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Alessandro Fedele
Andrea Mantovani
Francesco Liucci

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Alessandro Fedele† Andrea Mantovani‡ Francesco Liucci§

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Abstract

In this paper we consider a moral hazard problem between a creditworthy firm which needs funding and a bank. We first study under which conditions the firm does not obtain the loan. We then determine whether and how the intervention of an external financial institution can facilitate the access to credit. In particular, we focus on the European Investment Bank Group (EIBG), which provides (i) specific credit lines to help banks that finance small and medium-sized enterprises (SMEs) and (ii) guarantees for portfolios of SMEs' loans. We show that only during crises the EIBG intervention allows to totally overcome the credit crunch.

Keywords: credit crunch, moral hazard, EIBG, SMEs
JEL Classification: G01, D82, D21

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†Department of Economics, University of Brescia, Via S. Faustino 74/b, 25122, Brescia, Italy, Tel: +39 0302988827, Fax: +39 0302988837; email: fedele@eco.unibs.it.

‡Department of Economics, University of Bologna, Strada Maggiore 45, 40125, Bologna, Italy, Tel: +39 0512092602, Fax: +39 0512092664; email: a.mantovani@unibo.it

§Department of Economics and International Business, Oxford Brookes University, OX33 1HX, Oxford, United Kingdom, Tel: +44 (0)1865 485858, Fax: +44 (0)1865 485830; email: francesco.liucci@yahoo.it.

1 Introduction

The recent crisis of the global financial system has been generated by a multiplicity of factors, among which the failure of national and international regulation systems. The proliferation of creative financial innovations catered to investors' demand for higher return, but many of these instruments turned out to be riskier than they initially appeared. Financial regulation was ineffective and limited in scope. The system collapsed, banks became reluctant to grant loans and many creditworthy investors were denied the access to credit due to a sudden tightening of the conditions required to obtain a loan. The crisis rapidly spread from the financial markets to the real economy, thus exacerbating the effects of the global economic slowdown. Since then many economists and policy-makers agreed on the necessity to revamp the scope of financial regulation and improve the provision of liquidity. During the most recent G7, G8 and G20 meetings, participants called for urgent reforms and proposed to enhance liquidity and funding through traditional and newly created instruments.

Starting from these considerations, the aim of our paper is to pinpoint which role supranational financial institutions can play in their attempt to solve, or at least mitigate, information problems between lenders and creditworthy borrowers. This becomes of fundamental importance especially in periods of crisis, where trust between economic agents has to be re-established. In particular, we will target credit crunch problems faced by Small and Medium Enterprises (SMEs henceforth).

Notwithstanding the relevance of the topic, relative scanty attention has been paid to the specific analysis of external financial institutions that reduce information asymmetries in credit markets. Our contribution lies at the crossroads between two streams of research, one dealing with government intervention in credit markets and the other with the beneficial role of generic mediators. The issue of government support in credit provision with financial informational frictions has been studied by DeMeza and Webb (1987), Innes (1991) and Hellmann and Stiglitz (2000), *inter alii*. Williamson (1994) and Wang and Williamson (1998) consider public intervention which eliminates information asymmetries caused by costly state verification. On the other hand, the positive effect of external mediators has been initially examined by Myerson (1986) and Forges (1986) in communication games. Fedele and Mantovani (2008) show that delegation of hidden tasks to a third agent can mitigate the informational asymmetry between a start-up entrepreneur and a bank, thus improving the efficiency of the contracting game. Mitusch and Strausz (1999) demonstrate that the presence of consulting companies reduces informational frictions within a firm.

In the first part of this paper we provide a careful analysis of a credit market equilibria *before* and *after* the intervention of an external financial institution which supports the lending activity of the bank towards the firm. In the second part we evaluate the specific instruments used by the financial institution and suggest how to improve the effectiveness of such an intervention.

To represent the informational problem, we adopt a simple moral hazard model *à la* De Meza and Webb (1987) in which a wealthless firm applies for a bank loan to invest in two alternative risky projects: the good (or creditworthy) project has a positive expected value but is more costly to be implemented, in terms of the firm's effort; the bad project requires a less intense effort but its expected value is obviously lower than the good one, and in most cases also negative. The bank cannot verify the firm's choice of the project: this generates the information asymmetry in the form of a moral hazard (Holmstrom, 1979).

As anticipated above, we take into account two alternative scenarios: *before* (*without*) or *after* (*with*) the intervention of the external financial institution. The initial aim of our analysis is to unveil the mechanisms through which a financial institution can alleviate the credit crunch.

We start by considering the case in which the lending process is not supported by the financial institution. The firm applies for the funds and it is induced to implement the good project in exchange for a sufficiently high informational rent. We find that there exists a wide interval region, where the rent is high relatively to the project's value in case of success, in which the loan is not granted and a credit crunch occurs.

In the second scenario, the bank resorts to an external financial institution which favours the lending process essentially by an appropriate combination of two instruments: *(i)* co-funding of the investment project and *(ii)* provision of guarantees the bank gets if the project fails.[1] We show that the intervention of the external agent drastically reduces the occurrence of the credit crunch.

In the final part of our paper we evaluate the effectiveness of the tools adopted by the financial institution. Under the theoretical conditions of our model, we demonstrate that by increasing the percentage of co-funding and the amount of guarantee, the credit crunch area can be further reduced. Yet, only if the spread between the cost of raising capital for the bank as compared to that of the financial institution is sufficiently high, the area can be completely eliminated. This is what exactly happened since the intensification of the financial crisis in September 2009: the interest rate spreads on government bonds of many EU countries with different credit ratings have dramatically risen (Sgherri and Zoli, 2009), due to a higher risk aversion in international financial markets (Schuknecht, von Hagen and Wolswijk, 2009). This fact implies that especially during crises the intervention of the external financial institution turns out to be powerful, in that it allows to totally overcome the credit crunch. In the specific example of our model, the intervention allows the bank to always finance a creditworthy project. More generally speaking, it helps the recovery of the economy by stimulating the credit market.

As it has been mentioned before, we are particularly interested in interventions

[1] In a somewhat related paper, Arping, Loranth and Morrison (2010) consider the support by the state in form of credit guarantees and loan subsidies to entrepreneurs which are capital constrained and subject to moral hazard.

targeted to SMEs. In the US, the Small Business Administration (SBA) actively engages in provision of direct loans and bank loan guarantees. The situation is more ambiguous in Europe, and this is why we base our analysis in such a context. The European Monetary Union lacks both a centralized fiscal mechanism to absorb asymmetric shocks and a common institution capable to ease possible shortage of liquidity in the European markets. These structural deficits have been blindingly obvious in the aftermath of the financial crisis. In an open letter addressed to the European leaders, several economists asserted that European-level actions must supplement and coordinate the national efforts on recapitalization of the banking sector.[2] They argued that such disposals, necessary to solve the present situation and to prevent the occurrence of a future financial crisis, should be carried out by an institution which acts as a Lender of Last Resort.[3] In Europe the natural Lender of Last Resort should be the ECB, but the Protocol of ESCB/ECB, art. 25, chapter V, allows it only to offer non-binding advice regarding the prudential supervision of credit institutions and the stability of the financial system. The recent creation of the European Systemic Risk Council and of the European System of Financial Supervisors bank is intended to improve bank regulation and supervision across borders, but we are looking at proper supranational credit institutions which actively help firms to get access to credit. This is why we turn our attention to the European Investment Bank Group, which is particularly qualified to play the role of the external financial institution that we have in mind. In the next section we will justify our choice.

