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Credit Markets with Ethical Banks and Motivated Borrowers*

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Abstract

This paper investigates banks' corporate social responsibility. Two different competitive credit markets do exist: one for standard projects and one for ethical ones. Ethical projects have also a social profitability, but a lower (positive) expected revenue with respect to standard ones. Ethical projects are financed by ethical banks and undertaken by motivated borrowers. These borrowers obtain additional benefit (a social responsibility premium) from accomplishing ethical projects when trading with ethical banks.

If the expected profitability of ethical project is sufficiently close to that of standard ones and/or the social responsibility premium of motivated borrowers is sufficiently high, the market for ethical projects is active and the credit market is fully segmented. This result holds true irrespective of the information structure: only moral hazard on the borrower side, moral hazard and screening on the borrower side, moral hazard on the borrower side and screening on the lender side. The optimal contract in our set-up is always a debt contract. However, its precise form and welfare properties depend on the information structure.

Jel classification: D86, G21, G30.

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1 Introduction

According to the standard *shareholder-value approach* firms are controlled by profit-maximizing shareholders and the firms' interaction with other stakehold-

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ers is simply managed by contracts and regulation. However, in recent years, society's and lawmakers' interest and demand for corporate social responsibility (CSR) have dramatically increased (see, for example, the Green Paper "Promoting a European framework for Corporate Social Responsibility" prepared by the Commission of the European Communities in 2001). CSR has been interpreted as a response to market and redistributive failures alternative to government intervention. Following Benabou and Tirole (2009), "a standard definition of CSR is that it is about sacrificing profits in the social interest. For there to be a sacrifice, the firm must go beyond its legal and contractual obligations, on a voluntary basis. CSR embraces a wide range of behaviors, such as being employee friendly, environment friendly, mindful of ethics, respectful of communities where the firm's plants are located, and even investor friendly" (Bénabou and Tirole 2009, page 2). In practice, as the authors clarify, CSR can be translated essentially in one of the three following situations: the adoption of a more long-term perspective by firms, the delegated exercise of prosocial behavior on behalf to stakeholders, and insider-initiated corporate philanthropy.

CSR is also developing in the banking industry and it is becoming an important tool for many companies' management and work force. CSR by lenders (Ethical Banks) can be interpreted as *delegated philanthropy* since, as mentioned before, the firm can be a channel of stakeholders' values. In the case of banking crucial stakeholders are obviously investors: socially responsible investors provide saving to ethical banks and want the corporation to use their saving to finance social responsible project and firms[1] (see, for example, the Report on Socially Responsible Investing Trends in the U.S. prepared in 2007 by the Social Investment Forum). Example of ethical banks are the following: Wainwright Bank and ShoreBank[2] in the U.S.A., Cooperative Bank and Charity Bank in the U.K., Ekobank in Sweden, Cultura Sparebank in Norway, Triodos Bank in the Netherland, Ethikbank and GLS Bank in Germany, LaNef in France, Banca Popolare Etica and Banca Prossima in Italy, Grameen Bank in Bangladesh, BID Amerique in Latin America and in the Caribbean area. In Islamic banking (spread over 51 countries, including the United States), interest-free loan (qard hassan) are today quite frequent and funds must comply with Islamic principles (see also the Islamic Development Bank).

Also borrowers, through their economic activities, can promote social values. Motivated borrowers may provide services to individuals (for example services to persons with disabilities or rehabilitation services), culture and education diffusion, may promote the environment as well as art fruition and protection, access to work, protection and enhancement of minorities, local and community development and so forth.

[1] Socially responsible investors frequently accept, for their investment, a lower interest rate with respect to the market one.

[2] ShoreBank was founded in 1973 to prove that money could be lent profitably to poor people in poor neighborhoods, un experiment that became known as "community-development finance". On August 2010 the Federal Deposit Insurance Corporation (FDIC), called time on its experiment. (From "ShoreBank: Small Enough to Fail - The Sorry End to a Bold Banking Experiment". Economist. August 26, 2010, available at http://www.economist.com/node/16891993).

We define ethical banks as "corporate social responsible" lenders since they can commit to fund only socially relevant projects. While borrowers are called "motivated" since they prefer to engage in socially valuable activities, without necessarily committing to them.

In spite of its importance, a little consideration is given in the economics literature to ethics in finance in general and to ethics in banks in particular (exception is the literature on microcredit, e.g., Stiglitz 1990, Besley and Coate 1995, Ghatak 1999 and the large empirical literature which followed). Few works, mainly in the business literature, analyze ethical banks and show the relevant role of ethical banking as an independent activity (e.g., Lynch, 1991; San-Jose, Retolaza and Gutierrez, 2009). From Green (1989) and Lynch (1991) there are two accepted characteristics to define the ethical banking: i) social profitability, understood as funding economic activities with social added value and as the absence in any case of investments in speculative projects or in those that fulfill negative social criteria; ii) economic profitability, which means non negative profits. The dimension of profit obviously refers to the good management of the bank, because ethical banks do not distribute benefits between stockholders or, if they do so, the distribution is very limited.

In this paper we analyze banks CSR when offering loan agreements to entrepreneurs wishing to invest in ethical projects. In particular we investigate how social responsible lenders and motivated borrowers interact with each others when they compete in a credit market where also standard lenders and borrowers do operate.

In the model, ethical projects are those providing both social[3] and economic advantages, but which deliver lower expected revenue with respect to standard ones. Differently from standard profit maximizing banks, socially responsible lenders commit to invest in ethical projects.[4]

There exist two types of borrowers in the market: standard profit maximizing entrepreneurs and socially motivated ones. The latter obtain an additional benefit (a premium for social responsibility) from trading with ethical banks if the project is successful. This implies that motivated borrowers prefer to trade with ethical banks as long as loan conditions are not too unfavorable with respect to those offered by standard lenders.

Both project types are subject to moral hazard: the two types of entrepreneurs can behave or misbehave (see Tirole 2006). As mentioned before, moti-

[3] To give some examples of ethical projects, the Co-operative Bank (UK) supports both smaller local charities and high profile international organizations. It invests in projects within the renewable energy and carbon reduction sectors by funding a wide range of renewable energy projects. It provides services to Housing Associations including term loans and investments. It actively supports social enterprises by helping organizations that share its co-operative values of fairness and social responsibility and are committed to transforming lives through making social, economic and environmental change. (From the web-site http://www.co-operativebank.co.uk, consulted in November 2011)

[4] As an example of commitment to ethical projects, on the web site of Charity Bank (UK) on reads "Providing affordable charity loans and loans to social enterprises and other community organizations that benefit people and the planet, is our mission. As a charity and social enterprise ourselves we understand how the sector works and are here to help your organization". (Available at http://www.charitybank.org, consulted in November 2011)

vated borrowers trading with ethical banks gain a social responsibility premium when the project is successful, thus making the moral hazard problem less severe. Consequently, if the premium for social responsibility is high enough (and/or the profitability of ethical projects is not much lower than that of standard ones), ethical banks can offer a better contract to motivated borrowers than those offered by standard banks.

First we analyze the case where the borrowers' behavior is private information (moral hazard only). We then investigate the case where the borrowers' behavior and their preferences for social issues are private information (moral hazard and adverse selection both on the borrowers' side). Finally we consider the case where the borrowers' behavior and the lenders' preferences for corporate social responsibility are not observable (moral hazard on the borrowers' side and adverse selection on the lenders' side). Even though one usually tends to distinguish ethical bank from microcredit, we also provide a possible reinterpretation of the model in term of microfinance.

Our results are all driven by the interplay of the two crucial parameters of the model: the difference in expected revenue from standard and ethical projects and the premium for social responsibility received by motivated borrowers trading with ethical banks.

We first show that only socially motivated borrowers will engage in ethical projects. If the premium for social responsibility is low (and/or the profitability of ethical projects is much lower than that of standard ones), then ethical banks cannot operate. If, instead, the premium is high enough (and/or the difference between the two projects profitability is not too large) and the two lenders' type is observable, the ethical banks are active and the market is fully segmented. That is, profit maximizing agents trade among themselves in the market for standard projects and ethical banks trade with motivated borrowers in the market for ethical projects. The optimal second best contract is a debt one in both markets. The cost of moral-hazard is lower in the ethical projects market. Consequently, when the ethical projects market is active, under moral hazard the debt contract always provides a higher funding to motivated borrowers. It also allows a higher revenue to the motivated borrower when the premium for social responsibility is sufficiently high. Moreover, we proved that all of the previous results hold also under moral hazard and adverse selection on the borrower' side. However, when the ethical projects market is active, motivated borrowers are worse off with respect to the second-best, while standard receive the second best contract. Finally, under moral hazard on the borrowers' side and adverse selection on the lenders' side the market is fully segmented again and the second-best contract is offered to both agents' types, whatever the difference in expected revenue from standard and ethical projects and the premium for social responsibility.

Our results show that if the premium for social responsibility is sufficiently high (and/or the differential between profitability of the two project types is low enough), the benefit from the matching between motivated borrowers and ethical lenders always occurs through a perfect segmentation of the market for any considered information structure. The reason of the result is that the

socially responsible lenders and the motivated borrowers can solve the moral hazard problem in a cheaper way if they are matched together than if they are matched with standard agents. If the premium for social responsibility is sufficiently high (and/or the difference in projects profitability is low), the more efficient solution of the moral hazard problem more than compensate the lower profitability of ethical projects and segmentation increases the overall efficiency of the credit market.

The beneficial matching between agents of similar type recalls Besley and Ghatack (2005). However, they assume that the workers' and employers' types (whether the worker is mission oriented or not) are observable by the partner; we instead consider also the case where private information exists either on the borrowers' or on the lenders' type. As a consequence the first part of our paper investigates a situation similar to the one analyzed by Besley and Ghatack, while the second one considers an extension to the case of asymmetric information on the agents' type.

