Credit Markets with Ethical Banks and Motivated Borrowers*

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Abstract

We investigate banks' corporate social responsibility. Banks offer loans to standard and motivated borrowers in the credit market and can finance both standard and ethical projects. Standard banks loan both kinds of projects. Ethical banks commit to financing only ethical projects, which have social profitability but lower expected revenues. Motivated borrowers are keen to invest in ethical projects and to deal with ethical banks. Conditions for existence and social efficiency of ethical banks are stated. Efficiency is mainly induced by the "ethical collateral" provided by motivated borrowers to ethical banks. Model predictions are consistent with available data on ethical banks.

Jel classification: D86, G21, G30.

Key-words: corporate social responsibility, ethical projects, ethical banks, motivated borrowers, ethical collateral.

1 Introduction

According to the standard *shareholder-value approach* firms are controlled by profit-maximizing shareholders and the firms' interaction with other stakeholders 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: the recently updated OECD Guidelines for

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Multinational Enterprises, and the United Nations Guiding Principles on Business and Human Rights are internationally recognized principles. The Green Paper "Promoting a European framework for Corporate Social Responsibility" was prepared by the Commission of the European Communities in 2001 and the new document "A renewed EU strategy for Corporate Social Responsibility" was published in 2011.

CSR has been interpreted as a response to market and redistributive failures alternative to government intervention. Following Bénabou 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, investors are obviously crucial stakeholders: socially responsible investors provide savings 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[2] and ShoreBank[3] 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 Netherlands, 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).

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

[2] Eastern Bank Corp. has agreed to buy Wainwright Bank & Trust Co. in 2010. Since its founding in 1987, Wainwright's mission has been to invest in "socially responsible development projects," including ones related to the environment, affordable housing, AIDS, homeless shelters, and immigration. (See "Eastern Bank to buy Wainwright" - The Boston Globe, June 30, 2010)

[3] ShoreBank was founded in 1973 to prove that money could be lent profitably to poor people in poor neighborhoods, an 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).

Also borrowers, when accomplishing ethical projects, can promote social values. Motivated borrowers may invest in projects providing services to individuals (for example services to persons with disabilities or rehabilitation services), culture and education diffusion, may invest in projects promoting the environment as well as art fruition and protection, access to work, protection and enhancement of minorities, local and community development and so forth.

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.

While the literature on microcredit in developing countries is already sizeable (e.g., Stiglitz 1990, Besley and Coate 1995, Ghatak 1999 and the large amount of empirical works which followed); in high-income countries little consideration is still given to ethics in finance in general and to ethics in banking in particular. 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 bank good management, because ethical banks distribute benefits amongst stockholders only to a limited extent. Only recently, few empirical works focusing on ethical banks appeared (Becchetti et al. 2011, Becchetti and Garcia 2011, Cornée and Szafarz 2012); we will discuss them in Section 5 together with other empirical papers only indirectly related to our work. However we can shortly anticipate the main findings. First, and surprisingly, some ethical banks authorize loans of bigger dimension than commercial banks. Second, ethical banks typically charge a lower interest rate than the one prevailing in the market. Third, ethical banks typically require a lower collateral. Finally, borrowers financed by ethical banks have a lower default rate. We will argue that those documented facts are consistent with the predictions of the model.

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 other when they compete in a credit market where also standard lenders and standard borrowers do operate.

In the model, ethical projects are those providing both social[4] and economic

[4]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 website

advantages, but which deliver lower expected revenue with respect to standard ones. Different from standard banks, socially responsible lenders commit to investing in ethical projects.[5] Becchetti et al. (2011), using microdata on individual contracts, provide a very accurate description of the structure of Banca Popolare Etica (the main Italian ethical bank), its mission, the characteristics of its borrowers and, more interesting, its specific loan behaviors, which is consistent with our assumptions as argued in Section 2.

In our model, two types of borrowers exist in the market: standard entrepreneurs and socially motivated ones. The latter obtain a non-monetary premium for social responsibility when they can undertake an ethical project. This premium is higher if the project is financed by an ethical bank and the project is successful. We call this additional premium "premium for successful interaction". Given our assumptions, in equilibrium, 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. Standard borrowers, instead, always prefer to invest in standard projects with standard banks.

Both project types are subject to moral hazard: motivated and standard entrepreneurs can behave or misbehave (see Tirole 2006). As mentioned before, motivated borrowers trading with ethical banks gain the premium for successful interaction when the project is successful. The premium for successful interaction relaxes the motivated borrowers' incentive constraint thus helping increasing efficiency.