The potential impact of the European Investment Bank Group deserves additional attention if one considers that the recent financial turmoil has raised the cost of raising capital, one of the crucial factors of our paper. This contributed to deteriorate the attractiveness of risky investments, such as those proposed by SMEs. The EIBG, which is highly rated, introduced "anti-crisis measures" and became a stable anchor for banks wishing to finance firms navigating in stormy waters.

The remainder of the paper is organized as follows. In the next section we describe the functions of the European Investment Bank Group. The formal model is laid out in Section 3. Sections 4 and 5 consider the two scenarios described above, respectively before and after the intervention of the financial institution. In Section 6 we characterize the importance of such an intervention and suggest how to eliminate the credit crunch. Section 7 concludes the paper.

[2] 'Open Letter to European leaders on Europe's banking crisis: A call to action', by A. Alesina, R. Baldwin, T. Boeri, F. Giavazzi, D. Gros, S. Micossi, G. Tabellini, C. Wyplosz and K. F. Zimmermann, appeared on 1 October 2008 on VoxEU.org, a CEPR policy portal.

[3] The theory of the Lender of Last Resort, elaborated by Bagehot (1873), asserts that an institution, usually a country's central bank, has to offer loans to banks or other eligible institutions that are experiencing financial difficulty or are considered highly risky or near collapse, and whose failure would dramatically affect the economy. During a credit crunch, the Lender of Last Resort's functions are both to protect private investors who have deposited funds, and to prevent panic withdrawing from solvent banks who have temporary limited liquidity.

2 The European Investment Bank Group

The European Investment Bank Group (EIBG henceforth) was established in 2000 to bring the European Investment Bank (EIB) and the European Investment Fund (EIF) under the same umbrella. The EIB was founded under the Treaty of Rome as the EU's long-term lending institution. As defined by the Treaty on the Functioning of the European Union, pursuant to Article 309, the task of the EIB is "to contribute, by having recourse to the capital market and utilizing its own resources, to the balanced and steady development of the internal market in the interest of the Union".[4] The EIF, instead, was created in 1994 to support the development of SMEs. Its main operations regard venture capital and guaranteeing loans. Complementing EIB's product offering, the EIF promotes "the implementation of European Community policies, notably in the field of entrepreneurship, technology, innovation and regional development".[5] The relationship between the EIB and the EIF aims at encouraging a productive sharing of expertise in support of SMEs.

The EIBG as a whole is engaged into two main activities: the disbursement or partial-disbursement (co-funding henceforth) of loans, and the provision of guarantees. Let us look at their specific functioning, as this will represent the theoretical ground to model the intervention of the financial institution.

The first activity is particularly related to the general commitment of the EIB towards the integration, development and economic and social cohesion of the EU Member States, "on a non-profit maximizing basis".[6] This special feature allows the EIB to lend almost at the cost of borrowing. Since it does not distribute dividends to its shareholders, any euro earned is retained in order to cover the EIB's expenses, and to refund its operations and programs. The EIB's capital is subscribed by EU member States; the EIB raises resources through bond-issues and other debt instruments (EIB Statute, 2009). The EIB's "firm shareholder support, [...] strong capital base, exceptional asset quality, conservative risk management and [...] sound funding strategy" constitute the reasons for its constant triple-A credit rating, assigned by Moody's, Standard and Poor's, and Fitch.[7]

The EIB provides different kinds of loan. The *individual* loans are addressed to projects with a total investment cost higher than 25 million euros. They are available for promoters in both public and private sectors, including banks, and financed directly by the EIB. They are not the subject of our paper. We focus instead on *intermediated* loans, which are credit lines granted to intermediary banks (or other financial institutions) to facilitate the financing of projects proposed by SMEs.[8] The firm has to

[4] Official Journal of the European Union, C 115 of 9.5.2008: "Consolidated Version of the Treaty on the Functioning of the European Union".

[5] EIF website: "About Us".

[6] EIB website: "About the EIB".

[7] EIB website: "About the EIB".

[8] More precisely, these credit lines are directed to SMEs with total maximum cost lower than 25

apply directly to the intermediary institutions to which the credit lines are offered. Requirements for application may vary according to the respective intermediary, as "the conditions of financing (interest rate, grace period, loan period etc.) are determined by the respective EIB partner bank".[9] Nonetheless, one of the mission of the EIB is to stimulate competition among the intermediaries so as to pass on to SMEs the generous credit conditions offered by the EIB. The shortage of liquidity caused by the recent crisis augmented the quest for partnership by commercial banks, thus increasing the bargaining power of the EIB and actually giving vigor to competition in the banking sector. This will be a crucial assumption of our theoretical model.

The second activity of providing guarantee instruments is carried out by the EIF. Two main products are worth mentioning, the Credit Enhancement-Securitisation and the Guarantees/Counter-Guarantees for portfolios of micro-credits, SME loans or leases. The former, that will be explicitly considered in our model, concerns operations conducted by using guarantees provided by the EIF, which is directly involved in the SMEs' loans securitization transaction. The latter relates to different European framework programmes, such as the "Competitiveness and Innovation Framework Programme" (CIP 2007-2013), managed by the EIF on behalf of the European Commission who set them up to support SMEs' activities and development.[10]

Regarding the securitization transaction, the guarantee support is of fundamental importance. Under the Basel II capital requirements, the banks' ability to raise funds is conditional to the soundness of their credit exposures. In such a scenario, banks can transfer part of the risk of their portfolios through securitization transactions, in order to increase their lending capacity. In other words, securitization works like an insurance for loans, as the credit exposure attached to every loan is transferred from a bank to an investor, by issuing notes (called "asset backed-securities") on the capital market. The bank has to pay the investor a fee for the protection, and in case of default the investor pays the loss. The credit rating of the securitized loans is connected with the one assigned to the financial institution covering that specific part of the risk. In case of support by the EIF, even in presence of SMEs moral hazard, the rating of the covered loans is enhanced, due to the zero risk-weighting assigned to assets guaranteed by the EIF.[11] The beneficial role of the EIBG in the securitization transactions is supported by different studies (*e.g.* Robinson 2009, Janda 2008, ÖIR-Managementdienste GmbH 2007, European Commission 2006 and AMTE Final Report 2006).

However, and this will be very important for the policy implications of our paper, the EIBG set limits to the provision of loans and guarantee support. As for the co-funding, the intervention covers up to 50% of the initial investment needs. It has been argued that the imposition of a ceiling aims at avoiding opportunistic behaviors by the

million euros (small-sized enterprises) or up to 50 million euros (medium-sized enterprises).

[9] EIB website: "Intermediated Loans".