Our paper is organized as follows. In Section 2 we describe how socially responsible lenders and motivated borrowers are modeled and how they interact in the market where also standard profit maximizer agents exist. We also present the different information structures considered in the paper. In Section 3 we investigate loan agreements when the motivated and standard borrowers have private information on the behavior exerted in making the project successful. In Section 4 we analyze the case of loan agreements under moral-hazard and adverse selection on the borrowers' side and in Section 5 we briefly consider the case of loan agreements under moral-hazard on the borrowers' side and adverse selection on the lenders' side. Finally, Section 6 presents a possible re-interpretation of the model in terms of microfinance and Section 7 concludes.

2 The Model Set-up

The model borrows from Tirole (2006). We consider a credit market with a large numbers of both risk neutral borrowers (she) and lenders (he). The risk free interest rate is normalized to zero.

Borrowers have to undertake a project which needs an investment. Each borrower can apply for at most one lending and different projects type exist. We call I^k the amount of the investment, where $k \in \{0,1\}$ is an indicator of the type of project. When $k = 1$ the project is "ethical" and when $k = 0$ the project is "not-ethical". The difference between the two projects will be specified below. The borrowers owns an asset A, with $A < I^k$. In words, the borrowers have not enough capital and/or collateral whatever is the project they are interested in, hence they have to borrow $I^k - A$. We assume for simplicity that A is the same for all borrowers.

If the project is undertaken it generates a cash flow per unit of investment $R^k \in \left\{R^{Fk}, R^{Sk}\right\}$, with $R^{Sk} > R^{Fk} \geq 0$, where R^{Sk} is the cash flow per unit of investment in case of success, and R^{Fk} in case of failure.

Ethical projects represent all projects leading to *social benefits*, beyond prof-

its (as an example projects that improve communities, and have a positive impact on the environment). We do not model this aspect of ethical projects, which will then be taken for granted. Ethical projects can be thought of as being a subset of standard ones. For this reason one can assume that the profitability of ethical projects is on average lower than that of standard ones. We capture this idea with the following assumption: $R^{S0} \geq R^{S1}$ and $R^{F0} = R^{F1}$, such that $\Delta_{R_1} = R^{S1} - R^{F1} \leq \Delta_{R_0} = R^{S0} - R^{F0}$. The two types of projects are perfectly observable and have independent distributions. Finally, and considering both projects types, the total cash flow is $R^{Xk} \cdot I^k > 0$, with $X \in \{F, S\}$. $R^{Fk} I^k$ can be considered as the liquidation value of the assets.

The project is subject to moral hazard: the entrepreneurs can behave or misbehave. If they behave the probability of success is p_H, otherwise it is p_L, with $p_H > p_L$. We define $\Delta_p \equiv p_H - p_L$. However, if the entrepreneurs misbehave, they will enjoy a private benefit whose value is $P \cdot I$. The private benefit will be nought otherwise. The borrowers are protected by limited liability: hence their income cannot be negative. Given limited liability, the moral hazard problem is relevant even though both agents are risk neutral.

There are also two types of banks and entrepreneurs, denoted respectively as $i \in \{0, 1\}$ and $j \in \{0, 1\}$. Both for lenders and borrowers type 0 denotes the standard agents, while type 1 indicates the agents aware of social issues. The percentage of motivated borrowers in the credit market is q whereas that of standard ones is $1 - q$. This information is common knowledge.

Both in case of success and of failure, revenues are shared between lenders and borrowers: L_{ij}^{Xk} and B_{ij}^{Xk} respectively are the income of a lender of type i trading with a borrower of type j and of a borrower of type j trading with a lender of type i, when the investment is of type k and the state of the world is X. We obviously have that $L_{ij}^{Xk} + B_{ij}^{Xk} = R^{Xk} \cdot I_{ij}^k$. Thus, a contract $(B_{ij}^{Sk}, B_{ij}^{Fk}, I_{ij}^k)$ specifies the type of project, the amount invested and, how revenues are shared between lenders and borrowers both in case of success and of failure, given the type of the two agents trading together.

The entrepreneurs payoff is:

$$U_j^k = p(a)\left(B_{ij}^{Sk} + \tilde{\theta}_{ij}\right) + (1 - p(a))\, B_{ij}^{Fk} - A + (1 - a)\, PI_{ij}^k \tag{1}$$

where $a \in \{0, 1\}$ is the behavior of the entrepreneur. In particular, $a = 0$ if the entrepreneur misbehaves, while $a = 1$ if he behaves. The entrepreneur's behavior determines the probability of success which becomes $p(1) = p_H$ and $p(0) = p_L$ respectively.

$\tilde{\theta}_{ij}$ is the *premium for social responsibility* and it depends on the type of borrower and lender, that is, $\tilde{\theta}_{ij} = \theta > 0$ if $i = j = 1$, and $\tilde{\theta}_{ij} = 0$ otherwise.

In fact, the $(1-q)$ standard borrowers never receive a premium for social responsibility, whereas the q motivated borrowers receive a non pecuniary benefit (whose monetary value is θ) only when they trade with ethical banks. This is in line with Besley and Ghatack's idea of good matching between agents sharing the same mission.

In fact, once the loan contract has been signed, the motivated borrower has more willingness to repay the debt to a socially responsible lender. This occurs since, in a dynamic perspective, the motivated borrower anticipates that, if the ethical bank makes profits, it will use the liquidity to finance other social and solidarity-based projects and, conversely, if it makes losses it won't be able to finance them. Since ethical banks are committed to invest in ethical projects (see below), the premium for social responsibility is positive only if motivated borrowers interact with an ethical bank and undertake an ethical project.

One could object that the main concern for a motivated borrower should be to accomplish a socially valuable project and therefore one could find it reasonable to assume that $\widetilde{\theta}_{ij} > 0$ even if the ethical project is financed by a standard bank. However, in that case, our model would not provide an explanation for the existence of ethical banks since commercial lenders would finance both standard projects and ethical ones, provided that θ is sufficiently high.[5] Moreover, we think that the assumption of a positive premium for CSR when the ethical project is financed by a standard bank is not consistent with the kind of moral hazard we assumed. Moral hazard here, and in all the literature on corporate finance as well, does not correspond to the "incentive to shirk on a given task". In our specific model moral hazard translates into a higher (or lower) willingness to repay the debt to an ethical (standard) bank.

Note that motivated borrowers prefer to trade with ethical banks as long as ethical projects profitability is not too low with respect to standard project profitability. In that case the premium for social responsibility θ can compensate the difference in profitability between the two project types. In different words, in our formulation, if the gains in profits are sufficiently high, the motivated borrower behaves as a standard one. This is in line with the economics and psychology literature where it is acknowledged that the psychological motives are relevant if the material payoffs are not too big (see Rabin 1993).

On the contrary standard borrowers prefer the loan contract assuring them the highest expected revenue, whatever the type of project involved. As we will show in Subsection 3.2, when the premium for social responsibility is positive and ethical projects profitability is not too low, ethical banks can control moral hazard at a lower cost with respect to standard lenders trading with borrowers of the same type.

Standard lenders maximize their profits. When their moral hazard problem is taken care of, expected profits become:

$$p_H L_{0j}^{S0} + (1 - p_H) L_{0j}^{F0} - I_{0j}^{0} + A \tag{2}$$

Standard lenders invest in non-ethical projects to obtain higher expected profits, so that $k = 0$ in the previous objective function. In fact, motivated borrowers would gain a social responsibility parameter θ equal to zero when trading with standard lenders and so no advantages can be found in terms of less costly moral hazard in that case.

[5] About drawbacks of possible alternative model strategies see also Footnote 9.

As mentioned in the introduction we interpret lenders' corporate social responsibility as delegated philanthropy. In particular, the bank is a channel of its stakeholders values: socially responsible investors provide saving to ethical banks and want the corporation to use their saving to finance social responsible projects. In particular, ethical banks maximize expected profit as standard lenders but, differently from them, are able to commit in investing only in ethical projects.[6] As a consequence, socially responsible lenders' objective function is:

$$p_H L_{1j}^{S1} + (1 - p_H) L_{1j}^{F1} - I_{1j}^{1} + A \tag{3}$$

Note that ethical banks only invest in ethical projects, no matter which type of borrowers is undertaking the ethical project[7], so that $k = 1$ in (3). Since ethical projects have a lower profitability than standard ones, ethical banks are ready to sacrifice profits in the social interest. This is in line with the definition of CSR provided in the introduction.[8]

2.1 Information Structures

The assumption that the ethical nature of the project is common knowledge seems rather natural, in fact it implies that the creditor can observe the investment that was financed.[9]

We will consider two versions of the model. In both versions we will assume that the project type is common knowledge and that borrowers have private information on their behavior (making the project successful or not).

In the former version of the model we do not allow for adverse selection issues. The type of the borrowers is common knowledge (the banks observe whether the borrowers are motivated or not), but lenders cannot observe the borrowers' behavior. We call this model the second-best one (Section 3).

Thereafter we relax the assumption that the borrowers' type is common knowledge. The setting with moral hazard and adverse selection on the borrowers' side captures the situation where lenders are banks that built up a reputation or can set up credible commitment devices in their statute, while

[6] In a previous version of the paper we assumed that ethical banks maximized the *total revenue* from ethical projects, in analogy with Blinder (1993)'s assumption for stakeholder-oriented manufacturing firms. Nothing substantial changed in the analysis with respect to the current version.

[7] Thus the ethical banks are indifferent between financing a motivated borrower or a profit maximizer one, provided that they undertake an ethical project, other things equal. However, as we will clarify later on, if an ethical bank wishes to satisfy the incentive compatibility constraint for the profit maximizer it cannot match the offer of the commercial bank, since standard projects have a higher expected return.

[8] As will be clear in the following of the paper, the higher θ the lower the cost of providing incentives to the motivated borrowers. Thus, in the ethical banks' objective function, L_{11}^{S1} is actually increasing in θ. Concerning our interpretation of CSR as delegated philanthropy, this implies that not only depositors of ethical banks want their capital to be invested in ethical projects, but they are also "happier" when a financed ethical project is successful.