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).

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 successful interaction received by motivated borrowers trading with ethical banks in the case the project succeeds.

We first show that only socially motivated borrowers potentially engage in ethical projects. If they do not, then ethical banks cannot operate and the market for ethical projects does not exist. If, instead, motivated borrowers undertake ethical projects, then ethical banks are active and the market is fully segmented. That is, standard agents trade among themselves in the market for standard projects while ethical banks trade with motivated borrowers in the market for ethical projects. This occurs, whatever the information structure considered, when the premium for successful interaction is high enough (and/or the difference between the two projects' profitability is not too large). For larger values of the successful interaction premium, not only ethical banks are

http://www.co-operativebank.co.uk, consulted in November 2011)

[5] As an example of commitment to ethical projects, on the web site of Charity Bank (UK) one 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)

active but they even provide a higher funding to motivated borrowers than what received by standard ones from standard banks, in any considered information structure. Finally, in second-best when the premium further increases, ethical banks guarantee a larger revenue to motivated borrowers than what standard borrowers can obtain. For these parameter values and if the borrowers' type is not observable, standard borrowers would like to mimic motivated ones in order to obtain the better contract conditions. As a consequence, in third-best, for high values of the premium for successful interaction, self selection requires that motivated borrowers are worse off with respect to the second-best, while standard borrowers receive the second best contract.[6]

In short, perfect segmentation of the credit market always raises the overall efficiency and the welfare improvement is increasing in the premium for successful interactions. In particular, when the premium for successful interaction is high enough so that ethical banks are active, increased efficiency is driven by the overall premium for social responsibility that raises the welfare of motivated borrowers undertaking ethical projects beyond the simple expected profit. If the premium for successful interaction is higher, then a second efficiency gain must be considered together with the previous one, since motivated entrepreneurs also benefit from a larger borrowing capacity. Finally, if the premium for successful interaction is even larger and the borrowers' type is observable, then there is a last (and probably more interesting) efficiency gain, since the socially responsible lenders and the motivated borrowers solve the moral hazard problem in a more efficient way when are matched together than otherwise.

Our paper shares some similarities with Besley and Ghatack (2007) who interpret CSR as the private provision of a public good in the product market. In particular, the idea of motivated and standard borrowers operating in the credit market is close to that of "caring" and "neutral" consumers coexisting in the product market, where caring consumers are those who evaluate the public good. Moreover, borrowers self-selecting either in the market for ethical projects or in that for standard ones recall consumers choosing, in equilibrium, either ethical brands or neutral ones. In both papers, CSR of banks in the credit market and of firms in the product market is interpreted as a form of "delegated philanthropy" and, competition leads banks' and firms' profits to zero at the equilibrium. However, an important difference with respect to Besley and Ghatack (2007) is that they solve a model with full information, whereas we consider asymmetric information, which is a crucial issue in the credit market.

Finally, 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 on the borrowers' type as well. As a consequence the first part of our paper investigates a situation similar to the one analyzed by Besley and Ghatack (2005) and referring to a two sectors market, while the second one considers an extension

[6] In a slightly more general version of the paper we also prove that the optimal contract is a debt one. See Barigozzi and Tedeschi (2012).

to the case of asymmetric information on the borrowers' 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 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. Section 5 discusses the few empirical works related to ethical banks' behaviors. Finally, Section 6 concludes.

2 The Model Set-up

The model borrows from Tirole (2006). We consider a credit market with a large number of both risk neutral borrowers (she) and banks (it). We assume zero risk free interest rate and an infinitely elastic supply of funds in the deposit market.

Borrowers have to undertake a project which needs an investment. Each borrower can apply for at most one loan 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" or standard. The difference between the two projects will be specified below. The borrower owns an asset A, with $A < I^k$. In words, the borrowers have not enough capital and/or collateral whichever 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.[7]

If the project is undertaken it generates a cash flow per unit of investment $R^k \in \left\{R^{Sk}, R^{Xk}\right\}$, with $R^{Sk} > R^{Fk} = 0$, where R^{Sk} is the cash flow per unit of investment in case of success, and R^{Fk} in case of failure.[8]

Ethical projects represent all projects leading to *social benefits*, beyond profits (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 by assuming that standard projects have a higher return in case of success, that is: $R^{S0} \geq R^{S1} > 0$. The two types of projects are perfectly observable and have independent distributions. Finally, and considering both projects types, the total cash flow is $R^{Xk} \cdot I^k \geq 0$, with $X \in \{F, S\}$.

