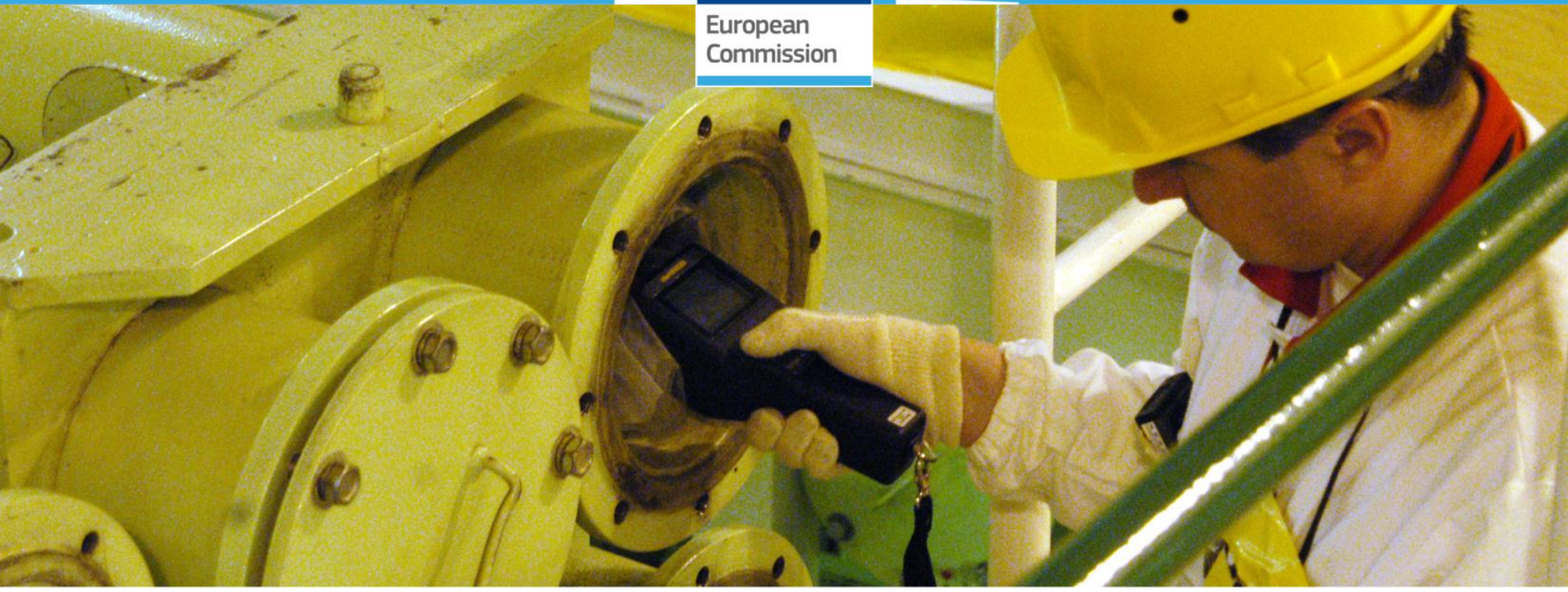

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The mitigation role of collaterals and guarantees under Basel II

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Abstract

Under the Basel II framework for capital adequacy of banks, regulatory financial collateral and guarantees (C&G) can affect lending policy in both a micro and a macro perspective.

This paper aims at assessing these effects throught the modelling of the impact of C&G on credit spreads. In doing this we assume the perspective of a bank adopting a Foundation Internal Rating Based approach to measure credit risk and we apply a comparative-static analysis to a pricing model, based on the intrinsic value pricing approach as in the loan arbitrage-free pricing model (LAFP) suggested by Dermine (1996).

Our results show that financial collaterals are more effective than guarantees in reducing credit spreads, this differential impact becoming greater as the borrower's rating worsen.

Moreover, the effects of C&G on credit spreads can be more effective than an improvement of borrower's rating, this possibly leading to negative outfits on credit industries' allocative efficiency.

Keywords: Loans pricing, credit spreads, collaterals and guarantees, credit risk mitigation.

TABLE of CONTENTS

1. Introduction

The Basel II framework for capital adequacy of banks, proposed by the Basel Comittee in June 2004 and adopted by the EU in 2005, has strongly modified the methodology to compute capital requirements for credit institutions.

In its prescription of a risk-sensitive measure of capital adequacy, the Basel II framework fully recognizes the role of collaterals and guarantees (C&G) as “mitigation” tools of the loan overall credit risk. Specifically, regulation prescribes that both the expected and unexpcted loss related to a given credit exposure, as defined for regulatory purposes, can be reduced to some extent if the loan is protected by eligible C&G. This might have some implications of both micro and macro nature.

Under a micro perspective, if we assume a bank’s pricing criteria is based upon the evaluations of credit risk components, C&G become a sort of “regulatory driver” that can be used both by lenders and borrowers in the credit relationship, especially in the negotiation process of credit spreads. In other words, banks could differentiate credit spreads not only according to the rating assigned to borrowers, but also taking into account the regulatory effect on credit risk components, due to the release of either collaterals or guarantees.