[9] However, the borrower could use the loan to finance projects different from the contracted one. In the present model, we will not deal with this kind of moral hazard and leave it for future research.

borrowers are start-ups, new firms without reputation. We call the solution of this model third best (Section 4). In Section 5 we will also briefly discuss the case where lenders cannot observe the borrowers' behavior but banks have private information on their corporate social responsibility. This assumption captures the situation called "strategic corporate social responsibility" (see Baron 2001) where a firm can pretend to be socially responsible only to strength its market position, for example to attract the better customers (in our model, under some conditions, better customers are the motivated borrowers). In this case lenders either are new banks who have no reputation yet or are well established firms who announce a change in their corporate social attitude but are not able to set up credible commitment devices for corporate social responsibility (for example, what is written in their statute does not impose stringent constraints on behavior). While here borrowers are firms well established in the market that already built up a reputation.

Finally in Section 6, where we offer an alternative interpretation of the model in terms of microfinance, we still consider the case of second-best (the type of the borrowers is common knowledge, but lenders cannot observe the borrowers' behavior).

2.2 Preliminaries

Let us consider the cash flow per unit of investment I. In this subsection we omit the superscript of the project type, k, since this does not raise any confusion. We will assume:

$$\begin{aligned} p_H R^S I_{ij} + (1-p_H) R^F I_{ij} - I_{ij} &> 0 \\ p_L R^S I_{ij} + (1-p_L) R^F I_{ij} + P I_{ij} - I_{ij} &< 0 \end{aligned}$$

therefore the net present value of both projects (ethical and non-ethical) is positive if the borrower behaves and negative otherwise. The two conditions can be simplified as:

$$p_H \Delta_R + R^F > 1 \tag{4}$$

$$p_L \Delta_R + R^F + P < 1 \tag{5}$$

Hence, if it is not possible to take care of the moral hazard problem the investment cannot be carried over.

Expected profit of both standard and socially responsible lenders must be non negative. The two lenders' participation constraints $\left(IR^L_{0j}\right)$ and $\left(IR^L_{1j}\right)$, thus, correspond to:

$$p_H L^S_{ij} + (1-p_H) L^F_{ij} \geq I_{ij} - A. \tag{6}$$

that is:

$$\begin{aligned} p_H \left(R^S I_{ij} - B^S_{ij}\right) + (1-p_H) \left(R^F I_{ij} - B^F_{ij}\right) &= \\ p_H \left(R^S - R^F\right) I_{ij} - p_H \left(B^S_{ij} - B^F_{ij}\right) + R^F I_{ij} - B^F_{ij} &\geq I_{ij} - A \end{aligned}$$

or

$$p_H \Delta_R I_{ij} + R^F I_{ij} - I_{ij} - B_{ij}^F + A \geq p_H \Delta_{B_{ij}} \tag{7}$$

where $\Delta_{B_{ij}} = B_{ij}^S - B_{ij}^F$.

3 Loan Agreements under Moral Hazard

Corporate social responsibility of both borrowers and lenders is observable, but lenders cannot observe the borrowers' behavior.

Remind that motivated borrowers will trade with ethical banks as long as the expected profit from ethical projects is not too low with respect to the expected profit from standard ones.

We assume Bertrand competition among lenders. This brings banks' profits to zero and borrowers consequently keep all the surplus from loan agreements. This is equivalent to endowing the borrowers with all the bargaining power and having them proposing the contract to lenders. Thus, the optimal contract maximizes the representative borrower's utility under the borrower's incentive compatibility constraint $\left(IC_{ij}^B\right)$ and the lenders' rationality constraint $\left(IR_{ij}^L\right)$.

As a consequence the timing of the second-best game is equivalent to that of the following game:

- First the representative borrower offers a contract to lenders, specifying a loan agreement.
- Second, lenders accept or refuse the contract.
- Then the borrower decides whether behave or misbehave
- Finally, uncertainty concerning the project is solved and the contract is implemented.

To characterize the credit market structure under pure moral hazard we proceed in the following way: (i) we find the optimal contract signed by (both types of) borrowers when trading with standard lenders. (ii) We describe the optimal contract signed by standard borrowers when trading with ethical banks and we show that standard borrowers always prefer to trade with standard lenders. (iii) We show the optimal contract signed by motivated borrowers when trading with ethical banks. (iv) We compare the contracts offered by standard and ethical lenders and we show that motivated borrowers prefer to trade with ethical banks only when the premium for social responsibility is sufficiently high (and/or the difference in profitability between the two projects types is sufficiently low). This allows us to identify conditions such that the market for ethical projects is active and thus ethical banks can operate.

3.1 Borrowers Trading with standard Lenders

The contract for a borrower trading with a standard bank is denoted by $(B_{0j}^{S0}, B_{0j}^{F0}, I_{0j}^{0})$, where the subscript j means that we are considering both types of borrowers and superscript 0 means that the borrowers invest in standard projects. Remind that, when trading with a standard bank, the two borrower's types have the same objective function (the premium for social responsibility θ is zero). The incentive compatibility constraint of borrowers trading with a standard lender is $\left(IC_{0j}^{B}\right)$:

$$p_H \cdot B_{0j}^{S0} + (1 - p_H)\, B_{0j}^{F0} + I_{0j}^{0} - A \geq p_L \cdot B_{0j}^{S0} + (1 - p_L)\, B_{0j}^{F0} + P \cdot I_{0j}^{0} + I_{0j}^{0} - A$$

that is:

$$\Delta_{B_{0j}} \geq \frac{P I_{0j}^{0}}{\Delta_p} \tag{8}$$

where $\Delta_{B_{0j}} = B_{0j}^{S0} - B_{0j}^{F0}$, which is the difference in the borrower's revenue in case of success and failure, for given contract.

Following Tirole (2006), chapter 3, the problem of a borrower trading with a standard lender becomes**:**

$$\begin{array}{ll} \max\limits_{\Delta_{B_{0j}}, B_{0j}^{F0}, I_{0j}^{0}} & p_H \Delta_{B_{0j}} + B_{0j}^{F0} - A \\ s.t. & \Delta_{B_{0j}} \geq \frac{P I_{0j}^{0}}{\Delta_p} \quad \left(IC_{0j}^{B}\right) \\ & \left(p_H \Delta_{R_0} + R^F - 1\right) I_{0j}^{0} - p_H \Delta_{B_{0j}} - B_{0j}^{F0} + A \geq 0 \quad \left(IR_{0j}^{L}\right) \end{array} \tag{9}$$

where $\left(IR_{0j}^{L}\right)$ has been obtained substituting the incentive compatibility constraint (8) in inequality (7) and re-arranging. Moreover, always following Tirole (2006), we assume that:

$$p_H \left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) + R^F < 1 \tag{10}$$

therefore I_{0j}^{0} has to be finite:

$$I_{0j}^{0} \leq \frac{A - B_{0j}^{F0}}{1 - p_H \left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F} \tag{11}$$

the previous inequality expresses the borrowing capacity of the entrepreneur, trading with a profit maximizing firm.

Solution to the Program (9) is described in the following remark.

Remark 1 *The optimal contract for a borrower trading with a standard lender*

under moral-hazard is a debt contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ *such that:*

$$\begin{aligned} I_{0j}^{0*} &= \frac{A}{1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F} \\ B_{0j}^{S0*} &= \frac{P}{\Delta_p}\frac{A}{1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F} = \frac{PI_{0j}^{0*}}{\Delta_p} \\ B_{0j}^{F0*} &= 0. \end{aligned} \tag{12}$$

Proof. See the appendix A.1. ■

The implications of the formulas in Remark 1 are the usual ones in this kind of models. (12) tells that firms' borrowing capacity I_{0j}^{0*} is increasing in tangible assets A, i.e. the higher is A, the lower is credit rationing. Borrowing capacity I_{0j}^{0*} is also decreasing in agency costs (private benefit, P, or inverse likelihood ratio, $\frac{p_H}{\Delta_p}$). The fact that $B_{0j}^{F0*} = 0$, instead, implies that the optimal contract is a debt one, which gives the highest incentives of behaving to the entrepreneur, which is the well known Jensen and Meckling (1976) result.

3.2 Borrowers Trading with Socially Responsible Lenders

The contract for a standard borrower trading with an ethical bank is denoted by $(B_{10}^{S1}, B_{10}^{F1}, I_{10}^{1})$, where the subscript 10 means that we are considering ethical banks together with standard borrowers and superscript 1 means that the borrowers invest in ethical projects.

In the same way a contract for a standard borrower trading with a standard lender is denoted by $(B_{00}^{S0}, B_{00}^{F0}, I_{00}^{0})$. Note that $(B_{10}^{S1}, B_{10}^{F1}, I_{10}^{1})$ and $(B_{00}^{S0}, B_{00}^{F0}, I_{00}^{0})$ are very similar contracts: the premium for social responsibility is always zero and the unique difference is in the fact that, when trading with ethical banks, standard borrowers must undertake ethical projects.

Considering that ethical projects generate a lower expected revenue with respect to standard ones, it is easy to check that standard borrowers prefer to trade with standard banks. In fact, following the same steps of the previous subsection we have:

$$\begin{aligned} B_{10}^{S1*} &= \frac{P}{\Delta_p}\frac{A}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} \\ &< \frac{P}{\Delta_p}\frac{A}{1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F} = B_{00}^{S0*} \\ I_{10}^{1*} &= \frac{A}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} \\ &< \frac{A}{1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F} = I_{00}^{0*}. \end{aligned} \tag{13}$$

Remark 2 *In the case of pure moral hazard, standard borrowers always prefer to trade with standard banks.*

We now consider contracts that are designed for motivated borrowers.

The contract for a motivated borrower trading with an ethical bank is denoted as $(B_{11}^{S1}, B_{11}^{F1}, I_{11}^{1})$, where the superscript 1 indicates that only ethical projects can be financed in this case. The incentive compatibility constraint of a motivated borrower trading with an ethical bank is:

$$p_H\left(B_{11}^{S1}+\theta\right)+(1-p_H)\,B_{11}^{F1}-I_{11}^{1}+A \geq p_L\left(B_{11}^{S1}+\theta\right)+(1-p_L)\,B_{11}^{F1}+PI_{11}^{1}-I_{11}^{1}+A$$

that is:

$$\Delta_{B_{11}}+\theta \geq \frac{PI_{11}^{1}}{\Delta_p} \tag{14}$$

where $\Delta_{B_{11}} = B_{11}^{S1} - B_{11}^{F1}$.