To summarize, in the credit market two sectors exist: the market for ethical

[7] See Sections 5 and 6 for a short discussion on the implications of the alternative assumption that different collateral is asked to different borrowers types.

[8] In a previous version of the model we assumed a positive revenue also in case of failure. We proved that borrowers would not get any income in case of failure, i.e., that the optimal contract is a debt one. All other insights are preserved with this simplifying assumption.

projects and the market for standard ones. The latter assures higher expected returns to investors.

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 $\Delta_p \equiv p_H - p_L$. An entrepreneur who misbehaves 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} are respectively the income of a lender of type i and that of a borrower of type j when trading with each other, if 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:

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

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

When investing in ethical projects, motivated borrowers receive a premium for social responsibility, a non pecuniary benefit with monetary value θ_{ij}^{Xk}. Or, in line with Besley and Ghatack (2007)'s interpretation of ethical and neutral consumers, motivated borrowers "care" for the social benefit produced by ethical projects, whereas standard borrowers do not.

Thus, the premium depends on the type of project and on the type of lender in the following way:

$$\begin{aligned} \theta_{ij}^{X0} &= 0, \forall X \in \{F,S\} \\ \theta_{01}^{X1} &= \theta, \ \forall X \in \{F,S\} \\ \theta_{11}^{S1} &= \theta^S > \theta_{11}^{F1} = \theta \end{aligned}$$

In words, the premium for social responsibility is positive only if a motivated borrower undertakes an ethical project. In particular, $\theta_{01}^{X1} = \theta$ is the premium when a motivated borrower undertakes an ethical project interacting with a standard bank, whatever the project's outcome. Whereas, when the motivated

borrower contracts with an ethical bank, the premium is higher in the case of success than in the case of failure: $\theta_{11}^{S1} = \theta^S > \theta_{11}^{F1} = \theta$. 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, given its commitment to investing in ethical projects. We define $\Delta_\theta = \theta^S - \theta$, the premium for successful interaction, that is, the additional premium of social responsibility accrued to a motivated agent when she accomplishes an ethical project which was financed by an ethical bank.[9]

In practice, the motivated borrower always obtains the premium when undertaking an ethical project but, once the loan contract has been signed, she has more willingness to repay the debt to a socially responsible lender. Our assumption is in line with Besley and Ghatack's idea of good matching between agents sharing the same mission.

Note that motivated borrowers prefer to undertake ethical projects as long as their profitability is not too low with respect to standard ones. In that case the total premium for social responsibility $\theta + \Delta_\theta$ can eventually compensate the difference in profitability between the two project types**,** as we will show below. In our formulation, the motivated borrower behaves as a standard one, if the gains in profits are sufficiently high. This is in line with the behavioral 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 that assures them the highest expected revenue, whatever the type of project involved.

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

$$p_H L_{0j}^{Sk} + (1 - p_H) L_{0j}^{Fk} - I_{0j}^k + A \tag{2}$$

In principle, standard lenders can invest both in ethical and in standard projects. In equilibrium, however, we will show that standard banks invest only in standard projects. In fact, standard borrowers prefer to undertake standard projects given the latter's higher expected revenue. Moreover, when undertaking ethical projects, and all else equal, motivated borrowers prefer to trade with ethical banks because of the premium for successful interaction Δ_θ.

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 savings to ethical

[9] As it will be probably clear after we presented our main propositions, our results are robust to the generalization $\theta_{01}^{S1} > \theta_{01}^{F1} = \theta_{11}^{F1}$, provided that $\theta_{11}^{S1} > \theta_{01}^{S1}$. In words: the motivated borrower receives an additional premium for successful interaction when she trades with a standard lender as well, provided that such a premium is lower than the one she receives when successfully trading with an ethical bank.

This assumption would capture an additional premium for the success of the ethical project, whatever the bank financing it. However we require that the premium for successful interaction depends on the type of lender in such a way that $\theta_{11}^{S1} > \theta_{01}^{S1}$. In fact, since ethical banks are committed to investing in ethical projects, a successful ethical project financed by an ethical lender necessarily implies that new social projects will be financed in the future. Whereas a successful ethical project financed by a standard bank does not.

banks and want the corporation to use their saving to finance social responsible projects.

As documented by Becchetti et al. (2011, page 1220 and 1241), although ethical banks pursue different goals from those of commercial banks, they exhibit very similar behaviours in terms of credit rationing and attitude toward risk projects. For this reason we assume that ethical banks maximize expected profit as standard lenders but, differently from them, commit in investing only in ethical projects:

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

Nothing would change assuming that ethical banks maximize the total revenue from ethical projects[10].