From a macro point of view, the new regulatory framework could have implications on the overall allocative efficiency of the credit industry. The banking system acts both as a mobiliser of savings and as a credit allocator for investment and production. The effectiveness of banking sector’s contribution to the economic growth and develpment is broadly determined by its efficiency in the allocation of mobilized savings amongst the more convenient projects (see Greenwood and Jovanovic, 1990; Levine, 1997). In this context, banking regulation should be aimed at allocative efficiency, in order to maximise economic growth.

Given these implications, it can be important to verify “how” and “how much” the C&G impact on credit spreads.

This paper aims at providing a quantitative assessment of these effects of C&G by assuming the perspective of a bank adopting an Internal Rating Based approach (IRB foundation) to measure credit risk and through a comparative-static analysis applied to a pricing model. The model is defined following the intrinsic value pricing approach, as in the loan arbitrage-free pricing model (LAFP) suggested by Dermine (1996), further developed for considering the regulatory treatment of financial collaterals and guarantees, and verify if credit exposure mitigation behaviours are relatively more convenient (in terms of credit spreads) than upgrading borrower’s rating quality, as such a regulation would result in a loose of efficiency in the credit allocation.

The paper is structured as follows: section 2 presents the regulatory treatment of C&G under IRB foundation approach as indicated in the Capital Requirement Directive. Section 3 after a general comment about the effects of C&G on loan pricing, describes the methodology we adopt to assess the C&G impact on credit spreads. Sction 4 reports the main results, and section5 concludes.

2. The treatment of collaterals and guarantees under the IRB approach

A whole annex of the Directive on capital adequacy is devoted to credit risk mitigation instruments, defined as on-balance sheet netting, collateral, guarantees and credit derivatives. The new regulatory framework defines with great details both the requirements that these risk mitigation instruments have to satisfy in order to be recognised by the supervisors and the quantitive methodology to assess their impact on expected and unxecpeted loss[1].

Focusing on collaterals and guarantees, it is worth mentioning that the Directive treats these credit risk mitigation instruments in a more extensive manner with respect to the 1988 Capital Accord (Basel I).

In other words, conversely to the previous regulation, the Directive not only expands the list of collaterals and guarantees eligible within the banking supervision context, but also modifies the methodology for computing their impact on credit risk.

In the rest of this paper we refer to banks measuring credit spreads trough the IRB approach (foundation), and we only consider the regulatory treatment of both financial collaterals and guarantees as described by the Capital Adequacy Directive only for this credit risk method.

1. Collaterals

The impact of financial collaterals on credit risk components (expected and unexpected loss) is measured by the so called "comprehensive method". Under this method the Market Value of the Collateral[2] (MVC) is applied by the bank to modify the value of the regulatory Loss Given Default (LGD) as follows: the regulatory value of the LGD suggested by the supervisors (45% for senior exposures; 75% for subordinated exposures) is multiplied by a corrective factor obtained as the ratio of the adjusted value of the exposure (E - MVC) to its current value (E). Formally speaking the LGD to be used for computing the capital requirement and the expected loss for an exposure assisted by a financial collateral is then the following:

$$LGD^{*} = LGD \times \left[\frac{E - MVC}{E} \right] \quad 0 \le MVC \le E$$

---

[1] The eligible conditions and the minimum requirements for collaterals and guarantees described in the Directive are not analysed in this paper. In fact the analysis of these requirements would require an extensive description, outside the purpose of this work. Obviously, we assume in the following sections that collaterals and guarantees obtained by the bank respect all the eligible conditions and the minimum requirements expected by the Directive. For a complete analysis of these requirements see the Directive, Annex VIII, part 1 and part 2, pp.1-38.

[2] The bank must adjust the market value of the collateral to take into account its volatility and any maturity mismatch with the exposure. For a description of the comprehensive method, see Directive, Annex VIII, part 3, paragraph 1.4, points 31-62, pp. 51-66.

As specified above, the market value of the collateral must be positive and lower than the exposure. If its value is either equal to or greater than the value of the exposure, the benefit for the lender is the reset of the LGD.

2. Guarantees

Under the IRB foundation approach, if an exposure can benefit from a guarantee, it can be decomposed into two parts for the computation of both the expected loss and the capital requirement to cover unexpected losses.

In particular the expected loss is measured as a weighted average of the one assigned to an exposure toward the guarantor and the one for an exposure toward the borrower. The weight for the first component is defined on the basis of the coverage degree ensured by the guarantor, the weight for the second component reflecting the percentage of the loan without any credit protection.

As regards the capital requirement, the risk weight coefficient for the first component is computed on the basis of the level of risk assigned to the guarantor in terms of Probability to Defult (PD) and using its own risk function, while the amount of the credit exposure not covered by the guarantee is computed applying the borrower’s PD. Therefore, a guarantee is only effective if the guarantor PD is lower than the debtor’s one.

3. Methodology

3.1 The loan spread function

The literature on pricing banking loans identifies two main, not necessarily alternative, behavioural models for financial institutions[3].

According to the first approach, a bank defines the loan pricing in order to be strictly conformed to the pricing conditions applied in the credit market. This model is called comparison pricing, since the pricing determinants are derived from the prices applied by other intermediaries on loans with similar features for both risk and maturity.