If the parameter θ is sufficiently high, the previous incentive compatibility constraint is more easily satisfied than the one before (see inequality 8).[10] In different words, if borrowers' motivation is sufficient to compensate ethical

[10] Note that, if θ is sufficiently high, then the ethical bank could set $\Delta_{B_{11}} = 0$ and the incentive constraint (14) would still be satisfied. The previous extreme situation can appear somehow unrealistic. However, consider the alternatives. For instance the entrepreneurs' payoff could be:

$$U_{ij}^{k} = p\,(a)\,B_{ij}^{Sk} + (1-p\,(a))\,B_{ij}^{Fk} - A + (1-a)\,\tilde{P}I_{ij}^{k}$$

where the private benefit parameter $\tilde{P} \in \{P_0, P_1\}$, with $P_1 < P_0$, depends on the borrowers' and the lenders' type. Namely, $\tilde{P} = P_1$ if a motivated borrower matches with an ethical bank, and $\tilde{P} = P_0$ when a matching involving at least one standard profit maximizer agent occurs. With this specification all our results still hold and the extreme case where θ is so high that a motivated borrower does not misbehave when $\Delta_{B_{11}} = 0$ can be avoided. However this specification would imply that the two relevant incentive compatibility constraints become:

$$\begin{aligned} \Delta_{B_{0j}} &\geq \frac{P_0 I_{0j}^{0}}{\Delta_p} \\ \Delta_{B_{11}} &\geq \frac{P_1 I_{11}^{1}}{\Delta_p} \end{aligned}$$

The formulas above (together with the optimality of the debt contract) imply that:

$$\frac{B_{0j}^{S}}{I_{0j}^{0}} = \frac{P_0}{\Delta_p} > \frac{B_{11}^{S}}{I_{11}^{1}} = \frac{P_1}{\Delta_p}$$

the share of investment that the borrower requires in order to behave is constant for any level of investment for both kind of borrowers, which is rather unrealistic.

Moreover, in our formulation, if the gain in profits are very high, the motivated borrowers behaves as a profit maximizer. In the formulation provided in this footnote, this is not necessarily the case, since intrinsic incentives are proportional to investment. To avoid this unrealistic prediction we could incorporate a fixed negative intrinsic motivation parameter in the value of the private benefit, but in this case the model would be totally equivalent to the present one.

A slightly different version of this specification will however be used in our microfinance interpretation of the model (see Section 6), where the sum at stake are small almost by definition.

projects' low profitability, agents aware of social issues interacting together can implement more efficient contracts, as we show below.

Remind that the participation constraint of socially responsible lenders is the same as for the standard ones:

$$p_H L_{11}^{S1} + (1 - p_H) L_{11}^{F1} \geq I_{11}^1 - A \tag{15}$$

Thus, despite the presence of the premium for social responsibility θ, we can follow the same steps as in the previous case. The problem of a representative motivated borrower trading with an ethical bank is**:**

$$\begin{array}{cll} \max\limits_{\Delta_{B_{11}}, B_{11}^{F1}, I_{11}^1} & p_H \Delta_{B_{11}} + p_H \theta + B_{11}^{F1} - A & \\ s.t. & \Delta_{B_{11}} + \theta \geq \frac{P I_{11}^1}{\Delta_p} & \left(IC_{11}^B\right) \\ & \left(p_H \Delta_{R_1} + R^F - 1\right) I_{11}^1 - p_H \Delta_{B_{11}} - B_{11}^{F1} + A \geq 0 & \left(IR_{11}^L\right) \end{array} \tag{16}$$

Solution to the previous program is described in the following remark.

Remark 3 *The contract for a motivated borrower trading with an ethical bank under moral-hazard is a debt contract* $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ *such that:*

$$\begin{aligned} I_{11}^{1*} &= \frac{A + \theta p_H}{1 - p_H \left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} \\ B_{11}^{S1*} &= \frac{P}{\Delta_p} \frac{A + \theta p_H}{1 - p_H \left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} - \theta \\ B_{11}^{F1*} &= 0 \end{aligned} \tag{17}$$

Proof. See the appendix A.2. ■

In the following Remark we provide conditions for the motivated entrepreneur being able to invest more than the standard one and/or obtaining a higher revenue in the case of success.

Remark 4 *Motivated borrowers trading with an ethical bank:*

- *have a higher borrowing capacity than when trading with a standard lender* $\left(I_{11}^{1*} > I_{0j}^{0*}\right)$ *if:*

$$\theta \geq I_{0j}^{0*} \left(\Delta_{R_0} - \Delta_{R_1}\right) \equiv \underline{\theta} \tag{18}$$

- *obtain higher expected net profits than when trading with a standard lender* $(B_{11}^{S1*} > B_{0j}^{S0*})$ *if:*

$$\theta \geq \frac{p_H P}{\Delta_p} \frac{\left(\Delta_{R_0} - \Delta_{R_1}\right) I_{0j}^{0*}}{p_H \Delta_{R_1} + R^F - 1} \equiv \overline{\theta} \tag{19}$$

where condition (19) implies condition (18), or $\underline{\theta} < \overline{\theta}$.

Proof. See the Appendix A.3. ■

As one can check, both conditions (18) and (19) require that the expected profit from the ethical projects is not too smaller than that from the other projects ($\Delta_{R_0} - \Delta_{R_1}$ is low), or that the premium for social responsibility θ is high enough.

We can compare the contracts offered by the two types of banks as follows:

Remark 5 *The contracts offered by standard and socially responsible lenders are as follows:*

- *if condition* (18) *does not hold, that is* $\theta < \underline{\theta}$, *then contracts* $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ *and* $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ *are such that* $I_{11}^{1*} < I_{0j}^{0*}$ *and* $B_{11}^{S1*} < B_{0j}^{S0*}$.
- *if condition* (18) *holds, but not (19), that is* $\underline{\theta} \leq \theta \leq \overline{\theta}$, *then contracts* $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ *and* $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ *are such that* $I_{11}^{1*} > I_{0j}^{0*}$ *and* $B_{11}^{S1*} < B_{0j}^{S0*}$.
- *if condition (19) holds, that is* $\theta \geq \overline{\theta}$, *then contracts* $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ *and* $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ *are such that* $I_{11}^{1*} > I_{0j}^{0*}$ *and* $B_{11}^{S1*} > B_{0j}^{S0*}$.

Obviously, if (19) holds so that $\theta \geq \overline{\theta}$, then motivated borrowers prefer to trade with socially responsible lenders since, by doing so, they can both benefit from their socially responsibility premium and they can also obtain a better contract.

Suppose now that (18) does not hold so that $\theta < \underline{\theta}$. Motivated borrowers receive in this case a higher loan and a higher expected profit when they trade with standard lenders. In principle they could even then prefer to trade with socially responsible banks, if the premium for social responsibility θ more than compensate better contract conditions. However we find that:

Remark 6 (18) *is a necessary condition for motivated borrowers to trade with socially responsible lenders* ($\theta \geq \underline{\theta}$).

Proof. See the Appendix A.4. ■

The previous remark states that, if $\theta \geq \underline{\theta}$, then motivated borrowers prefer to trade with socially responsible lenders even if, by doing so, they receive a lower expected revenue $\left(B_{11}^{S1*} < B_{0j}^{S0*}\right)$. Thus, under (18), the contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ obtained in Remark 1 becomes $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ since it is signed only by standard borrowers. This implies that the market is fully segmented in that case.

However, if the opposite of condition (18) holds ($\theta < \underline{\theta}$), and the contract offered by standard lenders is such that both $I_{11}^{1*} < I_{0j}^{0*}$ and $B_{11}^{S1*} < B_{0j}^{S0*}$, then motivated borrowers will prefer to trade with standard lenders. This implies that ethical banks are not active in the credit market in this case.

The following proposition summarizes results in subsections (3.1) and (3.2):

Proposition 1 ***Moral hazard****. Suppose that borrowers' type is observable, but lenders cannot observe the borrowers' behavior.*

- *If condition (18) holds* ($\theta \geq \underline{\theta}$)*, then the credit market is fully segmented and the debt contracts* $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ *and* $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ *are offered to standard and motivated borrowers respectively.*

  1. *If condition (19) holds* $\left(\theta \geq \overline{\theta}\right)$*, then the contracts are such that* $I_{11}^{1*} > I_{00}^{0*}$ *and* $B_{11}^{S1*} > B_{00}^{S0*}$.
  2. *If, instead, condition (19) does not hold* $\left(\underline{\theta} \leq \theta \leq \overline{\theta}\right)$*, the contracts are such that:* $I_{11}^{1*} > I_{00}^{0*}$ *and* $B_{11}^{S1*} < B_{00}^{S0*}$.

- *Finally, if condition (18) does not hold* ($\theta < \underline{\theta}$)*, then socially responsible banks are not active and the market for ethical projects does not exist: all borrowers accept the contract* $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ *offered by standard lenders.*

Proposition 1 shows that, if (18) holds ($\theta \geq \underline{\theta}$), two separated credit markets are created: one market for ethical projects where only agents aware of social issues trade and one for standard projects where only standard agents operate. In fact, when the premium for social responsibility is sufficiently high, it more than compensates the lower expected profitability of ethical projects so that motivated borrowers prefer to trade with ethical banks. Finally, if the social responsibility parameter is even higher $\left(\theta \geq \overline{\theta}\right)$, motivated borrowers obtain a contract that is more profitable than the one obtained by the standard borrowers. These results are in line with Besley and Ghatak's (2005), where mission oriented workers perfectly match with mission oriented firms of the same type and social productivity increases.

