionally, because MGSs typically have in-depth knowledge of the business sector, they maintain a good position to assess SMEs' creditworthiness, as they are considered to be effective in addressing the information asymmetries between the bank and the SME. The above facts help the MGS to reduce its overall credit risk.

Assessment of the cost of the MGS guarantee

Having reached this point, the resulting questions are as follows: what is the cost of the guarantee for the SME? Is this cost compensated by the reduction of the CRP previously calculated that, in theory, the bank should translate into a lower interest rate for an operation guaranteed by an MGS?

In guarantee systems of a mutual type, such as the Spanish one, those SMEs that are inclined to obtain a guarantee from an MGS must necessarily become partners (i.e., must participate in the ownership). However, once the credit has been amortized, the company can request the return of its participation. These recoverable contributions (subscription quota or SQ) represent an opportunity cost for the SME borrower. In addition, the SMEs that request a guarantee from an MGS must do so against a series of non-recoverable costs, particularly the following: (i) The study commission (SC) that is charged as a percentage on the amount of guarantee requested, which is intended to reimburse the MGS for conducting a study of the viability of the project. This cost is incurred irrespective of whether the guarantee is finally conceded. The study commission is paid only once, when the operation is requested; (ii) The commission in the concept of guarantee (GC), which is usually charged as a percentage of the amount due at the beginning of each accounting period. This commission is payable annually by the SME during the term of the guarantee. Its objective is to cover the possible insolvency of the partner endorsed and will depend on the amortization method of the loan granted by the bank.

To make it feasible to compare these costs with the credit risk premiums previously calculated, we must estimate the cost of the guarantee as an effective annual amount (IRR). This rate is given by the following equation:

$$0 = A - (SQ + SC).\ A - GC \cdot AD_1 - \frac{GC \cdot AD_2}{1 + IRR} - \cdots - \frac{GC \cdot AD_n}{(1 + IRR)^{n-1}} + \frac{SQ \cdot A - A}{(1 + IRR)^n} \quad (4)$$

where A is the amount of the guarantee, SQ is the subscription quota to the capital of the MGS, SC denotes the study commission, GC designates the guarantee commission, AD_t represents the amount due for the loan guaranteed at the beginning of year t, and n is the loan term (in years).

In the most usual case of the amortization of a loan with constant annual repayment, and for average data of the Spanish market for 2009, the result obtained after applying Equation (4) is 0.68%.[13]

Therefore, we find that it will be advantageous for an SME classified as corporate to request the guarantee from an MGS with the best credit quality (PD equal to 0.03%) provided that the SME credit rating is lower than BBB (small firms) or BBB+ (medium-

Table 7. Credit risk premiums for SMEs guaranteed by an MGS.

		Basel II			Basel III		
PDMGS	**EL**	**CR**	**ROE x CR**	**CRP**	**CR**	**ROE x CR**	**CRP**
0.030%	0.014%	1.419%	0.207%	0.221%	1.862%	0.272%	0.285%
0.250%	0.113%	4.614%	0.674%	0.786%	6.056%	0.884%	0.997%
0.500%	0.225%	6.396%	0.934%	1.159%	8.395%	1.226%	1.451%
0.750%	0.338%	7.544%	1.101%	1.439%	9.902%	1.446%	1.783%
1.000%	0.450%	8.367%	1.222%	1.672%	10.981%	1.603%	2.053%

Note: This table shows the credit risk premiums (*CRPs*) for SMEs guaranteed by an MGS under the IRB approach, as a percentage of the *EAD*, for different values of the *PD* of the *MGS (PDMGS)* (from 0.03% to 1%). *EL* denotes the expected loss as a percentage of the exposure to risk, which is estimated as the product of both the *PD* and the *LGD* (assumed to be 45%); *ROE* is the average return on equity for Spanish banks during the period 2000-2009 (assumed to be 14.6%). *CR* is the capital requirement or regulatory capital, as a percentage of the *EAD. ROE x CR* refers to the opportunity cost of the regulatory capital; and *CRP* is the sum of two components: the *EL* and the opportunity cost of the regulatory capital.

sized firms), either under Basel II or Basel III rules (see Tables 6 and 7). If the bank considers the SME portfolio to be retail, the MGS guarantee will be profitable for an SME as long as its credit rating is lower than BB, for Basel II standards, and below BBB, for Basel III proposals. However, when the credit quality of the MGS worsens, its guarantee becomes less attractive, being only profitable to those SMEs with the lowest credit ratings (with higher credit risk premiums).[14]

5. Conclusions

This paper analyzes the impact of the guarantee provided by the MGSs on the capital requirements for SMEs under the new banking rules established by the Basel Committee in 2004 and 2010. We also examine whether the foreseeable decrease in the theoretical credit risk premium, as a result of lower capital requirements for guaranteed SME loans, is compensated by the cost of the MGS guarantee. Although the conclusions of the study focus on the Spanish case, the analysis and methodology developed could have a much broader interest for supervisors concerned about benchmarking and validation issues related to Basel Accords.