The second model does not adopt a market perspective, but focuses on the “intrinsic components” of pricing (intrinsic value pricing). Under this approach, banks adopt a production criteria in defining the pricing, so that the loan pricing is firstly affected by the exposure level of risk (in particular credit risk) and then by the other cost components deriving from the same exposure. As a result it is possible to

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[3] On loan pricing see, amongst others,: J.B. Caouette, E.I. Altman, P. Narayanan, (1998), J. Dermine (1996, 2003); M.B Gordy (2003); F. Saita (2003).

identify a risk adjusted return proxy of the loan pricing as, the proper return on lending, on the base of its risk and the other costs to be supported by the financial intermediary.

In this second typology pricing models linked to RORAC (*return on risk-adjusted capital*) criteria are also classified. In these models the expected net return on the exposure (measured on own funds covering the unexpected loss) is at least equal to the ROE target that management want to ensure to shareholders.

Within the intrinsic value pricing category are also included models such as *LAFP* (*loan arbitrage-free pricing model*). This model, also following the criteria based on the comparison between ROE target and return on the loan, takes into account the time value of the money regarding the cashflows related to the credit exposure.

The pricing is therefore derived through the identity between the future values of the cashflow in and that of the cashflow out.

Considering the credit risk related to the exposure, namely the probability that the debtor is not able to repay the credit at maturity, we can have that:

1. the debtor defaults (with probability PD);
2. the debtor regularly pays the credit (with probability 1-PD)

Considering as a standard reference a unitary credit, with one year maturity, and interests paid at the end of the period, the expected value of the exposure *j* can be obtained as:

(1) $$E(M)=(1+i_j)\times(1-PD_j)+(1+i_j)\times(1-LGD_j)\times PD_j$$

where :

$E(M)$ is the expected value of the credit at the end of the period;

i_j is the interest rate applied on the *j* risky loan;

PD_j is the probability of default of the *j* debtor;

LGD_j is the probability to default of the *j* debtor;

Secondly, the price of a loan should be adequate with respect to all the cashflows coming from the credit exposure. These cashflows regard the funding needs and the operative costs for the screening and monitoring the credit risk of the borrower.

Formally, we have:

(2) $$U(M)=(1-C_j)\times(1+i_d)+C_j\times(1+r_e)+cop_j$$

where:

U (M) is the overall cash flows out;

C_j is the equity funding (%);

i_d is the interest rate paid on interbank funding;

r_e is the gross return to shareholders;

cop_j is the operative costs related to the loan;

By jointly considering (1) e (2) we can get the break-even price of the loan:

(3) $(1+i_j)\times(1-PD_j)+(1+i_j)\times(1-LGD_j)\times PD_j=(1-C_j)\times(1+i_d)+C_j\times(1+r_e)+cop_j$

solving for i_j :

$$(4)\qquad i_j=\frac{i_d+PD_j\times LGD_j+C_j\times(r_e-i_d)+cop_j}{1-PD_j\times LGD_j}$$

Where C_j is the regulatory capital, computed as in the Directive[4]:

$$C_j=\left[LGD_j\times N\left[\left(1-R\left(PD_j\right)\right)^{-0,5}\times N^{-1}\left(PD_j\right)+\left(\frac{R\left(PD_j\right)}{1-R\left(PD_j\right)}\right)^{0,5}\times N^{-1}\left(0,999\right)\right]-PD_j\times LGD_j\right]$$
$$\times\left(1-1,5\times B\left(PD_j\right)\right)^{-1}\times\left[1+\left(M_j-2,5\right)\times B\left(PD_j\right)\right]\times 1,06$$

where:

N is the cumulative distribution function for a standard normal random variable;

N^{-1} is the inverse cumulative distribution function for a standard normal random variable;

$B(PD)$ is a correction factor for the maturity adjustment, computed as follows:

$$B\left(PD_j\right)=\left[0.11852-0.05478\ln\left(PD_j\right)\right]^2$$

M_j is the effective maturity;

$R(PD_j)$ is the correlation parameter between assets, computed as follows:

$$R=0,12\times\left[1-EXP\left(-50\times PD_j\right)\right]/\left[1-EXP\left(-50\right)\right]+0,24\times\left[1-\left(1-EXP\left(-50\times PD_j\right)\right)/\left(1-EXP\left(-50\right)\right)\right]$$
$$-0,04\times\left[1-\left(S_j-5\right)/45\right]$$

where:

S_j = Sales; $5\leq S_j<50$

Subtracting from both members of (1) the cost of interbank funding, we obtain:

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[4] The capital requirements formula showed in the text can be used for pricing loans released to firms with total sales equal o greater than € 50 Mln. For firms with total sales lower than € 50 Mln. this formula must be adjusted to achieve a lower capital requirement for the same probability of default of the borrower. See Directive, Annex VII, part 1, par. 1.1, p. 28-29.

(5.1) $$Spread = i_j - i_d = \frac{i_d + PD_j \times LGD_j + C_j \times (r_e - i_d) + cop_j - i_d + i_d \times PD_j \times LGD_j}{1 - PD_j \times LGD_j}$$

That can also be written as:

(5.2) $$Spread = i_j - i_d = \frac{PD_j \times LGD_j \times (1 + i_d) + C_j \times (r_e - i_d) + cop_j}{1 - PD_j \times LGD_j}$$

Which can also be represented as the sum of three components:

1. the expected loss component, namely the percentage of the loan that the bank estimates to loose on average;
2. the unexpected loss component;
3. the operative cost component.