[10] EIF website, 'Guarantees & Securitisation'.

[11] EIF website, 'Credit Enhancement'.

partner banks.[12]

In order to preserve the achievement of the EIBG's objectives, in particular the support to SMEs, the EIB Corporate Operational Plan (2009) specify conditions and constraints in relation with its activities. With regard to the selection of the partner bank, the EIB's evaluation concerns an overall assessment of its credit worthiness in conjunction with its historical experience in the SMEs sector. In the contractual arrangement between the EIB and the partner bank, the amount of funding granted by the EU institution is calculated on the basis of the intermediate bank's capability to originate loans without the EIB's credit facilities. The EIB controls the reliability of the budgeted amount set by the partner bank and it disburse the credit lines accordingly. Moreover, the EIBG intervention creates a positive surplus through the 'leverage effect'. Every partner bank is obliged to pass on to the final beneficiary the financial benefit generated by the EIB's involvement: "for each euro provided by the EIB the partner bank undertakes to lend at least two to SMEs, so creating a leverage effect".[13] The EIB estimated the leverage factor between its financing and the total value of the investment as a range between 2 and 10 times.[14] This is consistent with Robinson (2009), who found that during the period 2004-2006 the leveraging factor generated by the EIB's lending activity in the EU ranged between 4.8 and 23.9.

3 The basic model

A wealthless firm needs funding to implement a business based on two alternative risky projects. Project i, $i = H, L$, yields a per-unit-of-investment return a with probability $p(e_i) \in (0,1)$ and 0 otherwise; e_i is a nontransferable effort, whose per-unit-of-investment disutility has a monetary equivalent equal to $c(e_i)$. We assume a linear specification for both the effort disutility and the success probability: $c(e_i) = c_i$ and $p(e_i) = p_i$. Moreover, we let $c_H = c > 0 = c_L$ and $p_H > p_L$: project H entails a bigger effort cost than project L but succeeds with higher probability.

The financial contracting game begins when the firm applies for a bank loan, whose amount is normalized to one. The timing of the game is as follows. At $t = 0$, first the bank designs a loan proposal, then the firm decides whether to accept it or not. If the loan is granted, in the time span between $t = 0$ and $t = 1$, the firm chooses between projects H and L, *i.e.* it decides whether to exert an extra effort cost $\Delta c \equiv c_H - c_L = c$, thereby increasing the success probability by $\Delta p \equiv p_H - p_L$, or to shirk. This choice is assumed to be hidden, thus giving rise to a moral hazard problem between the lender and the borrower. At $t = 1$ returns accrue and the firm repays the bank. If the firm does not apply for the loan, or the loan is not granted, the project cannot be implemented: the firm's outside option is zero.

[12] Interview information, EIF official, December 2009.

[13] EIB website: "EIB Loans for SMEs".

[14] EIB website: "EIB Directors approve anti-crisis measures for 2009-2010".

An additional possibility for the bank is to monitor the behavior of the firm by paying a fixed cost equal to m.[15] Monitoring is assumed to make the agent's behavior perfectly observable. The choice of the bad project is detected with probability one, in which case a non-monetary punishment can be imposed to the firm: the moral hazard issue disappears as the firm has no incentive to shirk if the punishment is sufficiently high.

In the light of what has been described in the Introduction, we study the effect of an external financial institution on credit availability by considering two alternative scenarios. In the first one, describing the 'without the EIBG' case, the firm resorts to a local bank (LB, henceforth) to obtain the unit of capital necessary to start the project. In the second one, the 'with the EIBG' case, the loan application is directed to an intermediary bank (IB, henceforth) supported by an external financial institution (FI, henceforth); the IB is required to concede just a fraction $\alpha \in [0, 1]$ of the unit of capital since it receives from the FI a monetary amount $(1 - \alpha)$ to be used for financing the firm. Moreover, the FI provides an additional guarantee W to insure the bank against the project's failure.

The players of our game are supposed to be risk-neutral. Furthermore, banks are assumed to operate in a perfectly competitive environment. We opt for this hypothesis because in our specific case study, following the discussion in Section 2, one of the objectives of the EIBG is to stimulate competition in the banking sector, as partner banks should be induced to pass on to the final beneficiary the favorable credit conditions that they enjoy.[16] One may object that the LB bank is not subject to such a pressure. Yet, the hypothesis of the same degree of competition for both representative banks allows to isolate the effect of the FI on credit availability without changing the market conditions in which the banks operate. Moreover, we will show that by relaxing the assumption of a perfectly competitive credit market for the LB does not modify our main results, hence we can assume .

We can now describe the different features characterizing the two scenarios.

(i) When resorting to the LB, the firm is offered a standard debt contract $\{r\}$, where $r \in [1, a]$ is the gross interest rate due by the firm only in case of success. The firm's expected share is

$$u_i \equiv p_i (a - r) - c_i, \tag{1}$$

where c_i is the firm's nontransferable effort cost. The bank's expected surplus is:

$$v_i \equiv p_i r - \rho, \tag{2}$$

[15] One can think of the time spent by the banks to directly monitor the behavior of the firm, parameter m thereby representing the opportunity cost of not devoting that time to other productive activities. Hauswald and Marquez (2006) assert that the aquisition of information via monitoring implies costly screening and other losses in terms of time, effort and resources employed by the bank.

[16] In general, the process of deregulation that took place in the last decades removed many restrictions on competition in the banking sector: an excellent survey is provided by Carletti (2008).

where ρ represents the bank's unitary cost of raising money, for example by issuing bonds or collecting deposits. Summing up (1) and (2) gives the expected welfare when project i is implemented:

$$s_i \equiv p_i a - c_i - \rho. \tag{3}$$

(ii) When the firm applies to the intermediary, the debt contract is $\{R\}$, where $R \in [1, a]$ is the gross interest rate,

$$U_i \equiv p_i (a - R) - c_i \tag{4}$$

is the firm's expected share,

$$V_i \equiv p_i R + (1 - p_i) W - \gamma (W) - (1 - \alpha) p_i \Gamma - \alpha \eta (W) \tag{5}$$

is the IB's expected share and

$$Z_i \equiv (1 - \alpha) p_i \Gamma - (1 - p_i) W + \gamma (W) - (1 - \alpha) \phi \tag{6}$$

is the FI's share. Expressions (5) and (6) show the way we model guarantee provision and co-funding by the FI. On the one hand, the IB pays a monetary amount $\gamma (W) > 0$, with $\gamma' > 0$, in exchange for the guarantee W which receives by the FI if the firm's project fails (with probability $1 - p_i$). On the other hand, $(1 - \alpha)$ is the amount lent by the FI to the IB to finance the firm's project; Γ is the unitary gross remuneration the IB owes to the FI only when the project succeeds (with probability p_i) in return for capital borrowed. Finally, parameter ϕ represents the FI's unitary cost of raising money, while $\eta (W)$ is the IB's unitary cost of raising money, which depends on the amount of guarantee. The functional form of $\eta (W)$ will be specified in the next subsection.