4 Loan Agreements under Moral Hazard and Adverse Selection on the Borrowers' Side

We consider here the following informational structure: lenders' corporate social responsibility is common knowledge, but lenders cannot observe neither the borrowers' behavior nor the borrowers' motivation. As already mentioned, this setting fits a situation where lenders are banks with well known characteristics, while borrowers are new firms without reputation. This context is interesting since, when the premium for social responsibility is sufficiently high (see Proposition 1 above), motivated borrowers trading with ethical banks obtain better contract conditions than standard borrowers trading with standard lenders: thus standard borrowers could take advantage of their private information by pretending to be motivated. Note that, in this latter case, since standard borrowers mimicking motivated ones possibly misbehave, ethical banks could obtain negative profits.

Lenders here simply know that the percentage of motivated borrowers in the credit market is q whereas that of standard ones is $1 - q$. We call this game the third-best.

Note that, since borrowers' motivation is part of the borrowers' private information, a self-selection constraints must be considered. Obviously, if second-best contracts $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ and $(B_{1j}^{S1*}, B_{1j}^{F1*}, I_{1j}^{1*})$ defined before verify such a self-selection constraint, those contracts can also be offered in third-best (they are envy free).

From Proposition 1, in second best all borrowers' types prefer contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ if condition (18) does not hold $(\theta < \underline{\theta})$. In the latter case ethical banks are not active and the two borrowers' types become identical since the premium for social responsibility is zero. Therefore, a direct consequence of Proposition 1 is that, in third-best and when condition (18) does not hold $(\theta < \underline{\theta})$**,** standard lenders offer the second-best contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ to all borrowers.

Let us consider now higher levels of the premium for social responsibility. From Remark 6 we know that, in second-best, motivated borrowers prefer contract $(B_{1j}^{S1*}, B_{1j}^{F1*}, I_{1j}^{1*})$ to contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ when (18) holds $(\theta \geq \underline{\theta})$. Moreover, it is easy to check that standard borrowers prefer contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ to contract $(B_{1j}^{S1*}, B_{1j}^{F1*}, I_{1j}^{1*})$ when (18) holds but (19) does not $\left(\underline{\theta} \leq \theta \leq \overline{\theta}\right)$, that is when $I_{1j}^{1*} > I_{0j}^{0*}$ and $B_{1j}^{S1*} < B_{0j}^{S0*}$. In fact, in that case, when they trade with standard lenders they receive a higher expected utility than when they trade with socially responsible lenders:

$$p_H \Delta_{B_{0j}^*} + B_{0j}^{F0*} - A > p_H \Delta_{B_{1j}^*} + B_{1j}^{F1*} - A$$

where $\Delta_{B_{0j}^*} > \Delta_{B_{1j}^*}$.

Summarizing, from the previous reasoning we know that when (18) holds but not (19) $\left(\underline{\theta} \leq \theta \leq \overline{\theta}\right)$, the second best contracts $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}) \equiv (B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ and $(B_{1j}^{S1*}, B_{1j}^{F1*}, I_{1j}^{1*}) \equiv (B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ are envy free and can also be offered in third-best. In this case the credit market is fully segmented. Whereas, when (18) does not hold $(\theta < \underline{\theta})$, only standard lenders are active in the credit market and the second-best contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ is offered to both borrowers' types.

We consider now the most interesting case where (19) holds $\left(\theta > \overline{\theta}\right)$ and the premium for social responsibility more than compensate non-ethical projects low profitability. Here both borrowers' types prefer contract $(B_{1j}^{S1*}, B_{1j}^{F1*}, I_{1j}^{1*})$.

Note that, in third-best, commercial banks still offer the second-best contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ even when (19) holds $\left(\theta > \overline{\theta}\right)$ since all borrowers are the same when trading with standard lenders. Thus, concerning standard banks we can state the following:

Remark 7 *In third-best, standard banks offer the second-best contract whatever the size of the premium for social responsibility.*

Instead, when (19) holds $\left(\theta > \overline{\theta}\right)$, ethical banks must offer a self-selecting contract to prevent standard borrowers from mimicking motivated ones. (Remind that, to trade with ethical banks and mimic CSR, standard borrowers will need to invest in ethical projects.) In particular, the third-best contract $(B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**})$ designed for motivated agents is self-selecting if, when

chosen by standard borrowers, it provides them with profits that are weakly smaller than the ones standard borrowers obtain with their second-best contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$. As a consequence, in the self-selection constraint of the third-best maximization program, the term B_{0j}^{S0*} appears (see the proof of Lemma 1 below).

Again, because of the assumption of Bertrand competition among lenders, borrowers are endowed with all the bargaining power and obtain all the surplus from trade in equilibrium. Thus, as in Section 3 we can solve the model as if the borrowers were the first movers and propose the contract in the first period. Importantly, since borrowers are the informed party, we consider here a case of contract design by an informed principal (see Maskin and Tirole 1992 and also Tirole 2006, page 264): when they observe the contract designed by borrowers, socially responsible lenders possibly learn something about the borrowers' type and update their beliefs. The timing of the third-best game is equivalent to that of the following game:

- First borrowers propose a contract to socially responsible lenders specifying the type of investment $k = 1$**.**
- Second, socially responsible lenders accept or refuse the offer.
- Third borrowers decide whether behave or misbehave.
- Finally, uncertainty concerning the project is solved and the contract is executed.

We characterize the contract $(B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**})$ in the following lemma.

Lemma 1 *If (19) holds* $\left(\theta \geq \overline{\theta}\right)$*, standard borrowers obtain the second-best debt contract. Motivated borrowers obtain a debt contract with lower revenue and investment than their second-best contract, but higher investment, than the second best contract offered to standard borrowers***.**

Proof. See the Appendix A.5. ■

In the Appendix we prove that the relevant maximization program to be solved takes into account the self-selection constraint when the mimicker misbehaves $(a = 0)$. This implies that the self-selection constraint is rather restrictive so that the distortion from the second-best is quite important.

The following proposition summarizes all results in this section:

Proposition 2 ***Moral hazard and adverse selection on the borrowers' side.***

- *When (19) holds* $\left(\theta \geq \overline{\theta}\right)$*, standard borrowers sign the second-best contract* $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ *with standard lenders. Motivated borrowers sign a debt contract* $(B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**})$ *with ethical banks such that* $B_{11}^{S1**} < B_{00}^{S0*}$**,** $I_{11}^{1**} > I_{00}^{0*}$ *and* $B_{11}^{S1**} < B_{11}^{S1*}$, $I_{11}^{1**} < I_{11}^{1*}$*. The credit market is fully segmented.*

- *When (18) holds but not (19)* $\left(\underline{\theta} \leq \theta \leq \overline{\theta}\right)$*, the second-best contracts* $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ *and* $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ *are envy free and are also offered in third-best. The credit market is fully segmented.*

- *When (18) does not hold* $(\theta < \underline{\theta})$*, then ethical banks are not active, the market for ethical projects does not exist and both borrowers' types obtain the second-best contract* $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$.

The first case described in Proposition 2 corresponds to the third-best equilibrium when the premium for social responsibility more than compensate ethical projects low profitability and, in second-best, motivated borrowers receive a better contract. Here, in third-best, standard borrowers are the mimickers and a self-selecting contract is offered to motivated entrepreneurs who are worse off with respect to the second best. In particular the latter obtain a contract that is characterized by a higher investment but a lower expected revenue with respect to standard borrowers, exactly as it occurs in the second-best for value of θ such that $\underline{\theta} \leq \theta \leq \overline{\theta}$ (see Proposition 1). In the second case, instead, adverse selection has no bite. Here the premium for social responsibility is characterized by an intermediate size so that contracts designed for motivated borrowers are not attractive for standard ones. The last case corresponds to the equilibrium of third-best when standard projects profitability more than compensate the premium for social responsibility: all borrowers become equivalent to standard entrepreneurs and no adverse selection issues arise.

5 Loan Agreements under Moral Hazard on the Borrowers' Side and Adverse Selection on the Lenders' Side.

In this section we briefly analyze lenders' private information on their corporate social responsibility. As explained in Subsection 2.1, we capture here the so called "strategic" corporate social responsibility, a situation where a firm can pretend to be socially responsible to strength its market position. In our model, standard lenders can be interested in mimicking ethical banks to trade with motivated borrowers and solve the moral hazard problem in a cheaper way. The timing is analogous to that of the previous sections.

First of all, socially responsible banks do not wish to mimic the standard ones, given their commitment to only invest in ethical projects. The standard lenders could mimic ethical banks, but it can be easily checked that they will not. In fact, we have to consider again the possible different sizes of the premium for social responsibility. Suppose first that (18) does not hold $(\theta < \underline{\theta})$. Ethical banks are not active and the equilibrium coincides with the second-best one. Suppose now that condition (18) holds $(\theta \geq \underline{\theta})$. Ethical banks are active, but all lenders are making zero profits at the second-best equilibrium, irrespective on whether condition (19) holds or not $\left(\theta \gtrless \overline{\theta}\right)$. Thus, the second best contracts

are envy free (in a weak sense) and they can be implemented also in this last case.

Thus we can state the following remark:

Remark 8 ***Moral hazard on the borrowers' side and adverse selection on the lenders' side.*** *Suppose that borrowers' type is observable, but not that of lenders. Moreover, lenders cannot observe the borrowers' behavior.*

Proposition 3

- *If condition (18) holds ($\theta \geq \underline{\theta}$), then the credit market is fully segmented and the debt contracts $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ and $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ are offered to standard and motivated borrowers respectively.*
- *If condition (18) does not hold ($\theta < \underline{\theta}$), then socially responsible banks are not active, the market for ethical projects does not exist and all borrowers accept the contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ offered by standard lenders .*

We find a perfect market segmentation between agents aware of social issues and standard ones also under moral hazard on the borrowers' side and adverse selection on the lenders' side. However, contrary to what happens with the previous information structure, no distortion from the second-best contract is necessary here to reach such a result.

6 A Different Interpretation: Microfinance

Our setting could be used to interpret also microcredit. We consider here only moral hazard on the borrowers side, so that our microcredit model is formally equivalent to that presented in section 3.

In the previous analysis and when (19) holds ($\theta \geq \underline{\theta}$), that is when the premium for social responsibility is sufficiently high, the motivated borrowers exert the role of the "good-type" in the agency relationship with the lender. In that case the motivated borrowers repay the debt at a lower cost when matched with a socially responsible lender.