(5.3) $$Spread = i_j - i_d = \underbrace{\frac{PD_j \times LGD_j \times (1 + i_d)}{1 - PD_j \times LGD_j}}_{\text{Expected loss component}} + \underbrace{\frac{C_j \times (r_e - i_d)}{1 - PD_j \times LGD_j}}_{\text{Unexpected loss component}} + \underbrace{\frac{cop_j}{1 - PD_j \times LGD_j}}_{\text{Operative cost component}}$$

3.2 The impact of collaterals and guarantees on pricing function

Collaterals and guarantees impact on credit spreads through their effects both on the expected loss and on the capital requirement, due for covering unexpected loss. In addition, the magnitudo of these effects depends on the type of C&G released to the banks and the level of coverage of the exposure ensured by the credit risk mitigation instruments.

We can analyse these aspects for a bank using an IRB foundation approach measuring credit spreads according to the function 5.3:

Under a regulatory perspective, G&C mainly affect the first two components of the spread function[5].

Considering the case of a loan with a recognised financial collateral, we find two effects on credit spread (see figure 1): the direct one (labelled as “A” in Fig. 1) is on LGD_j, while the second (B) indirectly results from the effect on C_j, the capital requirement ratio, of the change in LGD_j.

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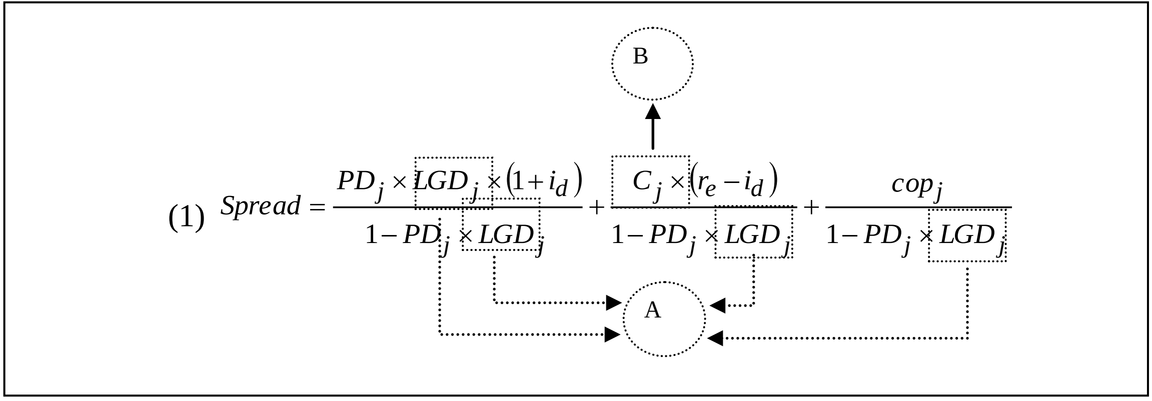
[5] From the regulatory point of view, we can assume that C&G do not impact on the organisational component, even though the mitigation instrument evaluation will impact on the operative costs of the credit relationship.

The overall effect results in an increasing function of the degree of protection ensured by the collateral. For example, in the extreme case of a 100% loan coverage by an eligible financial collateral, both LGD_j and C_j go to zero, and the resulting loan spread is equal to operative costs.

Fig. 1- Impacts of collaterals on pricing function



For an intermediate degree of coverage ensured by the collateral, we have a decrease in both the expected and unexpected component of credit spread with respect to a loan without any mitigation instrument.

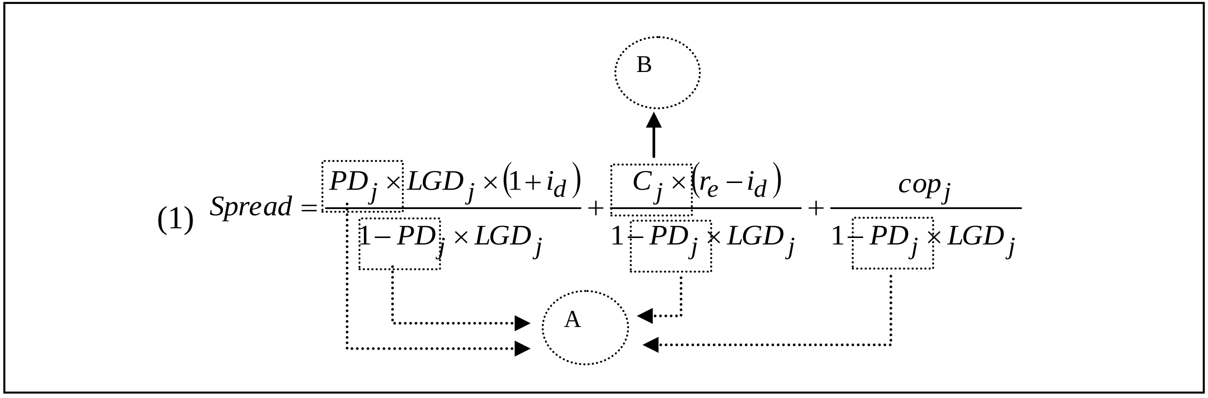
Conversely to the case of collateral, the impact of eligible guarantees on the spread function does not affect the LGD, but its effect is on the probability of default of the exposure.