Summing up (4), (5) and (6), one gets the expected welfare S_i when project i is implemented in presence of the FI:

$$S_i \equiv p_i a - c_i - \alpha \eta (W) - (1 - \alpha) \phi. \tag{7}$$

Before proceeding, we need to characterize the parameter region in which the financial contracting game is being played.

3.1 Initial conditions: the region of interest

The initial conditions of the game represent the starting point of our analysis. They are derived from the study of the activity of the EIBG.

Based on the constant triple-A credit rating enjoyed by the EIB compared to a worse rating for a local bank, we first assume that the cost of raising money is lower for the FI than for the LB:

$$\phi < \rho. \tag{8}$$

Second, we specify the functional form for $\eta (W)$, the IB's unitary cost of raising money. Recall that the guarantee W insures the IB against the credit risk when financing the firm's project. We assume that the risk-neutral IB's utility is *indirectly* affected

by the degree of insurance: the higher W, the lower the risk perceived by risk-averse bondholders and/or depositors on IB's assets. They will, in turn, require lower returns, thus reducing the cost $\eta(W)$. The upper bound on $\eta(W)$ is for $W = 0$ and equals ρ, the same cost sustained by the LB, which receives no guarantees. By contrast the IB, when fully or over insured ($W \geq R$), incurs the same cost ϕ borne by the highly credit rated FI. As a consequence,

$$\eta(W) = \begin{cases} \rho \text{ if } W = 0 \\ \phi < f(W) < \rho \text{ if } 0 < W < R \\ \phi \text{ if } W \geq R \end{cases} \tag{9}$$

where $f'(W) < 0$.

Given condition (8) and the functional form for $\eta(W)$, it follows that the FI generates a higher expected welfare by reducing the cost of financing:

$$\Delta S \equiv S_i - s_i = \rho - \alpha\eta(W) - (1-\alpha)\phi > 0. \tag{10}$$

As for the welfare generated by the investment project:

Assumption 1 *$a \in (\underline{a}, \overline{a})$ and $c \in (0, \overline{c})$, where $\underline{a} = \dfrac{c+\rho}{p_H}$, $\overline{a} = \dfrac{\rho}{p_L}$ and $\overline{c} = \rho\dfrac{\Delta p}{p_L}$. This implies that:*[17]

$$(i)\ s_H > 0 > s_L \text{ and } (ii)\ S_H > \max\{S_L, 0\}. \tag{11}$$

The expected total surplus is always positive when the firm behaves. On the contrary, the project is due to fail when the firm does not behave and the LB provides the loan, while we allow for the possibility that $S_L \gtrless 0$, *i.e.* when the loan is granted by the IB the project may have positive NPV even if the firm shirks because of the reduced cost of financing. This has to do with the general mission of the EIBG, whose top operational priority is to support the investments of SMEs, though this requires a very generous commitment in sectors where the risk of failing is high. As the financial crisis penalized in particular the access to credit of SMEs, we do not want to neglect the role that the FI can play in generating a positive surplus even in presence of the low effort from those players so seriously hit by the liquidity constraints in the financial markets.

Finally, regarding the monitoring cost:

Assumption 2 *$m > S_H$, i.e. the cost of monitoring is higher than the maximum expected welfare.*

Different sources of theoretical literature agree on the inability of lenders to monitor project outcomes at sufficiently low cost (see Townsend 1979, Williamson 1986, Border and Sobel 1987, and, more recently, Krasa and Villamil 2000, Lacker 2001 and Hvide and Leite 2007).

[17] The condition $s_H > 0$ is solved by $a > \underline{a}$, where $\underline{a}$ increases with c because the higher c, the lower, ceteris paribus, $s_H \equiv p_H a - c - \rho$. A higher a is therefore needed to satisfy the condition.

4 The local bank: when the credit market is left alone

In this section we consider the scenario in which the external FI does not intervene and only local banks are available on the market. Since the representative LB is competitive, it sets the gross rate r in order to maximize the firm's share $u_i \equiv p_i (a - r) - c_i$, otherwise the firm applies to a rival bank. The maximization is subject to the LB's participation constraint $v_i \equiv p_i r - \rho \geqslant 0$ and the firm's incentive compatibility constraint $u_i \geqslant u_{-i}$, with $i = H, L$ (and $-i = L, H$). This ensures that choosing project i instead of project $-i$ gives a higher share to the firm.

Since u_i is decreasing in r, the LB sets the gross rate at the lowest value with the effect that the IB's participation constraint becomes binding:

$$v_i = 0 \text{ if } r = r_i \equiv \frac{\rho}{p_i}. \tag{12}$$

There are two levels of r such that the LB breaks even, depending on the firm's project choice: $r_L \equiv \frac{\rho}{p_L}$ and $r_H \equiv \frac{\rho}{p_H}$, with $r_L > r_H$. If the firm decides to shirk the project succeeds with lower probability, hence the LB is forced to charge a higher rate, otherwise it would incur a loss.

The firm's incentive compatibility constraint is:

$$u_H \geqslant u_L \Longleftrightarrow r \leqslant \hat{r} \equiv a - \frac{c}{\Delta p}. \tag{13}$$

The firm behaves only if $R \leqslant \hat{r}$. In fact, effort disutility's negative effect on the firm's expected share is outdone by the positive effect of the increased success probability only for relatively low values of the gross interest rate.

In line of principles, the following three cases have to be accounted for: $r_H < r_L \leq \hat{r}$, $r_H \leq \hat{r} < r_L$ and $\hat{r} < r_H < r_L$. The first two lead to the same result, hence they are treated together through inequality

$$r_H \leq \hat{r} \Longleftrightarrow a \geq a_N \equiv \frac{\rho}{p_H} + \frac{c}{\Delta p}. \tag{14}$$

In this case the firm chooses project H according to the above reasoning. It follows that the break-even level is r_H, which can be plugged into u_H to give:

$$u_H (r_H) \equiv s_H = p_H a - c - \rho. \tag{15}$$

The firm accepts the LB's proposal r_H because it ends up with the entire surplus s_H, whose value is supposed to be positive under Assumption 1.

On the contrary, if $r_H > \hat{r}$, i.e. $a < a_N$, then the firm chooses project L and the LB's breaks even in $r_L = \frac{\rho}{p_L} > r_H$. Substituting r_L into u_L yields s_L: in this case the LB's proposal is not accepted by the firm that would otherwise end up with $s_L < 0$ under Assumption 1. The possibility for the LB to monitor the firm at cost $m > 0$ is ruled out by Assumption 2.