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

2.1 Information Structures

We will consider two versions of the model. In both versions the project type is common knowledge and borrowers have private information on their behavior (which may or may not increase the probability of success of the project).[11]

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

Thereafter we relax the assumption that the agents' types are common knowledge and we capture the situation called "strategic corporate social responsibility" (see Baron 2001) where a firm can pretend to be socially responsible only to strengthen its market position. In our setting, standard borrowers may be interested in receiving the contract designed for motivated borrowers since, under some conditions, such a contract is preferred to the one designed for standard borrowers.

The case of moral hazard and adverse selection on the borrowers' side refers to the empirically relevant situation where lenders are banks that built up a reputation or can set up credible commitment devices in their statute, while borrowers are start-ups, new firms without reputation. We call the solution of this model third-best and we characterize the optimal contracts in Section 4.[12]

[10] That was just our assumption in a previous version of the paper. The maximization of *total revenue* from ethical projects, would be in analogy with Blinder (1993)'s assumption for stakeholder-oriented manufacturing firms.

[11] 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. 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.

[12] In a previous version of the model, we also considered the situation where standard banks

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:

$$p_H R^S > 1 \tag{4}$$
$$p_L R^S + P < 1 \tag{5}$$

therefore the net present value of both projects (ethical and non-ethical) is positive if the borrower behaves and negative otherwise. Hence, if it is not possible to take care of the moral hazard problem the investment, in both standard and ethical projects, 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:

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

Rearranging:

$$p_H R^S I_{ij} - I_{ij} - B^F_{ij} + A \geq p_H \Delta_{B_{ij}}, \tag{7}$$

where $\Delta_{B_{ij}} = B^S_{ij} - B^F_{ij}$, which is the difference in the borrower's revenue in case of success and failure, for given contract.

3 Loan Agreements under Moral Hazard

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

Remember that motivated borrowers will undertake ethical projects and eventually 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. Moreover, ethical banks will finance only ethical projects, in principle, to both kinds of investor. Instead, commercial banks will potentially finance both kind of projects.

In this section we will characterize the market structure showing which kind of project is financed by each type of lender and find conditions for full segmentation. To do so we will derive optimal contracts that obviously depend on the kind of project and on the types of the agents.

We assume Bertrand competition among lenders so that banks' profits are zero at the equilibrium and borrowers consequently keep all the surplus from loan agreements. This is equivalent to endowing the borrowers with all the

may desire to attract motivated borrowers by pretending to be socially responsible. This has meaning when lenders cannot observe the borrowers' behavior but have private information on their own corporate social responsibility. Such a case turns out to be quite trivial because of the zero profit condition for lenders implying that the second-best allocation is always implemented.

bargaining power and having them propose the contract to lenders. Following this interpretation, first borrowers offer contracts, then lenders can accept or refuse the borrower's proposal. Subsequently, the borrower decides whether to behave or to misbehave and, finally, uncertainty concerning the project is solved and the contract is implemented. Given the time structure, the optimal contract maximizes the representative borrower's utility under the borrower's incentive compatibility constraint $\left(IC_{ij}^{Bk}\right)$ and the lenders' participation constraint $\left(IR_{ij}^{Lk}\right)$.

To characterize the credit market structure under pure moral hazard we first derive all optimal contracts possibly signed by standard borrowers in Section 3.1; then all optimal contracts possibly signed by motivated ones in Section 3.2. Finally in Section 3.3, for both borrowers' types we identify the preferred contract and we find out the equilibrium arising in the market for standard projects and in the one for ethical projects respectively.

More in details, we proceed in the following way: (i) in Subsection 3.1.1, we find out the optimal contract signed by standard borrowers when contracting standard projects with standard lenders. (ii) In Subsection 3.1.2, we characterize the optimal contract signed by standard borrowers when investing in ethical projects (which is the same whatever the type of the bank) and we conclude that standard borrowers always prefer to undertake standard projects (with standard lenders). (iii) We observe that motivated borrowers, when they invest in standard projects with standard banks, receive the very same contract as standard borrowers do (see Subsection 3.2.1). (iv) We characterize the contract signed by motivated borrowers when investing in ethical projects with standard lenders and with ethical banks respectively, and we observe that the latter contract is necessarily dominating the former one (see Subsection 3.2.2).