More specifically, the PD to be considered is a weighted average of the borrower PD (PD_j), and the guarantor PD (PD_g) which is supposed to be lower than PD_j. Formally we have:

$$PD_j^* = (1-\alpha) \times PD_j + \alpha \times PD_g \qquad 1 \geq \alpha \geq 0$$

The effects on credit spread due to these changes are summarised in Figure 2.

Fig. 2- Impacts of guarantees on pricing function



Also in this case we have two effects on credit spread (see Fig. 2): the direct one (A) is on PD_j, while the second (B) indirectly results from the effect on C_j, the capital requirement ratio, of the change in PD_j.

It is worth mentioning that the loan spread price reaches the minimum level (equal to the operative costs, as in the case of a collateral) only when there is a full protection ensured by a guarantor with zero risk weight, such as a central bank or similar.

An equal effect can not be produced by all the other typologies of guarantors recognised by the directive (i.e. banks or other financial institution), since their PD has a minimum regulatory value fixed to 0,03%.

3.3 The pricing model

What is described in the previuos paragraph can be formally described by the set of four equations listed below:

(6.1)
$$Spread = \frac{PD_j^* \times LGD_j^* \times (1+i_d)}{1-PD_j^* \times LGD_j^*} + \frac{C_j^* \times (r_e - i_d)}{1-PD_j^* \times LGD_j^*} + \frac{cop_j}{1-PD_j^* \times LGD_j^*}$$

(6.2)
$$PD_J^* = (1-\alpha)\times PD_D + \alpha \times PD_G \qquad 1 \geq \alpha \geq 0$$

(6.3)
$$LGD_J^* = MAX\left[0;45\% \times \frac{E-MVC}{E}\right]; \qquad 0 \leq LGD^* < 45\% \qquad E \geq MVC \ \geq 0$$

(6.4)
$$C_j^{\,*} = \left[LGD^* \times N\left[(1-R)^{-0,5} \times G(PD) + \left(\frac{R}{1-R}\right)^{0,5} \times G(0{,}999) \right] - PD \times LGD^* \right] \times (1-1{,}5\times b)^{-1} \times \left[1+(M-2{,}5)\times b\right] \times 1{,}06$$

where:

PD_j is the probability of default of the borrower

PD_g is the probability of default of the garantor

Equation (6.1) represents the pricing function already presented; (6.2) is the PDs weighted average for considering the guarantees; (6.3) refers to the adjustement of LGD for the presence of collaterals; (6.4) represents the regulatory capital for covering the unexpected loss.

4. Results

The pricing model results are evaluated in terms of comparative-static analysis, on the base of its elasticies.

Figure 3 shows the pricing function given a regulatory 45% LGD. The spread function is an increasing function of PD with a decreasing slope, as shown by the first order derivative analysis plot (Fig. 4).

Fig 3 – The pricing function (given a LGD=45%)