Here we analyze a different situation: the socially responsible lender is a microfinance institution and the motivated borrower is a "microborrower". In this context the project type is not relevant and we will assume that a unique type of project exists, what matters is uniquely the characteristics of the two agents aware of social issues.

We have in mind, in particular, the idea of microfinance associated with Muhammad Yunus and Grameen Bank of Bangladesh, winners of the 2006 Nobel Peace Prize. According to such an idea, microfinance institutions use a group-based lending approach by which the peer-pressure within the group leads the borrowers to follow through and use caution in conducting their financial affairs with strict discipline, ensuring repayment eventually and allowing the borrowers to develop good credit standing. We implicitly assume that a standard forprofit bank is not able to apply the group-based lending approach such that microborrower's moral-hazard has a larger cost for a commercial bank.

Finally, it is reasonable to assume that standard borrowers are not interested in trading with microfinance institutions.

Within the previous interpretation, opportunistic behavior is more likely when a microborrower meets a commercial bank than when he meets a microfinance institution, because a standard bank is not as efficient as a microfinance institution in solving the moral hazard problem. We thus suppose that the entrepreneurs payoff is:

$$U_j = p(a) B_{ij}^S + (1 - p(a)) B_{ij}^F - A + (1 - a) \tilde{P} I$$

The *private benefit parameter* $\tilde{P} \in \{P_0, P_1\}$, with $P_1 < P_0$, depends on the borrowers' and the lenders' type. Namely, $\tilde{P} = P_1$ only if a microborrower matches with a microfinance institution, and $\tilde{P} = P_0$ otherwise.

As for the objective functions of the two types of lenders, since the project type k is no more relevant in the present context, expressions (2) and (3) become substantially equivalent.

Under the previous assumptions and with full information on the lenders' and the borrowers' types, the market is still fully segmented. Microfinance institutions will sign contracts only with microborrowers according to their mission and commercial banks will loan only to forprofit entrepreneurs to reduce the moral hazard cost rising in the agency relationship. Lenders' profit will be zero in equilibrium. Moreover, since the moral hazard cost is the same in equilibrium for the two bank types and contrary to the results in Section 3, the contracts offered to micro- and standard-borrowers in the second best equilibrium are the same:

Remark 9 ***Microfinance under moral hazard****. Suppose that both borrowers' and lenders' types are observable, but lenders cannot observe the borrowers' behavior. The contracts* $(B_{00}^{S*}, B_{00}^{F*}, I_{00}^*)$ *and* $(B_{11}^{S*}, B_{11}^{F*}, I_{11}^*)$ *are debt contracts such that* $(B_{00}^{S*}, B_{00}^{F*}, I_{00}^*) = (B_{11}^{S*}, B_{11}^{F*}, I_{11}^*) = (B^{S*}, B^{F*}, I^*)$*. The credit market is fully segmented.*

The previous result depends on our assumption that the collateral A is not part of the contract and it is the same for all agents. However, suppose that the microfinance projects have a fixed (minimal) size. If in our model we fix the level of investment and allow for different amounts of collateral, a smaller collateral can be sufficient to induce microborrower to behave when trading with microfinance institutions than when trading with profit maximizing banks, because group lending can make the moral hazard problem less severe in the former case. This can make microcredit profitable for microfinance institutions, but not for standard banks. The existing literature on microfinance (Stiglitz 1990, Besley and Coate 1995, Ghatak 1999 among others) investigates group lending and peer monitoring as an efficient tool to provide loans, we instead model microborrowers as entrepreneurs who are riskier than standard borrowers for commercial banks, but who can generate more efficient relationships when trading with microfinance institution.

In the microfinance interpretation of our model, the case of loan agreements under moral hazard and adverse selection on the borrowers' side has little meaning. In fact it is hard to think about microborrowers pretending to be standard borrowers to obtain credit from a commercial bank. As already mentioned, in the real world microborrowers and standard borrowers can be easily discriminated by commercial banks using collateral A. For that reason we think that the appropriate model to analyze moral hazard and adverse selection in a market with microfinance institutions and standard banks should differentiate contracts using the collateral A as an endogenous variable. This has meaning in a richer model where, as an example, there is a negative covariance between the collateral and the private benefit parameter P of potential borrowers. A negative covariance implies that, on average, borrowers with higher wealth available as collateral are also characterized by a lower private benefit from misbehaving (a higher cost of defaulting). This means that lenders can fix a value of the collateral sufficiently high to screen the most part of bad borrowers. We leave this analysis for future research.

7 Conclusion

Our paper investigates corporate finance of ethical banks. To the best of our knowledge this analysis was still missing in the credit markets literature.

In our model there are two different credit markets: the market for standard projects and the market for ethical ones. We define ethical projects as projects with both social and economic profitability but a lower expected revenue with respect to standard ones. We model ethical banks as lenders which are able to commit to finance only ethical projects so that they are not interested in operating in the markets for standard projects. Motivated borrowers, instead, obtain an additional benefit (a premium for social responsibility) from trading with ethical banks in the case their project is successful. This implies that motivated borrowers prefer to trade with ethical banks as long as the contract conditions are not too unfavorable with respect to those offered by standard lenders. We investigate how ethical banks and motivated borrowers interact together when credit markets are competitive and also standard agents exist and, we consider different information structures. First we analyze the case where banks do not observe borrowers' behavior (the pure moral hazard case). We then investigate the case where banks do not observe neither borrowers' behavior nor borrowers' motivation (the case of moral hazard and adverse selection on the borrowers' side). Finally we briefly consider the case where banks do not observe borrowers' behavior and borrowers do not observe the banks' social responsibility (the case of moral hazard on the borrowers' side and adverse selection on the lenders' side). We also provide a possible reinterpretation of ethical banks as microfinance institutions.

In the model standard lenders choose to not operate in the market for ethical projects. We find conditions such that only standard agents operate in the market for standard projects and only agents aware of social issue trade in the

market for ethical projects, implying that the market is fully segmented. All our results depend on the interplay between two crucial parameters of the model: the difference in profitability of standard and ethical projects and the size of the premium for social responsibility.

Intuitively ethical banks improve market efficiency by leading to perfect matching between socially motivated agents on one side and standard ones on the other side, provided that the premium for social responsibility is sufficiently high and/or the difference in profitability between standard and ethical projects is low enough. In fact, if the previous condition is satisfied, by giving credit to motivated borrowers ethical banks can induce repayment of their loan at a lower cost, because they solve more efficiently the moral hazard problem. However, if the previous condition is not satisfied, then ethical banks are not active so that the market for ethical projects does not exist.

We also show that both in the case where banks do not observe borrowers' behavior and in the case where banks do not observe neither borrowers' behavior nor borrowers' type, motivated borrowers obtain a higher funding with respect to the standard ones. Put it differently, with and without adverse selection motivated entrepreneurs have higher borrowing capacity. Finally we prove that both banks' types offer debt contracts to their borrowers both under pure moral hazard and under moral hazard and adverse selection.

In line with Bénabou and Tirole's view of CSR, our model interprets ethical banks as firms correcting some market failures in the credit market. In particular, in equilibrium, standard lenders are only active in the market for standard projects so that, without ethical banks, the market for ethical projects will never exist. This suggests that, in the real world, ethical banks can be welfare improving not only because they can solve more efficiently the moral hazard problem when interacting with motivated borrowers, but also because they allow the financing of projects exerting a positive externality to the society.

An interesting extension of our model would be to analyze microfinance institutions in a similar but reacher model where borrowers' collateral is endogenously determined in the optimal loan contract (see our comments in Subsection 6).

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A Appendix

A.1 Proof of Remark 1

The following proof is quite standard (see Tirole 2006), however we prefer to insert it since it turns out to be useful to understand Remarks 2, 3 and 4 in Subsection 3.2.

It is easy to prove that $\left(IR_{0j}^{L}\right)$ must be satisfied with equality. In fact, if we assume the opposite, the borrower can add a small and equal amount both to B_{0j}^{S0} and B_{0j}^{F0} leaving $\left(IC_{0j}^{B}\right)$ satisfied, but increasing the expected utility. Hence we have a contradiction.

Notice that, since $\left(IR_{0j}^{L}\right)$ is binding :

$$p_H\left(B_{0j}^{S0}-B_{0j}^{F0}\right)+B_{0j}^{F0}-A=p_H\left(R^S-R^F\right)I_{0j}^{0}+R^F I_{0j}^{0}-I_{0j}^{0}$$

and substituting the previous expression in the objective function, it yields:

$$\max\ \left(p_H\Delta_{R_0}+R^F-1\right)I_{0j}^{0}$$

which implies that the borrower wishes to increase the investment, I_{0j}^{0}, as much as he can. However, according to expression (10) and constraint $\left(IC_{0j}^{B}\right)$, I_{0j}^{0} must be finite. Thus, to assure that the highest as possible value of I_{0j}^{0} is reached, also $\left(IC_{0j}^{B}\right)$ has to be binding.

Now suppose that $B_{0j}^{F0}>0$. Hence we can clearly decrease it by a small amount ∂B_{0j}^{F0} and increase B_{0j}^{S0} by another small amount ∂B_{0j}^{S0} in such a way that:

$$p_H\partial B_{0j}^{S0}+\left(1-p_H\right)\partial B_{0j}^{F0}=0$$

In this case $\left(IR_{0j}^{L}\right)$ is still satisfied, U_j^0 is unchanged but, since B_{0j}^{S0} increases while B_{0j}^{F0} decreases, $\left(IC_{0j}^{B}\right)$ is now slack, a contradiction. Hence

$$B_{0j}^{F0*}=0.$$

the lender offers to the borrower a debt contract, with the value of the debt D, satisfying $D>R^F I_{0j}^{0}$. Substituting the above result in (11) and recalling that this last inequality is satisfied with equality if $\left(IC_{0j}^{B}\right)$ and $\left(IR_{0j}^{L}\right)$ are, we obtain:

$$I_{0j}^{0*}=\frac{A}{1-\left[p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)+R^F\right]} \tag{20}$$

Finally, substituting in $\left(IC_{0j}^{B}\right)$ we obtain the equilibrium revenues of the borrower in the good state.