From the previously described facts we just learn the following: *standard borrowers always sign a contract with a standard bank for a standard project, whereas motivated borrowers can either sign the very same contract or they can invest in an ethical project with an ethical bank.* Thus, the market structure arising at the equilibrium depends on the motivated borrowers' choice between investing in a standard project with a standard bank or in an ethical one with an ethical bank. (v) To find out the motivated borrowers' preferred choice we compare their profits under the two previous contracts and we show that motivated borrowers are willing to trade with ethical banks only when the premium for successful interaction 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 exists and thus ethical banks can operate.

3.1 Standard Borrowers

We now describe optimal contracts for standard borrowers when they invest in standard and in ethical projects respectively.

3.1.1 Standard Borrowers Undertaking Standard Projects

When borrowers undertake a standard project, they will trade with a standard bank. The contract is denoted by $(B_{00}^{S0}, B_{00}^{F0}, I_{00}^{0})$. We recall that the subscript 00 indicates a contract between standard borrowers and standard banks and the superscript 0 means that the borrowers invest in standard projects. The incentive compatibility constraint which induces borrowers to behave is standard (see Tirole 2006, p 116) and equal to:

$$\Delta_{B_{00}^{0}} \geq \frac{PI_{00}^{0}}{\Delta_p} \qquad (IC_{00}^{B0})$$

where $\Delta_{B_{00}^{0}} = B_{00}^{S0} - B_{00}^{F0}$. Lender's participation constraint can be derived from inequality (7) and is:

$$\left(p_H R^{S0} - 1\right) I_{00}^{0} - p_H \Delta_{B_{00}^{0}} - B_{00}^{F0} + A \geq 0 \qquad (IR_{00}^{L0})$$

The standard borrower's program is presented in the Appendix 7.1 (see program 17). It corresponds to the maximization of the borrower's expected utility under her own incentive compatibility constraint (IC_{00}^{B0}) and under the participation constraint of the lender (IR_{00}^{L0}). The solution of the program is described in the following:

Lemma 1 *The optimal contract for standard borrowers undertaking a standard project financed by a standard lender under moral-hazard is* $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ *such that:*

$$\begin{aligned} I_{00}^{0*} &= \frac{A}{1 - p_H\left(R^{S1} - \frac{P}{\Delta_p}\right)} \\ B_{00}^{S0*} &= \frac{P}{\Delta_p}\frac{A}{1 - p_H\left(R^{S1} - \frac{P}{\Delta_p}\right)} = \frac{PI_{00}^{0*}}{\Delta_p} \\ B_{00}^{F0*} &= 0. \end{aligned} \qquad (8)$$

Proof. See the Appendix 7.1. ■

In Subsection 3.2.1 we will observe that the contract $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ is also offered to motivated borrowers trading with standard banks.

The implications of Lemma 1 are the usual ones in these kinds of models. From (8), firms' borrowing capacity I_{00}^{0*} is increasing in the entrepreneur's tangible assets A, i.e. the higher is A, the lower is credit rationing. Borrowing capacity I_{00}^{0*} is also decreasing in agency costs (private benefit, P, or inverse likelihood ratio, $\frac{p_H}{\Delta_p}$). The fact that $B_{00}^{F0*} = 0$, instead, is the way to provide the borrower with the highest incentives, which is the well known Jensen and Meckling (1976) result.

3.1.2 Standard Borrowers Undertaking Ethical Projects

The standard borrower can undertake an ethical project either with an ethical or with a standard bank. In the two cases the problem to be solved is identical and the contract is denoted by $(B_{i0}^{S1}, B_{i0}^{F1}, I_{i0}^{1})$, where the subscript $i0$ means that we are considering standard borrowers indifferently trading with either a standard or an ethical bank and the superscript 1 means that the borrowers invest in ethical projects.

The program here is identical to that of the previous section, except for the fact that the expected revenue of the ethical project is lower than that of the standard one ($p_H R^{S1} < p_H R^{S0}$). Thus, we can easily prove that the optimal contract for a standard borrower undertaking an ethical project has the same structure than $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ as presented in Lemma 1, but lower expected revenue in the case of success, $B_{i0}^{S1*} < B_{00}^{S0*}$, and lower borrowing capacity, $I_{i0}^{1*} < I_{00}^{0*}$.[13]

The standard borrower obviously makes higher profits with a standard project than with an ethical one and therefore will always prefer the former to the latter. This implies that standard borrowers will always perform standard projects financed by standard lenders.

Lemma 2 *Standard borrowers under pure moral hazard:*

- *when undertaking an ethical project, standard borrowers are indifferent between contracting with a standard bank and contracting with an ethical one since they receive the same contract* $(B_{i0}^{S1*}, B_{i0}^{F1*}, I_{i0}^{1*})$.
- *Standard borrowers always prefer to undertake standard projects with standard banks. At the second-best equilibrium they will therefore sign the contract* $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ *characterized in Lemma 1 above.*

We now are going to describe all optimal contracts potentially signed by motivated borrowers.