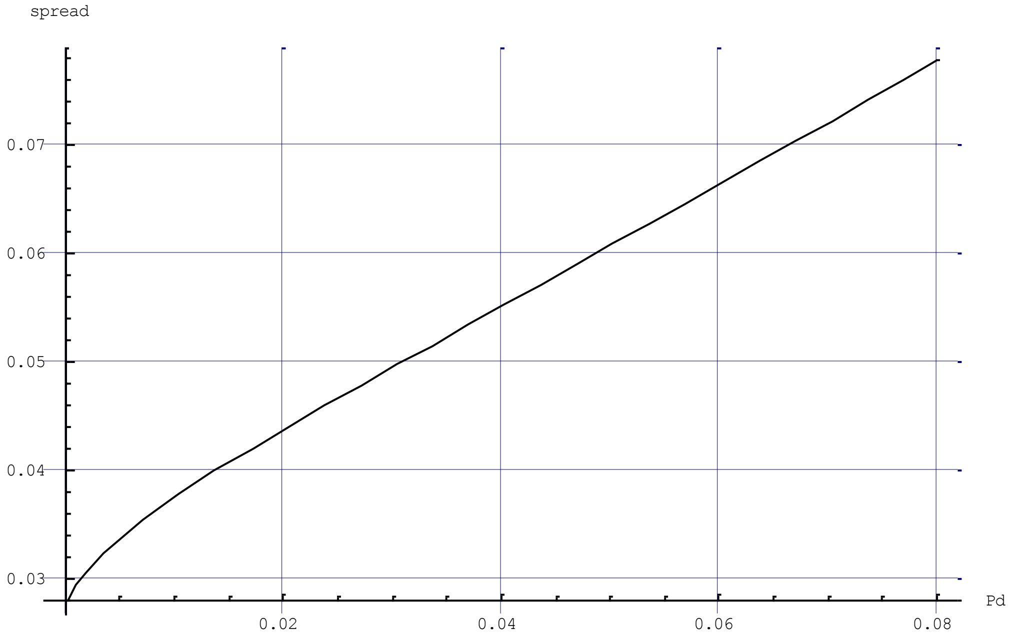
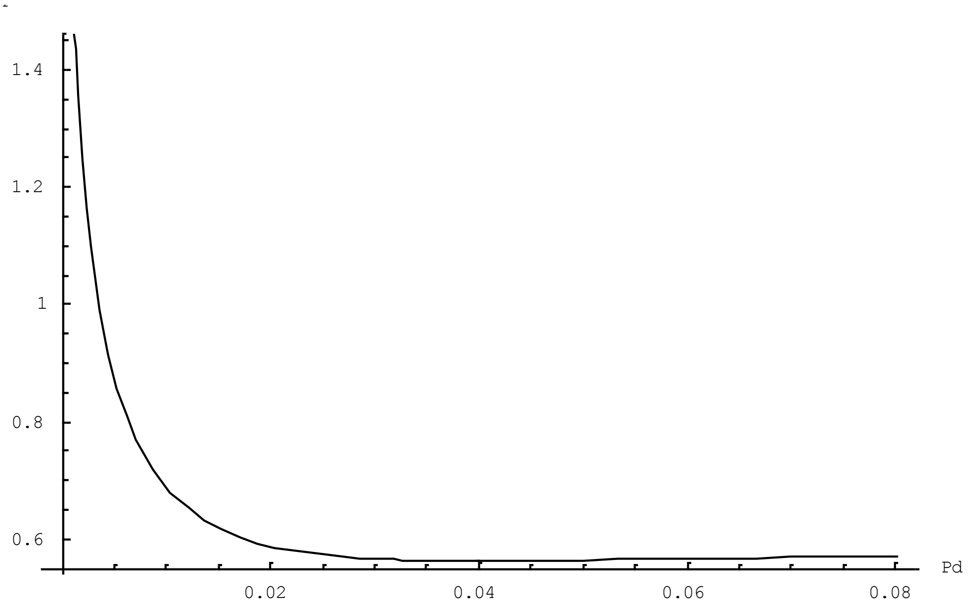
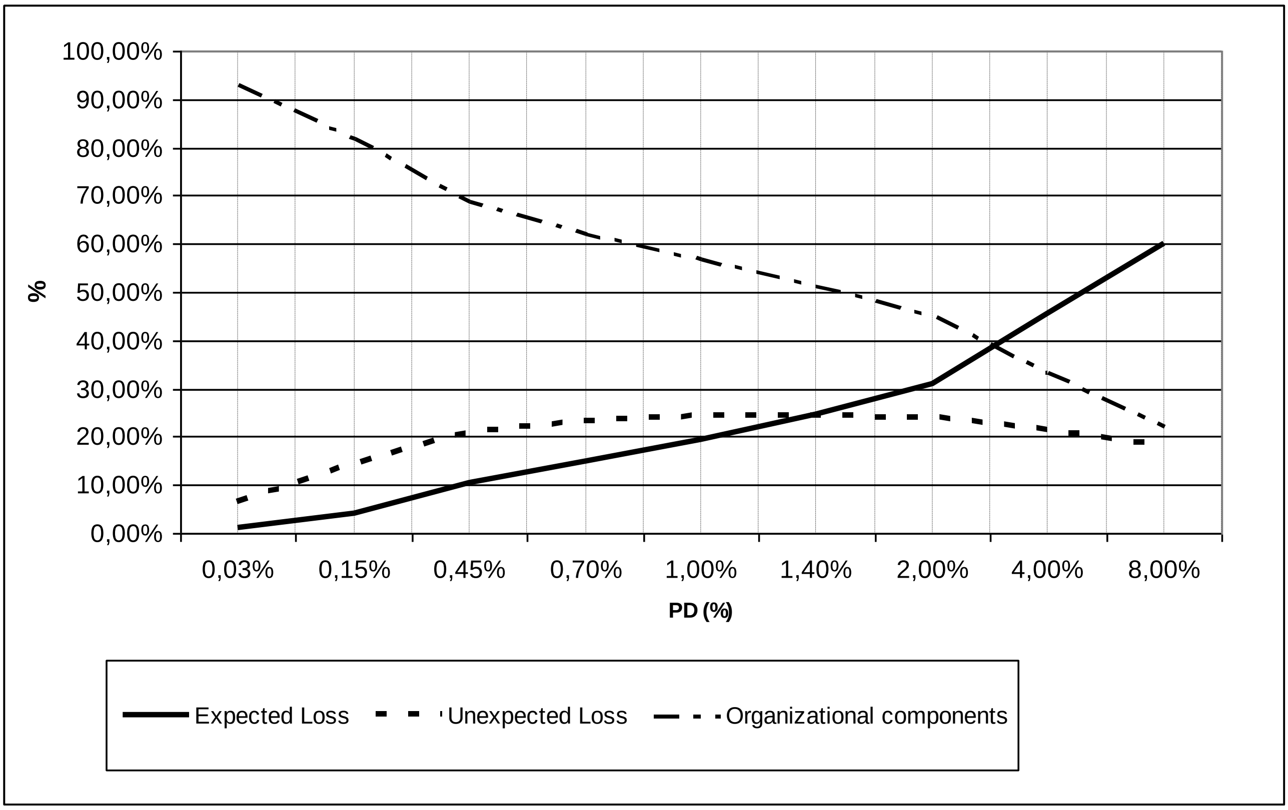


Fig. 4 – First order derivative of the pricing function with respect to PD (given a LGD=45%)



Extending the analysis to the determinants of credit spreads, we see that in cases of low PDs the organizational component plays the major role. The expected loss shows the highest weights when the PDs are very high (Fig. 5), reducing the role of unexpected losses.