We show that the role of the guarantee has been strengthened under the new banking regulation, which has benefited the ability of the MGSs to function as mediators between banks and SMEs. It appears clear that if the SME loan is approved with the guarantee of an MGS, this guarantee reduces the risk, and, consequently, bank capital requirements should be lower. However, although our results support this idea, we find that the final effect of the guarantee on the theoretical risk premium depends on the values of the credit variables of the MGS (essentially the PD). It is therefore necessary to promote the establishment of rating systems not only to assess the creditworthiness of SMEs but also of MGSs. The guarantee will be beneficial for most SMEs if the MGS has a good soundness; however, when the credit quality of the MGS worsens, its guarantee may become less attractive.

This finding has important policy implications and suggests that the initiatives aimed to improve the credit quality of the MGSs must be reinforced. In this context, the

importance of counter-guarantee systems is highlighted. Counter-guarantees are usually provided by a public financial entity, which assumes part of the risk associated with the SME loan guaranteed by the MGS. Slightly over half of the guarantee systems in Europe have some type of counter-guarantee. Although in most cases this counter-guarantee does not cover the total amount of the operation, it represents significant support for the soundness of the MGS. Therefore, an SME bank loan covered by an MGS guarantee that is indirectly counter-guaranteed to a significant percentage by a reinsurance company (e.g., CERSA in Spain) should benefit from lower bank interest rates.

Finally, in relation to future research, it would be interesting to compare the results of this paper with those obtained by using other well-known default prediction models (e.g., the Z-score Altman model (1968) or Moody's KMV RiskCalc).[15]

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Notes

1. A new and innovative financial instrument to improve the creditworthiness and reduce the borrowing cost of SMEs is described in Zhang and Wu (2012).
2. The Spanish system of public support to MGSs is based mainly on counter-guarantees granted by CERSA (*Compañía Española de Reafianzamiento, S.A.*), an instrumental society of the Spanish Government. The coverage rate (30 to 75%) depends on policy priorities, such as innovation promotion, and types of operations, such as investments. CERSA has also a helpline to assist companies with less than 100 employees.
3. The SABI database is compiled by the Bureau van Dijk Electronic Publishing. See http://www.bvdinfo.com/Products/Company-Information/National/SABI.aspx for a more detailed description of the database.
4. Other significant works that have examined different aspects of the Basel Capital Accords are those by Andersen (2011); Antão and Lacerda (2011); Cardone-Riportella and Trujillo-Ponce (2007); Dietsch and Petey (2004); Drehmann and Gambacorta (2012); Hakenes and Schnabel (2011); Johnston (2009); Kerkhof and Melenberg (2004); Lindquist (2004); Medema, Koning, and Lensink (2009); Repullo and Suárez (2004); and Scellato and Ughetto (2010).
5. We have borrowed the average default rate reported by Saurina and Trucharte (2004) for Spanish SMEs over 1994–2001 as input to select (part of) our sample due to the lack of current statistics on Spanish SME default rates.
6. INE data account for small and large firms. Unfortunately, we could not obtain bankruptcy data decomposed by sales volume.
7. We included interaction terms in the form of year dummy variables multiplied by the explanatory variables for all years considered. This methodology allows us to test whether the determinants of default differ through the different years of the economic cycle.
8. The financial literature concludes that including qualitative variables improves the model's predictive power. Despite this finding, we are obliged to use only firms' financial statement data because the SABI database does not contain qualitative variables.
9. Under the IRB approach, for the purposes of the firm-size adjustment for SME borrowers, companies with sales of less than €5 million are treated as equivalent to €5 million.
10. A more exact determination of the credit risk premium would involve using the concept of economic capital instead of regulatory capital.
11. The formula for calculating risk-weighted assets for MGS exposures is the same as that used for bank exposures: see Basel Committee on Banking Supervision (2004), paragraph 272.
12. The Basel Accords establish a minimum PD value (0.03%) under the IRB approach.

13. We assume the following data taken from the Confederation of Spanish Mutual Guarantee Societies (CESGAR) (2010): average amount of the guarantee (A), 66,000€; study commission (SC), 0.5%; guarantee commission (GC), 1.0%; contribution to the capital of the MGS (SQ), 1.0%; interest rate (i), 6.0%; and average term of the loan (n), 8 years.
14. We have not considered that the lower creditworthiness measurement cost of MGSs in comparison with SMEs could affect the loan interest rates. For a more detailed insight, please see He and Wang (2007).
15. Please see http://www.moodysanalytics.com for detailed information about Moody's KMV RiskCalc model. An analysis about different models used to obtain the PD can be found in Murro (2013).