3.2 Motivated Borrowers

We just saw that two different contracts are potentially available to standard borrowers: the one signed in the case of standard projects $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ and the one in the case of ethical projects $(B_{i0}^{S1*}, B_{i0}^{F1*}, I_{i0}^{1*})$, where the latter is independent of the type of the bank. Motivated borrowers, instead, can potentially sign *three* different contracts: two contracts with standard lenders, in the case of standard $(B_{01}^{S0*}, B_{01}^{F0*}, I_{01}^{0*})$ and ethical projects $(B_{01}^{S1*}, B_{01}^{F1*}, I_{01}^{1*})$ respectively, and a contract with ethical banks $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$. Importantly, we will show that motivated borrowers undertaking ethical projects receive a different contract when trading with standard banks and when trading with ethical ones: $(B_{01}^{S1*}, B_{01}^{F1*}, I_{01}^{1*}) \neq (B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$. This depends on the

[13] To derive the optimal contract $(B_{i0}^{S1}, B_{i0}^{F1}, I_{i0}^{1})$ we assume that inequalities (15) and (16) holds for ethical projects as well.

additional premium for successful interactions that arises when agents aware of social issues trade together.

3.2.1 Motivated Borrowers Undertaking Standard Projects

Remember that, when investing in standard projects, motivated borrowers are equivalent to standard ones. This implies that motivated borrowers undertaking standard projects with standard banks receive the same contract as standard borrowers. We denote this contract as $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$, where the subscript $0j$ means that we are considering standard lenders indifferently trading with either a standard or a motivated borrower.

Lemma 3 *The optimal contract for both motivated and standard borrowers undertaking a standard project financed by a standard lender under moral-hazard is:*

$$(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}) = (B_{01}^{S0*}, B_{01}^{F0*}, I_{01}^{0*}) = (B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*}) \tag{9}$$

where $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ *is defined in Lemma 1 above.*

Proof. The proof is the same as in Appendix 7.1. ■

3.2.2 Motivated Borrowers Undertaking Ethical Projects

We first consider the optimal contract signed by motivated borrowers undertaking ethical projects financed by *standard banks*. Remind that, in this case, the premium for social responsibility is $\theta_{01}^{S1} = \theta_{01}^{F1} = \theta$. Interestingly, we will show that standard banks offer the same contract to both types of borrowers, despite the fact that the premium θ, accruing motivated borrowers investing in ethical projects, becomes active in this case.

The contract between a motivated borrower and a standard bank when undertaking an ethical project is denoted by $(B_{01}^{S1}, B_{01}^{F1}, I_{01}^{1})$. It can be easily verified that, in this case, the borrowers' incentive compatibility constraint is the standard one:

$$\Delta_{B_{01}^{1}} \geq \frac{PI_{01}^{1}}{\Delta_p} \tag{IC_{01}^{B1}}$$

where $\Delta_{B_{01}^{1}} = B_{01}^{S1} - B_{01}^{F1}$. Note that, since the premium θ has no impact on the incentive compatibility constraint of the motivated borrower, (IC_{01}^{B1}) is similar to constraint (IC_{00}^{B0}) before. We can state:

Remark 1 *The premium for social responsibility* θ *affects the payoff of the motivated borrower but not the contract that she signs with the standard bank; thus, in the case of ethical projects, standard lenders offer the same contract to both types of borrowers, or* $(B_{00}^{S1*}, B_{00}^{F1*}, I_{00}^{1*}) = (B_{01}^{S1*}, B_{01}^{F1*}, I_{01}^{1*}) = (B_{0j}^{S1*}, B_{0j}^{F1*}, I_{0j}^{1*})$.[14]

[14] The procedure to characterize contract $(B_{0j}^{S1*}, B_{0j}^{F1*}, I_{0j}^{1*})$ is equivalent to the one used to obtain $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ and then it is omitted. The reader can nevertheless refer to Appendix 7.1 for a comparison of the two contracts from the point of view of the motivated borrowers.