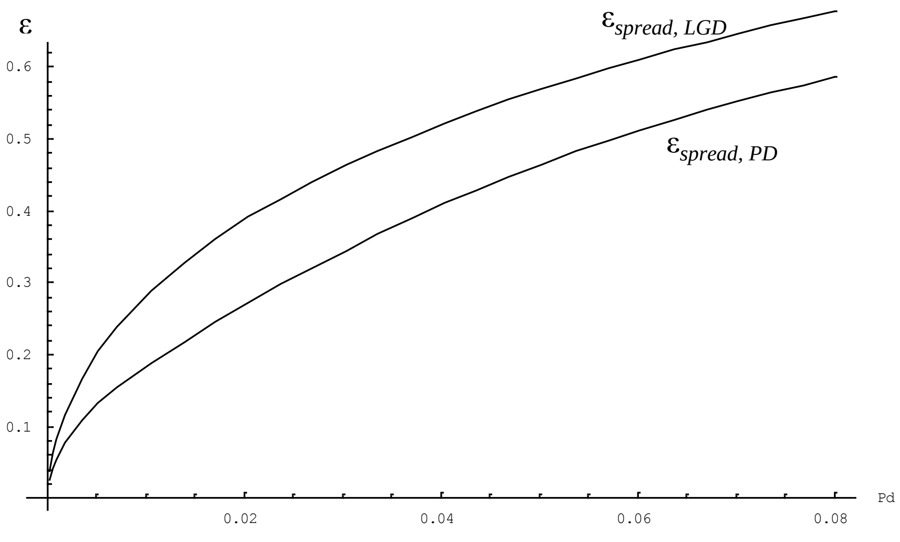
Fig. 5 – The pricing function: weights of components



In order to investigate the sensitivity of the loan spread price to the components, we computed the elastisties with respect to PD and LGD. The elasticities plots are reported in Fig.6.

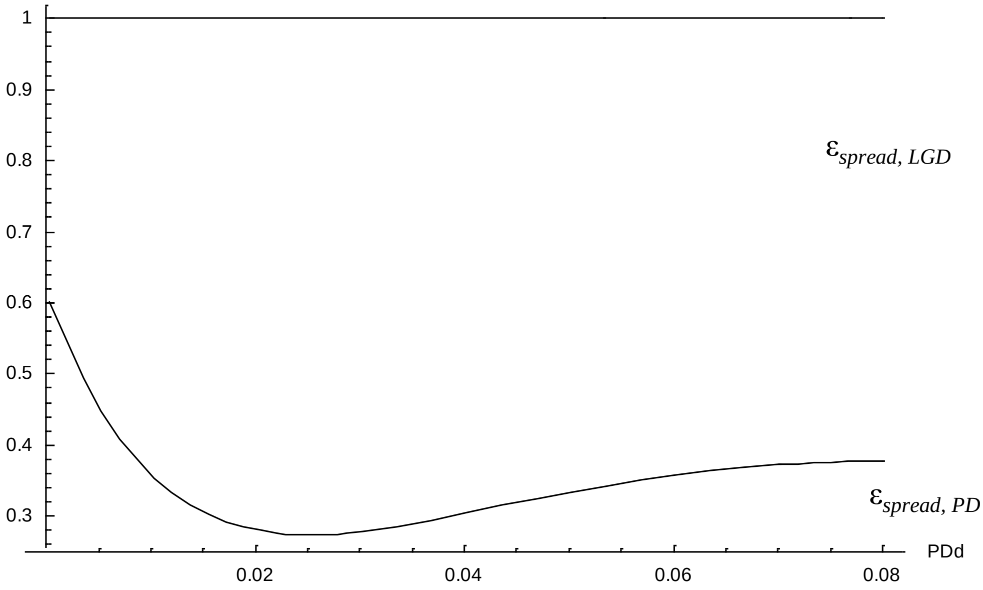
The graph shows that the loan spread is more elastic with respect to LGD than PD. As an exemple, for a PD of 1,4%, the spread elasticity with respect to LGD is equal to 0,33; with respect to PD is equal to 0,22 (εlgd/εpd =1,5). Moreover, the point elasticities increase as borrower's PD increases.

Fig. 6 – Elasticities of credit spread with respect to PD and LGD



The relative major importance of the LGD factor in affecting the price can also be seen trough the elasticities of C (regulatory capital) spread component with respect to LGD and PD (Fig. 7). In the graph, the elasticities of the credit spread with respect to LGD is constantly higher than the PD one.