We can summarize the result of our analysis as:

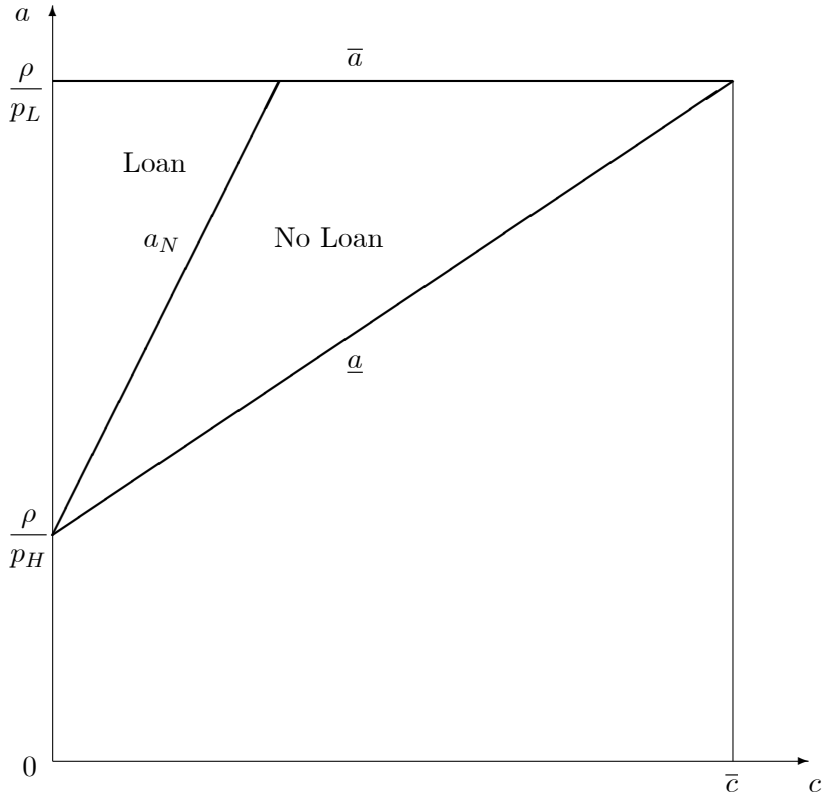
Lemma 1 *When the firm applies to the local bank, (i) the loan is granted if $a \geq a_N$, in which case the expected welfare is s_H; (ii) the loan is not granted if $a < a_N$ and the resulting expected welfare is nil.*

Proof Directly follows from Assumption 1 and 2 and by inspecting (14). ■

The firm's equilibrium expected share (15) is affected positively by the expected return a and negatively by both the cost of raising fund ρ and the effort disutility c. When $a < a_N$ the expected gain is low relatively to the costs. This is more likely to occur in a period of crisis, in which case the firm does not accept the LB's loan proposal as it is not properly motivated to implement the good project.

Figure 1 illustrates the results of Lemma 1 in the parametric space (c, a). Notice that a_N divides the interval region of interest $a \in (\underline{a}, \overline{a})$ in two parts, as its vertical intercept (when $c = 0$) coincides with that of $\underline{a}$ but its slope is steeper. The area $a \in (\underline{a}, a_N]$ represents the credit crunch.

Figure 1: The Local Bank Case



In the Appendix we study the case of a monopolistic local bank. We find that the result of Lemma 1 still holds, the only difference being a redistribution of the total surplus between the bank and the firm. This confirms that the hypothesis of a local competitive banking sector does not affect our findings.

5 The intermediary bank supported by the external financial institution

In this section we consider the situation where the firm resorts to the IB supported by the external FI which provides co-funding and additional guarantees. It is first worth recalling that we tailor the intervention of the FI on the basis of our analysis of the EIBG, whose lending activity is ruled by the EIB on a non-profit maximizing basis. We assume therefore that the FI has a nonprofit status, which implies in our model that its unitary remuneration Γ is determined through the break-even condition $Z_i = 0$. From (6):

$$Z_i = 0 \iff \Gamma = \frac{\phi}{p_i} + \frac{(1-p_i)\,W - \gamma(W)}{p_i(1-\alpha)} \equiv \Gamma_i. \tag{16}$$

There are two break-even levels of Γ, depending on the firm's project choice, with $\Gamma_L > \Gamma_H$. Plugging the above value into the IB's share (5), one gets:

$$V_i|_{\Gamma=\Gamma_i} \equiv p_i R - \alpha\eta(W) - (1-\alpha)\,\phi. \tag{17}$$

We first study the firm's project choice, starting from the incentive compatibility condition:

$$U_H \geqslant U_L \Leftrightarrow R \leqslant a - \frac{c}{\Delta p} \equiv \hat{r}. \tag{18}$$

Inequality (18) puts an upper bound on R: as explained in the previous section (see inequality (13)) the firm finds it profitable to behave only if $R \leqslant \hat{r}$. The IB has thus to solve two problems, depending on whether the firm chooses project H or L:

$$\max_R U_H \equiv p_H(a-R) - c \tag{19}$$
$$\text{s.t. } V_H \equiv p_H R - \alpha\eta(W) - (1-\alpha)\,\phi \geq 0 \text{ and } R \leq \hat{r}$$

and

$$\max_R U_L \equiv p_L(a-R) \tag{20}$$
$$\text{s.t. } V_L \equiv p_L R - \alpha\eta(W) - (1-\alpha)\,\phi \geq 0 \text{ and } R > \hat{r}$$

Following the basic assumptions of our model, the banking sector is perfectly competitive. The firm has full bargaining power when it applies for the loan, hence the bank sets R to maximize the firm's share, otherwise it loses the client. The IB's participation constraint is binding:

$$V_i|_{\Gamma=\Gamma_i} = 0 \text{ if } R_i = \frac{\alpha\eta(W) + (1-\alpha)\,\phi}{p_i}. \tag{21}$$

Now we consider the two cases illustrated above. First, when

$$R_H \leq \hat{r} \Leftrightarrow a \geq a_B \equiv \frac{\alpha\eta(W) + (1-\alpha)\,\phi}{p_H} + \frac{c}{\Delta p}, \tag{22}$$

the firm chooses project H and the IB solves problem (19). Plugging R_H into U_H gives:

$$U_H(R_H) = S_H = p_H a - c - \alpha\eta(W) - (1-\alpha)\phi. \tag{23}$$

The firm receives the entire 'good' welfare S_H, whose value is always positive under Assumption 1.

On the contrary, when $R_H > \hat{r}$, *i.e.* if $a < a_B$, the firm is induced to select project L as the break-even condition for the bank requires $R_L > R_H$. The IB thus solves problem (20). Substituting R_L into U_L yields:

$$U_L(R_L) = S_L = p_L a - \alpha\eta(W) - (1-\alpha)\phi. \tag{24}$$

The firm ends up with the entire 'bad' welfare S_L, whose value has not been yet examined. It is easy to check that:

$$S_L \geq 0 \Leftrightarrow a \geq a_L \equiv \frac{\alpha\eta\left(W\right) + \left(1-\alpha\right)\phi}{p_L}. \tag{25}$$

If condition (25) is satisfied, the firm accepts the loan proposal by the bank and produces surplus S_L. Monitoring is not a viable option, as one can easily check taking into account Assumption 2.