We now consider contracts $(B_{11}^{S1}, B_{11}^{F1}, I_{11}^{1})$ that are designed for motivated borrowers interacting with *ethical banks*. Recall that Δ_θ is the premium for successful interaction that a motivated borrower obtains when trading with an ethical bank in the case of successful project. Thus, the incentive compatibility constraint of a motivated borrower trading with an ethical bank (following the same steps as in Tirole, 2006, p 116) writes:

$$\Delta_{B_{11}^{1}} + \Delta_\theta \geq \frac{PI_{11}^{1}}{\Delta_p} \qquad (IC_{11}^{B1})$$

where $\Delta_{B_{11}^{1}} = B_{11}^{S1} - B_{11}^{F1}$. On the left hand side of the incentive compatibility constraint there are all gains obtained by the borrower in case of success: an increase in revenues, $\Delta_{B_{11}^{1}}$, and an increase in the psychological well-being, Δ_θ. The latter is the novelty of this incentive compatibility constraint.

It is interesting to compare the three possible incentive compatibility constraints of a motivated borrower, IC_{11}^{B1} with IC_{01}^{B1} and IC_{01}^{B0}, where the first two are relative to ethical projects (respectively financed by an ethical bank and a commercial one) and the last to normal projects. First, considering IC_{11}^{B1} and IC_{01}^{B1}, we observe that when the motivated borrower invests in an ethical project, her incentive compatibility constraint is more easily satisfied trading with an ethical bank than with a standard one. Second, considering IC_{11}^{B1} and IC_{01}^{B0}, we observe that the premium for successful interaction Δ_θ might be sufficiently high to compensate ethical projects' low profitability. When this is the case, then the motivated borrower's incentive compatibility constraint is more easily satisfied trading with an ethical bank than investing in a standard project with a standard bank. Thus, it is possible that a motivated borrower interacting with an ethical bank implements a more efficient contract than trading with a standard bank, despite the higher profitability of standard projects. Below we will find conditions under which this occurs.

Considering the motivated borrowers' choice whether to invest in ethical projects either with a standard or with an ethical bank we can state:

Remark 2 *When undertaking an ethical project, motivated borrowers will always prefer to trade with an ethical bank rather than with a standard lender. In fact, interacting with an ethical bank, they obtain a contract that is at least as profitable as the one they can obtain from a standard bank and they also receive the premium Δ_θ for successful interaction.*

Despite the presence of the premium for successful interaction Δ_θ, we can follow the same steps as in the previous cases to find the optimal contract:

Lemma 4 *The contract for a motivated borrower trading with an ethical bank*

under moral-hazard is the contract $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ *such that:*

$$\begin{aligned} I_{11}^{1*} &= \frac{A + p_H \Delta_\theta}{1 - p_H \left(R^{S1} - \frac{P}{\Delta_p} \right)} \\ B_{11}^{S1*} &= \frac{P}{\Delta_p} \frac{A + p_H \Delta_\theta}{1 - p_H \left(R^{S1} - \frac{P}{\Delta_p} \right)} - \Delta_\theta \\ B_{11}^{F1*} &= 0 \end{aligned} \tag{10}$$

Proof. See the appendix 7.2. ■

Note that, in the contract $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$, the premium for successful interaction Δ_θ positively affects the borrowing capacity I_{11}^{1*} of the motivated investors. This implies that $I_{11}^{1*} > I_{01}^{1*}$,[15] or the motivated borrower investing in ethical projects with an ethical bank can invest more, i.e., she obtains bigger loan than when trading the same type of project with a standard bank. While the impact of the premium for successful interaction on the expected return in case of success B_{11}^{S1*} is ambiguous.

From the current and the previous subsections we know that standard borrowers always sign a contract with a standard bank for a standard project, whereas motivated borrowers can either sign the very same contract or they can invest in an ethical project with an ethical bank. Thus, as we anticipated before, the market structure arising at the equilibrium depends on the motivated borrowers' choice between investing in a standard project with a standard bank or in an ethical one with an ethical bank.

In order to find out conditions such that a motivated borrower prefers to undertake an ethical project with an ethical bank than a standard project with a standard bank, the next step will be to compare contracts $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ and $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ and the motivated borrowers' pay-off under the two contracts. As mentioned before, since the ethical bank can be more efficient in solving the moral hazard problem of the motivated borrowers, it is possible that ethical banks offer better contract conditions to them even if ethical projects imply lower expected returns.

3.3 The Equilibrium under Pure Moral Hazard

The comparison of the two contracts $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ and $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ allows us to compute a few critical levels for the parameter of successful interaction Δ_θ which will be useful to characterize the equilibrium.

Lemma 5 *Motivated borrowers trading with an ethical bank:*

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

$$\Delta_\theta \geq \left(R^{S0} - R^{S1}\right) I_{0j}^{0*} \equiv \underline{\Delta}_\theta \tag{11}$$

[15] This can be easily observed by comparing the expression for I_{11}^{1*} to the one appearing in Lemma 1 for I_{00}^{0*}, recalling to substitute there the standard project with the ethical one.