A.2 Proof of Remark 3

We can prove that $\left(IR_{11}^{L}\right)$ should be satisfied with equality and substituting in the objective function this implies that the borrower wishes to set I_{11}^{1} as large

as possible. If we can prove that $\left(IC_{11}^{B}\right)$ implies finite I_{11}^{1}, the proof can follow the same lines as in the previous case. Using $\left(IC_{11}^{B}\right)$ in $\left(IR_{11}^{L}\right)$ we obtain:

$$I_{11}^{1} \leq \frac{A - B_{11}^{F1} + \theta p_H}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} \tag{21}$$

The denominator of the rhs is positive because of (10). Hence I_{11}^{1} has to be finite. Since the borrower wishes to set I_{11}^{1} as large as possible, $\left(IC_{11}^{B}\right)$ cannot be slack.

Now suppose that $B_{11}^{F1} > 0$. We can reach a contradiction according to the same lines of the profit maximizing borrower. Hence $B_{11}^{F1} = 0$: again we have a debt contract. Substituting $B_{11}^{F1} = 0$ in (21) and in $\left(IC_{11}^{B}\right)$, where (21) is taken with equality since both $\left(IC_{11}^{B}\right)$ and $\left(IR_{11}^{L}\right)$ are taken with equality, we obtain:

$$\begin{aligned} B_{11}^{S1*} &= \frac{\frac{P}{\Delta_p}A}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} + \frac{p_H\Delta_{R_1} + R^F - 1}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F}\theta = \\ & B_{0j}^{S0*} + \frac{p_H\Delta_{R_1} + R^F - 1}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F}\theta \end{aligned}$$

A.3 Proof of Remark 4

If the socially responsible agent trading with an ethical bank gets more financing it can also invest more, that is, $I_{11}^{1*} \geq I_{0j}^{0*}$. The inequality holds if and only if:

$$\frac{A + \theta p_H}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} \geq \frac{A}{1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F}$$

that is:

$$\theta \geq \frac{A\left(\Delta_{R_0} - \Delta_{R_1}\right)}{1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F} = I_{0j}^{0*}\left(\Delta_{R_0} - \Delta_{R_1}\right)$$

The socially responsible entrepreneur trading with an ethical bank pays less if: $B_{11}^{S1*} > B_{0j}^{S0*}$, that is:

$$\frac{P}{\Delta_p}\frac{A + \theta p_H}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} - \theta \geq \frac{P}{\Delta_p}\frac{A}{1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F}$$

or:

$$\begin{aligned} &\frac{\theta\left(p_H\Delta_{R_1} + R^F - 1\right)}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} \geq \\ &\frac{PA}{\Delta_p}\frac{p_H\left(\Delta_{R_0} - \Delta_{R_1}\right)}{\left(1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F\right)\left(1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F\right)} \end{aligned}$$

and finally:

$$\theta\left(p_H\Delta_{R_1}+R^F-1\right)\geq\frac{P}{\Delta_p}p_H\left(\Delta_{R_0}-\Delta_{R_1}\right)I_{0j}^{0*}$$

which is equivalent to (19). It is easy to prove that

$$\frac{p_HP}{\Delta_p\left(p_H\Delta_{R_1}+R^F-1\right)}>1$$

and hence (19) implies (18).

A.4 Proof of Remark 6

Motivated borrowers prefer to trade with socially responsible lenders if, by doing so, they receive a higher expected utility than the one they would receive with standard lenders:

$$p_H\Delta_{B_{11}^*}+p_H\theta+B_{11}^{F1*}-A\geq p_H\Delta_{B_{0j}^*}+B_{0j}^{F1*}-A$$

which implies:

$$\theta\geq\Delta_{B_{0j}^*}-\Delta_{B_{11}^*}=B_{0j}^{S1*}-B_{11}^{S1*}$$

By substituting B_{0j}^{S1*} and B_{11}^{S1*} as from Remarks 1 and 3 we find:

$$\theta\geq\frac{P}{\Delta_p}\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}-\left(\frac{P}{\Delta_p}\frac{A+\theta p_H}{1-p_H\left(\Delta_{R_1}-\frac{P}{\Delta_p}\right)-R^F}-\theta\right)$$

rearranging:

$$\theta\geq\frac{A\left(\Delta_{R_0}-\Delta_{R_1}\right)}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}$$

which is exactly our condition (18).

A.5 Proof of Lemma 1

First of all, remind that the ethical banks are indifferent between financing a motivated borrower or a profit maximizer one, provided that they undertake an ethical project, other things equal. However, if an ethical bank wishes to satisfy the incentive compatibility constraint for the profit maximizer ($\Delta_{B_{10}}\geq\frac{P}{\Delta_p}I_{10}^1$ where $\Delta_{B_{10}}=B_{10}^{S1}-B_{10}^{F1}$), it cannot match the offer of the commercial bank, since standard projects have a higher expected return (see Remark 2). Hence, under the assumption of the present Lemma, if the ethical bank wishes to finance ethical projects, it needs to attract motivated agents and satisfy their incentive compatibility constraint. Under that contract, if the profit maximizer borrower

mimics the motivated one, he will misbehave. Therefore, the problem to be solved is the following:

$$\begin{array}{ll} \max\limits_{\Delta_{B_{11}},B_{11}^{F1},I_{11}^{1}} & p_H\Delta_{B_{11}}+p_H\theta+B_{11}^{F1}-A \\ s.t. & \Delta_{B_{11}}+\theta\geq\dfrac{P}{\Delta_p}I_{11}^{1} \qquad \left(IC_{11}^{B}\right) \\ & \left(p_H\Delta_{R_1}+R^F-1\right)I_{11}^{1}-p_H\Delta_{B_{11}}-B_{11}^{F1}+A\geq 0 \quad \left(IR_{11}^{L}\right) \\ & p_HB_{0j}^{S0*}\geq p_L\Delta_{B_{11}}+B_{11}^{F1}+PI_{11}^{1} \qquad \left(SS_{10}^{B}\right) \end{array} \tag{22}$$

Notice that in this program $\left(SS_{10}^{B}\right)$ must be binding, otherwise parties could reach the second-best program which is not feasible by assumption, because in the second-best contracts the profit maximizer borrower would prefer the motivated borrower's contract. Hence

$$p_HB_{0j}^{S0*}=p_L\Delta_{B_{11}}+B_{11}^{F1}+PI_{11}^{1}$$

That is:

$$p_H\Delta_{B_{11}}+B_{11}^{F1}=p_HB_{0j}^{S0*}+\Delta_p\Delta_{B_{11}}-PI_{11}^{1}$$

Let us make the working assumption that the optimal contract is a debt contract, that is: $B_{11}^{F1}=0$. We first characterize the optimal debt contract. Then we prove that no other contract can do better than the optimal debt one. Notice that the three constraints in Program 2 can be written as:

$$\begin{array}{cc} I_{11}^{1}\leq\dfrac{\Delta_p}{P}\Delta_{B_{11}}+\dfrac{\Delta_p}{P}\theta & \left(IC_{11}^{B}\right) \\ I_{11}^{1}\geq\dfrac{p_H\Delta_{B_{11}}-A}{\left(p_H\Delta_{R_1}+R^F-1\right)} & \left(IR_{11}^{L}\right) \\ I_{11}^{1}\leq\dfrac{p_H}{P}B_{0j}^{S0*}-\dfrac{p_L}{P}\Delta_{B_{11}} & \left(SS_{10}^{B}\right) \end{array}$$

In the space $\left(\Delta_{B_{11}},I_{11}^{1}\right)$ the boundary of the sets are straight lines. That of $\left(SS_{10}^{B}\right)$ is negatively sloped while those of the other two are positively sloped. Suppose now that $\left(IC_{11}^{B}\right)$ is binding and hence holds with equality. Then substituting $\left(IC_{11}^{B}\right)$ into $\left(SS_{10}^{B}\right)$ (which is binding) we obtain:

$$p_HB_{0j}^{S0*}=p_L\left(\frac{P}{\Delta_p}I_{11}^{1}-\theta\right)+PI_{11}^{1}=\left(\frac{p_L}{\Delta_p}+1\right)PI_{11}^{1}-p_L\theta=\frac{p_H}{\Delta_p}PI_{11}^{1}-p_L\theta$$

that is:

$$I_{11}^{1}=\frac{\Delta_p}{P}B_{0j}^{S0*}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\theta=$$

$$\frac{\Delta_p}{P}\frac{P}{\Delta_p}\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\theta=$$

$$\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\theta$$

and substituting back into $\left(IC_{11}^{B}\right)$ we have the motivated borrower income:

$$\begin{aligned}\Delta_{B_{11}} &= \frac{P}{\Delta_p}\left(\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\theta\right)-\theta \\ &= \frac{P}{\Delta_p}\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}-\frac{\Delta_p}{p_H}\theta\end{aligned}$$

We now check if the participation constraint of the lender is satisfied. If we substitute our result into $\left(IR_{11}^{L}\right)$ we obtain:

$$\left(p_H\Delta_{R_1}+R^F-1\right)I_{11}^{1}-p_H\Delta_{B_{11}}+A=$$

$$\left(p_H\Delta_{B_{11}}+R^F-1\right)\left(\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\theta\right)-$$

$$p_H\left(\frac{P}{\Delta_p}\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}-\frac{\Delta_p}{p_H}\theta\right)+A=$$

$$-p_H\frac{\Delta_{R_0}-\Delta_{R_1}}{1+\frac{P}{\Delta_p}p_H-R^F-p_H\Delta_{R_0}}A+\left(p_H\Delta_{R_1}+R^F-1\right)\frac{\Delta_p}{P}\frac{p_L}{p_H}\theta+\Delta_p\theta\geq 0$$

or:

$$\left(p_H\Delta_{R_1}+R^F-1\right)\frac{\Delta_p}{P}\frac{p_L}{p_H}\theta+\Delta_p\theta\geq Ap_H\frac{\Delta_{R_0}-\Delta_{R_1}}{1+\frac{P}{\Delta_p}p_H-R^F-p_H\Delta_{R_0}}$$