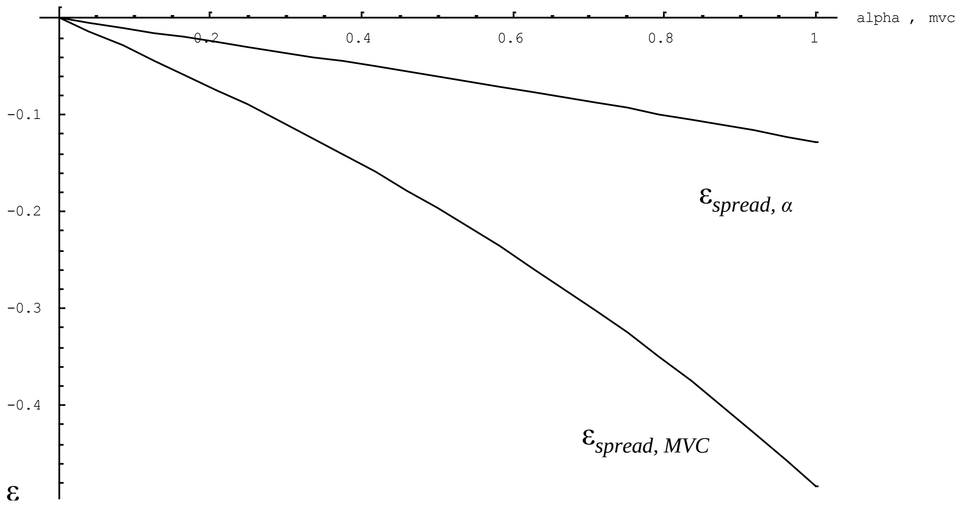
Fig. 7– Elasticities of capital requirement with respect to LGD and PD



The last point of the analysis is devoted to the investigation of the relative importance of financial collaterals and guarantees in affecting credit spreads. In this aim, we compared the elasticities of the loans spread for a given borrower PD with respect to the market value of financial collateral, MVC, and with respect to the coverage degree, α.

Fig. 8 plots the spread elasticities in case of different values of MVC and α, with a guarantor PD of 0,45%, and a borrower PD of 1,4%.

Fig. 8 – Elasticities of credit spread with respect to MVC and α (given a borrower's PD of 0,45%)



As can be seen from Fig. 8, the credit spread is more affected by MVC than α, this implying that, for a given value of coverage degree, the financial collateral is stronger than a guarantte in determining price decreases. More, the differential “strenght” of the financial collateral increases as the coverage degree increases.

Conversely, the credit spread elasticity with respect to α decreases as the guarantor’s rating quality decreases.

5. Conclusions

Under the Basel II capital adequacy framework collaterals and guarantees play a relevant role in the determining credit pricing, as their presence reduces the overall credit risk for a given loan.

The comparative-static analysis presented in this paper aims at investigating the sensitivity of credit spreads to C&G, under the new European regulatory framework. To do so, we adopted a loan pricing function derived from the intrinsic loan pricing literature (LAFP - loan arbitrage-free pricing model), adjusted for capturing the regulatory treatment of financial collaterals and guarantees.

Our results show that financial collaterals are stronger than guarantees in lowering the credit spread for a given loan, and even if it is more evident when borrower’s PD is at the highest level, this holds also in those cases where the borrower’s PD is very low.

In general, credit spreads are more elastic to C&G than to borrower’s rating improvements.

Given this last result, borrowers’ choices towards the release of credit risk mitigation tools seem to be more appealing than corporate strategies aiming at upgrading borrower’s rating quality. If this can be efficient for the banking point of view, the same do not holds with respect to the whole economic system, as the cosequences of a default are not covered by the same kind of instruments.

Under this perspective, a credit credit allocation policy based on this role of C&G could lead to a decrease in the allocative efficiency of credit industry and a less contributing to the overall economic growth.

References

European Commission, Proposal for Directives of the European Parliament and of the Council Re-casting Directive 2000/12/EC of the European Parliament and of the Council of 20 March 2000 relating to the taking up and pursuit of the business of credit institutions and Council Directive 93/6/EEC of 15 March 1993 on the capital adequacy of investment firms and credit institutions - 20 October 2005, http://europa.eu.int/comm/internal_market/bank/regcapital/index_en.htm#consultation

J.B. Caouette, E.I. Altman, P. Narayanan, (1998), *Managing credit risk. The next great financial challange*, John Wiley & Sons, Inc. New York.

J. Dermine (1996), *Loan valuation. A modern finance perspective*, Insead Working Papers.

J. Dermine (2003), *ALM in banking, in Handbook of assets and liability management*. editors S. Zenios, W. Ziemba, North Holland Handbooks in Finance series, Elsevier Science B.V.;

M. B. Gordy (2003), *A Risk-Factor Model Foundation for Ratings-Based Bank Capital Rules*, Journal of Financial Intermediation, 12(3), July.

R. Levine (1997), *Financial development and economic growth: views and agenda*, Journal of economic literature, Vol. 35.

F. Saita (2003), *Measuring Risk-Adjusted Performances for Credit Risk*, Working Paper, N. 89, Research Division, SDA Bocconi Business School, Milan, http://www.sdabocconi.it/dr/file/wp89.pdf

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Moreover, the effects of C&G on credit spreads can be more effective than an improvement of borrower's rating, this possibly leading to negative outfits on credit industries' allocative efficiency.

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