Before continuing, we have to locate the position of a_B and a_L in our region of interest. First of all, from (10) *(i)* a_B represents a rightward parallel shift as compared to a_N; *(ii)* a_L represents a downward parallel shift as compared to $\overline{a}$. See Figure 2. Moreover,

$$a_B \leq a_L \Leftrightarrow c \leq \tilde{c} \equiv \frac{\left(\Delta p\right)^2}{p_L p_H}\left(\alpha\eta\left(W\right) + \left(1-\alpha\right)\phi\right) \tag{26}$$

and

$$a_B \leq \underline{a} \Leftrightarrow c \leq \hat{c} \equiv \frac{\Delta p}{p_L}\left(\rho - \alpha\eta\left(W\right) - \left(1-\alpha\right)\phi\right) \tag{27}$$

where both $\tilde{c}$ and $\hat{c}$ belong to the interval $(0, \overline{c})$, as it can be easily ascertained. In the next section we will come back to comparison between $\tilde{c}$ and $\hat{c}$ and the precise representation of a_B and a_L. For the moment it is sufficient to highlight that the above values are compatible with the region of interest.

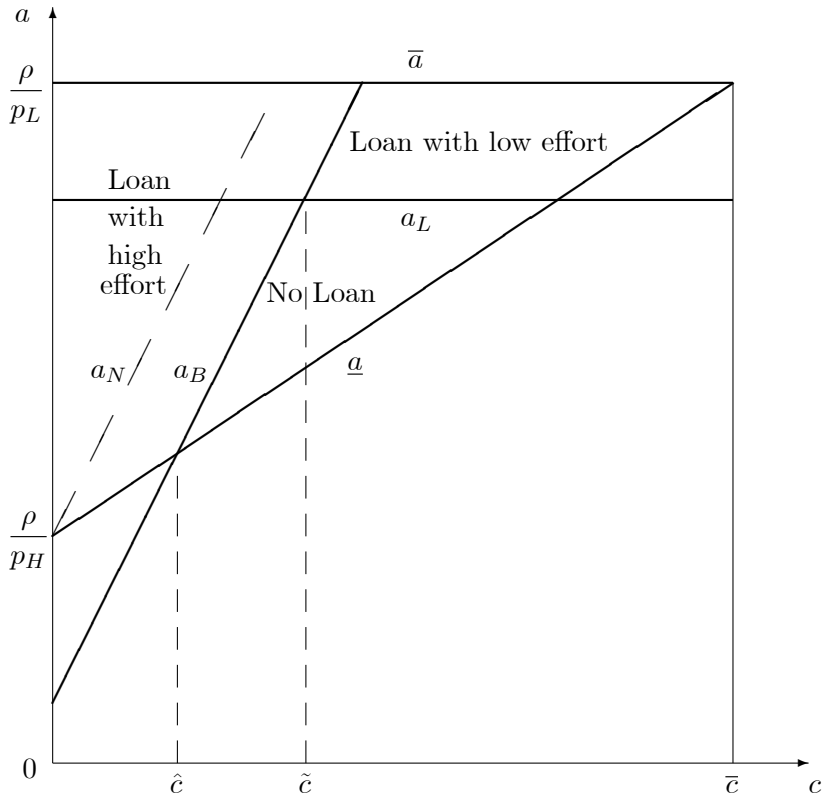
We can therefore sum up the main results of this section as follows:

Lemma 2 *When the firm applies to the intermediary bank supported by the financial institution, (i) the loan is granted in $a \geq a_L \cup a \geq a_B$ and the resulting expected welfare is either S_H for $a \geq a_B$ or $S_L \geq 0$ for $a_L \leq a < a_B$; (ii) the loan is not granted if $a < a_L \cap a < a_B$ and the expected welfare is nil.*

Proof Directly follows from Assumption 1 and 2 and by inspecting (22), (25) and (26). ■

The results of Lemma 2 in the interval region of interest are depicted in Figure 2. Comparing this figure to the one representing the local bank case (Figure 1), it is evident that the area of credit crunch can be dramatically reduced by the intervention of the external financial institution.

Figure 2: The Intermediary Bank Case



We can therefore claim that:

Proposition 1 *The intervention of an external financial institution in support to the lending activity of an intermediary bank mitigates the moral hazard problem between the bank itself and a firm which needs a loan to start a creditworthy project.*

Proof Directly follows from comparing Lemma 1 and Lemma 2 and by our previous discussion on the respective position of a_B and a_L in the region of interest. ■

The combination of co-funding and guarantees provided by a nonprofit external agent as the FI represents therefore a powerful device to soften the credit crunch problem in periods of recession, where informational and monitoring costs are high, due to limited trust between economic actors, relatively to projects' returns. In the next section we will investigate the mechanism underpinning the positive role of the external financial institution and suggest how to improve the effectiveness of its action.

Turning to the welfare implications, consider the effort choice and loan arrangement in our two scenarios and take into account Figure 2. First of all, the rightward shift of a_B implies an expansion of the area in which the firm behaves and the loan is granted. The expected surplus is now S_H: *(i)* in $a \geq a_N$ the firm behaves under both contractual environments, therefore the net welfare gain is ΔS ; *(ii)* in $a_B \leq a < a_N$ the firm behaves only when the FI gives support, hence the net welfare gain is S_H. Second, the downward shift of a_L gives rise to a new area of surplus S_L, which is non-negative for sufficiently high values of a. In particular, in $a_L \leq a < a_B$ the net welfare gain is S_L. Notwithstanding the low effort exerted by the firm, the deriving negative effect on the success probability is outweighed by the decrease in the cost of financing induced by the FI.

6 On the elimination of the credit crunch

The initial aim of the analysis carried in the previous sections was to find a theoretical road to model the role played by an external agent which intervenes to restore a credit market seriously hit by the crisis. We described the problem faced by a firm which asks for a loan to two different types of banks. In the first case the bank was left alone and we found a relatively big area in which a credit crunch existed. In the second case such an area shrank, thanks to the measures adopted by the FI in support of intermediary bank's lending activity. However, nothing has been said yet regarding the extent of the credit crunch area remaining *after* the intervention of the FI. This is why the mechanism through which the FI intervenes has to be further investigated.

Notice first that $a_B = a_N$ and $a_L = \overline{a}$ if $\alpha = 1$ and $W = 0$: in this case we would be back to the LB case represented in Figure 1, in which neither co-funding nor guarantees were available. Furthermore, it is easy to check that both a_B and a_L are decreasing in W and increasing in α: the respective (and beneficial) rightward shift of a_B and downward shift of a_L are proportional to the amount of guarantee and co-funding. The two instruments are substitutes as they both reduce the cost of raising capital for the IB, as it appears when taking into consideration (17) *vis à vis* (2). Focus, for instance, on the region where $a \geq a_B$, which requires that condition (22) holds, *i.e.* $R_H \leq \hat{r}$. Given that R_H is increasing in α and decreasing in W, whilst $\hat{r}$ is independent on α and W, $R_H \leq \hat{r}$ is more likely to be satisfied when higher co-funding ($\alpha \downarrow$) and/or higher guarantees ($W \uparrow$) are provided by the FI. An analogous reasoning holds for $a \geq a_L$, which solves $S_L \geq 0$. The economic intuition is as follows: on the one hand the FI's intervention reduces the gross interest rate R_i charged by the IB, thereby enlarging the area in the parametric space (c, a) where the firm chooses project H. On the other hand it raises the value of welfare S_L, thus increasing the area where the firm accepts the bank's proposal.