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Appendix 1. Basel Capital Accord formulas for capital requirements

	Basel II	Basel III
SMEs classified as retail	$CR(BII) = \left\langle LGD \times N\left[\frac{G(PD)+\sqrt{R}\times G(0.999)}{\sqrt{1-R}}\right] - PD \times LGD\right\rangle \times 1.06$ where $\mathrm{R} = 0.03 \times \left(\frac{1-e^{-35\times PD}}{1-e^{-35}}\right) + 0.16 \times \left[1 - \left(\frac{1-e^{-35\times PD}}{1-e^{-35}}\right)\right]$	$CR(BIII) = CR(BII) \times 0.105/0.08$
SMEs classified as corporate	$CR(BII) = \left\langle LGD \times N\left[\frac{G(PD)+\sqrt{R}\times G(0.999)}{\sqrt{1-R}}\right] - PD \times LGD\right\rangle \left\langle \frac{1+(M-2.5)\times b}{1-1.5\times b}\right\rangle \times 1.06$ where $R = 0.12 \times \left(\frac{1-e^{-50\times PD}}{1-e^{-50}}\right) + 0.24 \times \left[1 - \left(\frac{1-e^{-50\times PD}}{1-e^{-50}}\right)\right] - 0.04 \times \left(\frac{1-(S-5)}{45}\right)$ $\mathrm{b} = (0.11852 - 0.05478 \times \ln(\mathrm{PD}))^2$	$CR(BIII) = CR(BII) \times 0.105/0.08$

Source: Basel Committee on Banking Supervision (2004, 2010).

Note: This appendix presents the formulas used to estimate the capital requirements (*CR*) for SMEs under the IRB approach when the SMEs are classified as retail or as corporate. *CR*(*BII*) indicates the formulation under the Basel II Accord, whereas *CR*(*BIII*) indicates the formulation under the Basel III Accord. In Basel III, a capital conservation buffer of 2.5% is established above the regulatory minimum capital requirement. In addition, national authorities may require a countercyclical buffer that varies between zero and 2.5% if the excess aggregate credit growth is judged to be associated with a build-up of system-wide risk (we do not consider this additional requirement in our study). *LGD* is the loss given default; $N(x)$ is the standard normal cumulative distribution; R denotes the correlation; $G(z)$ is the inverse standard normal cumulative distribution; *PD* is the probability of default; M designates the maturity of the operation; b designs the maturity adjustment; S represents annual sales in millions of euros.

Appendix 2. Estimation of SME rating classes

Retail				
$p_1 < PPD \leq p_2$	Cases (1)	Observed defaults (2)	Observed PD (2/1)	Rating
0 - 0.64%	933	1	0.107%	A
0.64% - 5.00%	1,729	3	0.174%	BBB+
5.00% -13.50%	1,637	4	0.244%	BBB
13.50% - 25.00%	1,336	11	0.823%	BB
25.00% - 46.00%	1,724	42	2.436%	B+
46.00% - 60.00%	793	47	5.927%	B
60.00% - 100%	1,331	381	28.625%	CCC
Total	9,483	489	5.157%	
Corporate (sales less than €25 mill.)				
$p_1 < PPD \leq p_2$	Cases (1)	Observed defaults (2)	Observed PD (2/1)	Rating
0 - 0.64%	793	1	0.126%	A
0.64% - 3.50%	1,112	2	0.180%	BBB+
3.50% - 19.00%	2,341	6	0.256%	BBB
19.00% - 26.00%	629	7	1.113%	BB+
26.00% - 40.00%	1,044	19	1.820%	BB
40.00% - 58.00%	914	43	4.705%	BB-
58.00% - 100%	1,213	345	28.442%	CCC
Total	8,046	423	5.257%	
Corporate (sales between €25 mill. and €50 mill.)				
$p_1 < PPD \leq p_2$	Cases (1)	Observed defaults (2)	Observed PD (2/1)	Rating
0 - 10.00%	546	1	0.183%	BBB+
10.00% - 13.30%	96	1	1.042%	BB
13.30% - 19.00%	143	2	1.399%	BB-
19.00% - 37.50%	257	6	2.335%	B+
37.50% - 70.00%	297	21	7.071%	B
70.00% -100%	133	35	26.316%	CCC
Total	1,437	66	4.593%	

Note: This appendix shows the classification into rating categories of the sample firms, following a procedure similar to that used by Altman and Sabato (2007). *PPD* is the predicted probability of default obtained through the logit model (Equations 1 and 2). The cut-off values (*p*) are selected to obtain the observed *PDs* closest to the one-year *PD* distribution provided by Standard & Poor's (2010). The second column (*Cases*) shows the number of firms with a *PPD* less than or equal to *p2* (e.g., $p2 \leq 0.64\%$ for the first row); we take this number of firms as the rating class size. The third column shows the number of real (observed) defaults contained in the Cases column. *Observed PD* shows the ratio of real defaults (2) to the number of firms in the rating class (1). The fifth column shows the S&P rating associated to the *Observed PD*.