Recall that, from inequality (19), we are considering the following set of parameter values:

$$\theta\geq\frac{p_HP}{\Delta_p}\frac{\left(\Delta_{R_0}-\Delta_{R_1}\right)I_{0j}^{0*}}{p_H\Delta_{R_1}+R^F-1}=\frac{p_HP}{\Delta_p}\frac{\left(\Delta_{R_0}-\Delta_{R_1}\right)}{p_H\Delta_{R_1}+R^F-1}\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}$$

Hence the participation constraint is surely satisfied if:

$$\left(p_H\Delta_{R_1}+R^F-1\right)\frac{\Delta_p}{P}\frac{p_L}{p_H}\frac{p_HP}{\Delta_p}\frac{\left(\Delta_{R_0}-\Delta_{R_1}\right)}{p_H\Delta_{R_1}+R^F-1}\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}+$$

$$p_HP\frac{\left(\Delta_{R_0}-\Delta_{R_1}\right)}{p_H\Delta_{R_1}+R^F-1}\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}\geq$$

$$Ap_H\frac{\Delta_{R_0}-\Delta_{R_1}}{1+\frac{P}{\Delta_p}p_H-R^F-p_H\Delta_{R_0}}$$

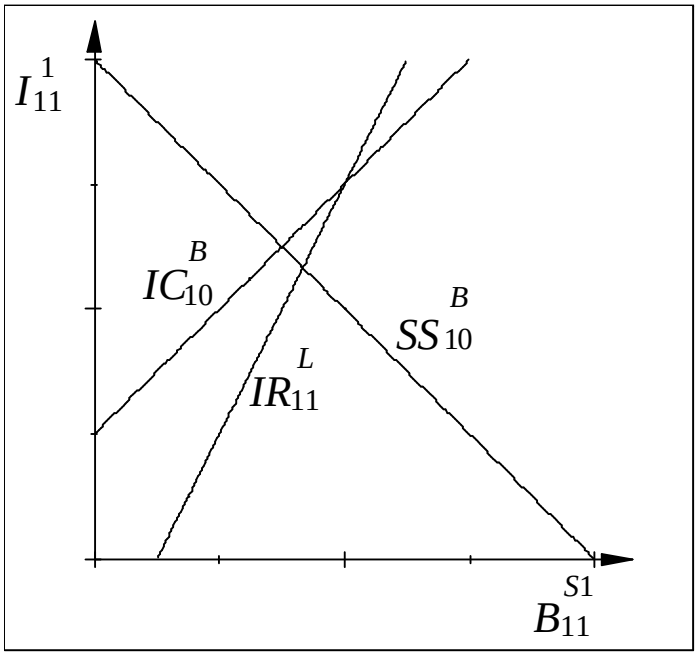
which boils down into

$$\frac{p_HP}{p_H\Delta_{R_1}+R^F-1}\geq p_H-p_L=\Delta_p$$

or

$$p_H \frac{P}{\Delta_p} - \left(p_H \Delta_{R_1} + R^F - 1\right) = 1 + \frac{P}{\Delta_p} p_H - R^F - p_H \Delta_{R_1} \geq 0$$

which is certainly satisfied for (13). Hence the participation constraint of the lender is satisfied. This implies that the two constraints, $\left(IR_{11}^L\right)$ and $\left(IC_{11}^B\right)$, are compatible with each other. That is, $\left(IR_{11}^L\right)$ (taken with equality) crosses $\left(SS_{10}^B\right)$ at a lower investment level, I_{11}^1, and (more importantly) at a bigger borrower's revenue, $\Delta_{B_{11}}$, with respect to $\left(IC_{11}^B\right)$ (again taken with equality). This means that the former is characterized for the highest $\Delta_{B_{11}}$, which is also B_{11}^{S1}, since $B_{11}^{F1} = 0$, in the intersection of all constraints. This implies that in the same point the expected utility of the borrower is the highest, as can be checked in the figure, considering that the relevant area is inside the three constraints.



Third-best program.

The point where $\left(IR_{11}^L\right)$ crosses $\left(SS_{10}^B\right)$ is characterized by the system

$$\begin{bmatrix} \left(p_H \Delta_{R_1} + R^F - 1\right) & -p_H \\ B & p_L \end{bmatrix} \begin{bmatrix} I_{11}^1 \\ \Delta_{B_{11}} \end{bmatrix} = \begin{bmatrix} -A \\ p_H B_{0j}^{S0*} \end{bmatrix}$$

with solutions:

$$\begin{aligned} I_{11}^1 &= \frac{p_H^2 B_{0j}^{S0*} - p_L A}{p_L \left(p_H \Delta_{R_1} + R^F - 1\right) + p_H P} \\ \Delta_{B_{11}} &= \frac{\left(p_H \Delta_{R_1} + R^F - 1\right) p_H B_{0j}^{S0*} + AP}{p_L \left(p_H \Delta_{R_1} + R^F - 1\right) + p_H P} \end{aligned}$$

This is the optimal debt contract. Now we will prove that this is the best overall contract. Let us take the system $\left(IR_{11}^{L}\right)$ and $\left(SS_{10}^{B}\right)$ with equality and let us differentiate it with respect to B_{11}^{F1}, we find the following system:

$$\left[\begin{array}{cc} \left(p_H\Delta_{R_1}+R^F-1\right) & -p_H \\ B & p_L \end{array}\right] d\left[\begin{array}{c} I_{11}^{1} \\ \Delta_{B_{11}} \end{array}\right] = \left[\begin{array}{c} 1 \\ -1 \end{array}\right] dB_{11}^{F1}$$

which implies that:

$$\frac{\partial \Delta_{B_{11}}}{\partial B_{11}^{F1}} = -\frac{P+p_H\Delta_{R_1}+R^F-1}{\left(p_H\Delta_{R_1}+R^F-1\right)p_L+Pp_H}$$

Hence the expected utility varies with dB_{11}^{F1} at the rate:

$$\frac{d}{dR_{b1}^{F}}\left(p_H\Delta_{R_{b1}}+R_{b1}^{F}\right) = -\frac{\Delta_p\left(p_H\Delta_{R_1}+R^F-1\right)}{\left(p_H\Delta_{R_1}+R^F-1\right)p_L+p_HB} < 0$$

Hence the best contract when $\left(SS_{10}^{B}\right)$ and $\left(IR_{11}^{L}\right)$ are binding is just a debt contract, that is with $B_{11}^{F1}=0$.

If we assume instead that $\left(SS_{10}^{B}\right)$ and $\left(IC_{11}^{B}\right)$ are binding, we can solve $\left(IC_{11}^{B}\right)$ for I_{11}^{1} and obtain:

$$I_{11}^{1} = \frac{\Delta_p}{P}\Delta_{B_{11}} + \frac{\Delta_p}{P}\theta$$

and substituting into $\left(SS_{10}^{B}\right)$:

$$p_H\Delta_{B_{11}} + B_{11}^{F1} = p_HB_{0j}^{S0*} - \Delta_p\theta$$

Hence the expected utility of the borrower is constant even if we let B_{11}^{F1} to vary. However we already proved that for $B_{11}^{F1}=0$ the dominating allocation is that where $\left(IR_{11}^{L}\right)$ and $\left(SS_{10}^{B}\right)$ are binding, and that the latter is also the optimal contract. Therefore the best contract for this program is $B_{11}^{F1}=0$ and:

$$B_{11}^{S1**} = \frac{\left(p_H\Delta_{R_1}+R^F-1\right)p_HB_{0j}^{S0*}+AP}{p_L\left(p_H\Delta_{R_1}+R^F-1\right)+p_HP}$$

Substituting the value of B_{0j}^{S0*} we obtain:

$$\begin{aligned} B_{11}^{S1**} &= \frac{p_L\left(p_H\Delta_{R_1}+R^F-1\right)+p_HP-\Delta_pp_H\left(\Delta_{R_0}-\Delta_{R_1}\right)}{p_L\left(p_H\Delta_{R_1}+R^F-1\right)+p_HP} \cdot \\ &\quad \frac{P}{\Delta_p}\frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F} \end{aligned}$$

while the investment is:

$$I_{11}^{1**} = \frac{p_H^2B_{0j}^{S0*}-p_LA}{p_L\left(p_H\Delta_{R_1}+R^F-1\right)+p_HP}$$

and substituting the value of B_{0j}^{S0*} we obtain:

$$I_{11}^{1**} = \frac{p_L\left(p_H\Delta_{R_1}+R^F-1\right)+p_HP+p_Lp_H\left(\Delta_{R_0}-\Delta_{R_1}\right)}{p_L\left(p_H\Delta_{R_1}+R^F-1\right)+p_HP} \cdot \frac{A}{1-p_H\left(\Delta_{R_0}-\frac{P}{\Delta_p}\right)-R^F}$$

Note that B_{11}^{S1**} and I_{11}^{1**} do not depend on θ and, by comparison with expressions in Remark 1, they are such that $B_{11}^{S1**} < B_{0j}^{S0*}$ and $I_{11}^{1**} > I_{00}^{0*}$.

Moreover, since when condition (19) holds the contracts are such that $B_{11}^{S1*} > B_{0j}^{S0*}$ (see Proposition 1), we have that $B_{11}^{S1*} > B_{0j}^{S0*} > B_{11}^{S1**}$. We showed before that the third-best debt contract is at the intersection between $\left(SS_{10}^{B}\right)$ and $\left(IR_{11}^{L}\right)$. The second-best contract is instead at the intersection between $\left(IC_{11}^{B}\right)$ and, again, $\left(IR_{11}^{L}\right)$. Moreover, we just proved that $\left(SS_{10}^{B}\right)$ crosses $\left(IR_{11}^{L}\right)$ at a lower I_{11}^{1**} than $\left(IC_{11}^{B}\right)$. Since $\left(IR_{11}^{L}\right)$ is positively sloped, it must also be true that the level of investment in the third best is lower than in the second best, $I_{11}^{1**} < I_{11}^{1*}$ (see the figure).