It is worth verifying whether and how the FI's intervention can completely eliminate the credit crunch area: this occurs as long as $\hat{c} \geq \tilde{c}$ in Figure 2. We can easily prove

that:

Lemma 3 *A necessary condition for the intervention of the financial institution to completely eliminate the credit crunch problem is*

$$\frac{\rho}{\phi} \geq \frac{p_H + \Delta p}{p_H} \tag{28}$$

Proof Take the case where the FI fully commits to help the intermediary institution, *i.e.* to reduce the cost of raising funds up to its lowest level ϕ: this is obtained when $\alpha = 0$ and/or $W = R$. Consider the values $\hat{c}$ and $\tilde{c}$ which appear respectively in (26) and (27). After substituting $\alpha = 0$ and/or $W = R$ into $\hat{c}$ and $\tilde{c}$, inequality (28) solves $\hat{c} \geq \tilde{c}$. ■

Lemma 3 highlights the importance of the costs of financing. When (28) is not satisfied, a region of credit crunch still persists even in presence of the full support by the FI ($\alpha = 0$ and/or $W = R$). Only when the ratio between the cost or raising capital with and without the intervention is sufficiently high, the credit crunch can be eliminated. More exactly, the equality $\hat{c} = \tilde{c}$ is satisfied by

$$\eta^*(W, \alpha) = \frac{1}{\alpha}\left[\frac{p_H}{p_H + \Delta p}\rho - (1 - \alpha)\phi\right] \tag{29}$$

The function $\eta^*(W, \alpha)$ is depicted in Figure 3: it represents $\eta(W)$ as a function of α and identifies the locus of points below (resp. above) which $(\tilde{c} - \hat{c})$ is negative (resp. positive). The feasible set for the FI's support is $\eta(W) \in [\phi, \rho]$ and $\alpha \in [0, 1]$. Notice that $\eta^*(W, \alpha)|_{\alpha=0} = \infty$ and $\eta^*(W, \alpha)|_{\alpha=1} = \frac{p_H}{p_H + \Delta p}\rho$: the latter value belongs to the interval $[\phi, \rho)$ given (28).

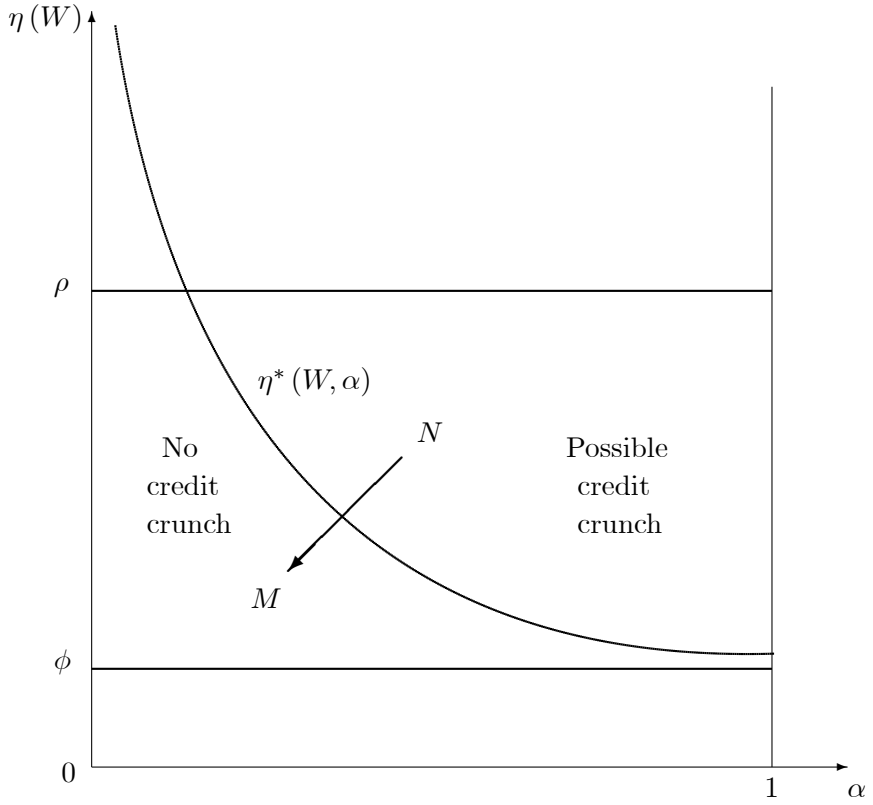
Figure 3 deserves an additional explanation. *Ceteribus paribus*, higher levels of co-funding $(1 - \alpha)$ are captured by a move to the left, while an increase in the guarantee W is displayed by a move to the bottom, since $\eta'(W) < 0$ for $\eta(W) \in (\phi, \rho)$. For example, point N represents a weak intervention in support of the IB and a credit crunch may arise here, depending on the vales of c and a (see Figure 2), because $(\tilde{c} - \hat{c}) > 0$. On the contrary, a stronger support by the FI is shown in point M, which results from the combined action of higher co-funding and guarantee: this is sufficient to eliminate the credit crunch. Finally, notice that $\eta^*(W, \alpha)$ decreases with α, confirming that α and W act as substitutes, in that smaller guarantees ($\eta^* \uparrow$) are needed to overcome the credit crunch if the FI is providing a higher percentage of co-funding ($\alpha \downarrow$).

The above discussion can be summarized in:

Proposition 2 *When the firm applies to the intermediary bank supported by the financial institution, the credit crunch problem can be completely eliminated only if (i) (28) holds and (ii) the FI provides a sufficiently high combination of co-funding and guarantees, the minimum level of which is indicated by (29).*

The result of Proposition 2 turns out to be interesting if the two relevant parametric areas are interpreted as follows. In our model ϕ (resp. ρ) is the cost of raising fund for the FI (resp. the LB) and the former is supposed to have the best credit rating, while the latter a substantial worse one. As anticipated in the Introduction, the interest rate spreads on government bonds of the EU countries have risen dramatically after the intensification of the financial crisis. This confirms that during a crisis the spread between ρ and ϕ is likely to be sufficiently high to satisfy condition (28). The deriving implication is worth remarking: an appropriate intervention by the FI in support of the intermediary bank turns out to be a very powerful instrument given that it allows to eliminate the credit crunch problem especially in periods of crisis.

Figure 3 The intervention of the FI



6.1 Which role for the EIBG?

It is time to evaluate whether the analytical results obtained above apply to the concrete case study that we have in mind. Can the EIBG remove the obstacles in the credit market and unlock the access to the loan for SMEs?

As described in Section 2, the EIBG limits the amount of co-funding to 50% of the project cost and sets an upper bound on guarantees. The aim is to avoid the

occurrence of moral hazard between the EIBG and the intermediary bank. In our theoretical model, this translates into $\alpha \in [\underline{\alpha}, 1]$, with $\underline{\alpha} \equiv \frac{1}{2}$, and $W \in \left[0, \overline{W}\right]$, with $\eta\left(\overline{W}\right) \in (\phi, \rho)$. Substituting $\underline{\alpha}$ into $\eta^*(W, \alpha)$ one gets

$$\eta^*(W, \underline{\alpha}) = \frac{2p_H}{2p_H - p_L}\rho - \phi, \tag{30}$$

which is the minimum cost of raising fund necessary to fully eliminate the credit crunch area when co-funding is at its maximum of 50%.

The value $\eta^*(W, \underline{\alpha})$ is lower than $\eta\left(\overline{W}\right)$, the minimum cost of raising fund attainable under the constraint $W \leq \overline{W}$, if and only if

$$1 + \frac{\Delta p}{p_H} < \frac{\rho}{\phi} < \left(1 + \frac{\Delta p}{p_H}\right)\frac{\eta\left(\overline{W}\right) + \phi}{2\phi}. \tag{31}$$

On the contrary, if

$$\left(1 + \frac{\Delta p}{p_H}\right)\frac{\eta\left(\overline{W}\right) + \phi}{2\phi} < \frac{\rho}{\phi}, \tag{32}$$

then $\eta^*(W, \underline{\alpha})$ is higher than $\eta\left(\overline{W}\right)$. We can therefore state:

Proposition 3 *The effectiveness of the EIBG ultimately depends on the spread between ρ and ϕ. In particular: (i) if (31) holds, the credit crunch problem is eliminated only by relaxing the upper constraints on the amount of co-funding, $\alpha \in [\underline{\alpha}, 1]$, and/or guarantees, $W \in \left[0, \overline{W}\right]$; (ii) if (32) holds instead, such constraints do not prevent the EIBG from overcoming the credit crunch.*

The result of Proposition 3 indicates that we have to focus our attention on two parametric intervals: (31) denotes a relatively medium spread between ρ and ϕ, whilst (32) a higher one. Only when the spread is sufficiently high, the EIBG is able to eliminate the credit crunch problem by respecting the constraints on co-funding and guarantee support. We already know from Proposition 2 that the intervention of the FI allows to eliminate the credit crunch problem especially in periods of crisis. Here we can confirm that the more severe the crisis, the more effective the intervention by the EIBG in support of intermediary banks financing SMEs' productive projects.

7 Conclusion

The recent crisis of the global financial system has generated a wide debate on the necessity of supranational financial institutions playing an active role in enhancing credit availability. In this paper we have fundamentally demonstrated how nonprofit top-credit-rated financial institutions providing additional credit and guarantees to intermediary banks can mitigate informational problems between lenders and borrowers. This is crucial in periods of crisis, where trust between economic actors has to be re-established. Focusing on the European context, we have argued that the European

Investment Bank Group is a very good candidate for this task, as it can effectively support intermediary banks to finance creditworthy projects proposed by SMEs. Indeed, we have shown that the intervention of the EIBG turns out to be particularly helpful when the credit market is hit the hardest by the financial crisis.

Recent reforms and new measures taken by the EIBG reinforce the validity of the message conveyed in our contribution. After the dramatic deterioration of the situation on the financial markets and the expansion of the economic crisis, the EIBG reinforced its skills with "anti-crisis measures". In particular, the EIBG deployed exceptional resources in support of SMEs. In a Briefing Note it was written that:

> "[...] the EIB Group launched an out-and-out offensive in support of SMEs, which have been indirectly affected by the financial crisis and, consequently, the credit squeeze. In its role as a public bank, the EIB was asked by the European Council to commit unprecedented sums, EUR 30bn, in the form of loans for SMEs via commercial banks by 2011. The EIB is on its way to meeting these targets for in 2008 it granted a total of EUR 8.1bn in credit lines for SMEs to 75 commercial banks in 16 countries and aims to cover the whole European Union in 2009"
>
> (Annual Press Conference 2009, Briefing Note No.5, Brussels, 9 March 2009)

We are convinced that a prompt and lasting recovery has to pass through a widespread feeling of trust, primarily raising the morale of those "small" and innovative entrepreneurs that represent the backbone of the newly established economic and financial system. We have shown that the EIBG can mitigate the informational problem connected to the squeeze of the credit availability. Nonetheless, the activity of this institution should be included in a broader and integrated European framework.

8 Appendix

In this Appendix we consider the case of a monopolistic local bank, which sets the gross rate r in order to maximize its expected share $v_i \equiv p_i r - \rho$, provided that the firm participates and selects project i. The following firm's constraints have to be satisfied: the participation constraint $u_i \equiv p_i (a - r) - c_i \geqslant 0$ and the incentive compatibility constraint $u_i \geqslant u_{-i}$, with $-i = L, H$; they ensure that choosing project i gives to the firm a nonlower share than the outside option and the choice of project $-i$, respectively.

Solving $u_H \geqslant u_L$ by r we obtain $r \leqslant \hat{r}$, where recall that $\hat{r} \equiv a - \dfrac{c}{\Delta p}$. Moreover, $u_i \geqslant 0$ when $r \leqslant \overline{r}_i = a - \dfrac{c_i}{p_i}$. Since $c_H > 0$ and $c_L = 0$ it is always true that $\overline{r}_i > \hat{r}$, hence the bank faces a trade-off: its share is increasing in r, but when $r > \hat{r}$ the firm chooses the bad project, thus reducing total welfare. The bank is then forced to propose a lower interest rate to have the firm selecting project H.

We have now all the elements to solve the problem of the bank, i.e. to maximize $v_i \equiv p_i r - \rho$. When setting $\hat{r}$, the maximum interest rate that induces the firm to select

project H, the bank gets $v_H(\hat{r}) = s_H - \frac{p_L}{\Delta p}c$, whilst the firm obtains $u_H(\hat{r}) = \frac{p_L}{\Delta p}c$.

On the other hand, when setting $\overline{r}_L > \hat{r}$, the maximum interest rate that induces the firm to participate by choosing the bad project, the bank ends up with $v_L(\overline{r}_L) = s_L$ and the firm with zero.

Alternatively, the bank has the possibility to monitor the proper implementation of the good project at total cost m. In this case we know that the moral hazard issue disappears: the bank's problem is to choose r to maximize $v_H(m) \equiv p_H r - \rho - m$, subject only to the firm's participation constraint $u_H \geqslant 0$. The solution is $r = r_M \equiv a - \dfrac{c}{p_H}$: the bank gets $v_H(r_M) = s_H - m$ and the firm zero.

The IB compares its expected share when setting either $\overline{r}_L$ or $\hat{r}$ or r_M. First, setting $\overline{r}_L$ is not profitable as $v_L(\overline{r}_L) = s_L$ is negative under Assumption 1. Second, Assumption 2 is sufficient to rule out monitoring, as it implies that $v_H(r_M)$ is lower than zero. Finally, $v_H(\hat{r}) \geq 0$ if $a \geq a_N \equiv \dfrac{\rho}{p_H} + \dfrac{c}{\Delta p}$.

We can conclude that the LB proposes the contract $\{\hat{r}\}$ and that the firm accepts if $a \geq a_N$, otherwise no loan is proposed: the result of Lemma 1 still holds, with the only difference that the firm does not appropriate the entire welfare when the loan is granted. Modifying the relative bargaining power between the parties produces only a redistributive effect.

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