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

$$\Delta_\theta \geq \frac{p_H P}{\Delta_p} \frac{\left(R^{S0} - R^{S1}\right) I_{0j}^{0*}}{p_H R^{S1} - 1} = \frac{p_H B_{0j}^{S0*}}{p_H R^{S1} - 1} \left(R^{S0} - R^{S1}\right) \equiv \overline{\Delta}_\theta \qquad (12)$$

where condition (12) implies condition (11), or $\underline{\Delta}_\theta < \overline{\Delta}_\theta$.

Proof. See the Appendix 7.3. ■

As one can check, both conditions (11) and (12) require that the expected profit from the ethical projects is not too small compared to that from the other projects ($R^{S0} - R^{S1}$ is low), or that the premium for successful interaction Δ_θ is high enough.

The first condition, $\Delta_\theta \geq \underline{\Delta}_\theta$, in Lemma 5 has a simple interpretation. The premium for successful interaction has to be greater than the difference in expected revenue between standard and ethical projects, for unit of investment. If this condition holds, the premium for successful interaction is sufficiently high to produce the following ranking of investment capacities: $I_{11}^{1*} > I_{0j}^{0*} > I_{01}^{1*}$. In words: the impact of the premium for successful interactions on the borrowing capacity of the motivated borrower trading with the ethical bank overcomes the impact of the high profitability of standard projects when interacting with the standard lender.

The second condition, $\Delta_\theta \geq \overline{\Delta}_\theta$, is more tricky to interpret. The ratio $\frac{\left(R^{S0} - R^{S1}\right) I_{0j}^{0*}}{p_H R^{S1} - 1}$ is the rate of increase in profitability from ethical to standard projects with respect to the profit of the ethical project, while the term $\frac{p_H P}{\Delta_p}$ represents the agency costs to be paid for letting borrowers commit to a correct behavior, $\frac{P}{\Delta_p}$ (see IC_{11}^{B1}, IC_{01}^{B1} and IC_{01}^{B0}), weighted for the probability of having to bear those costs, p_H. Summarizing, $\overline{\Delta}_\theta$ represents the agency cost that a motivated borrower has to pay in order to (make it credible to) behave in turning to a standard project, weighted for the expected rate of increase in profitability. Interestingly, under condition (12), the premium for successful interaction is sufficiently high to allow for a more efficient solution of the moral hazard problem. In other words, not only Δ_θ leads to higher borrowing capacity, but it also more than compensates the lower profitability of ethical projects, thus leading to overall better contract conditions.

Lemma 5 allows us to fully compare the two contracts $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ and $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ depending on the magnitude of the premium for successful interaction Δ_θ. When the premium for successful interaction is low, $\Delta_\theta < \underline{\Delta}_\theta$: motivated borrowers trading with ethical banks receive a contract with lower expected profits ($B_{11}^{S1*} < B_{0j}^{S0*}$) and lower borrowing capacity $\left(I_{11}^{1*} < I_{0j}^{0*}\right)$ than when trading with a standard bank. Here the premium for successful interactions is not big enough in order to induce a higher borrowing capacity of the motivated borrowers and hence the lower expected returns from ethical projects prevails. If Δ_θ belongs to an intermediate range, $\underline{\Delta}_\theta \leq \Delta_\theta \leq \overline{\Delta}_\theta$, then the motivated borrowers get a lower expected profit ($B_{11}^{S1*} < B_{0j}^{S0*}$), but gain a

higher borrowing capacity $\left(I_{11}^{1*} > I_{0j}^{0*}\right)$ by dealing with an ethical bank since the positive impact of the premium for successful interaction on investment is now operating. Finally, if the premium for successful interaction is high enough, $\Delta_\theta \geq \overline{\Delta}_\theta$, motivated borrowers trading with ethical banks receive a contract characterized by higher expected profits ($B_{11}^{S1*} > B_{0j}^{S0*}$) and higher borrowing capacity $\left(I_{11}^{1*} > I_{0j}^{0*}\right)$ than when trading with a standard bank. In fact, the relationship allows to solve the moral hazard problem so efficiently that this more than compensates the lower expected revenue of ethical projects.

Now we can finally obtain the preferred choice of the motivated borrowers. Obviously, if $\Delta_\theta \geq \overline{\Delta}_\theta$, then motivated borrowers prefer to trade with socially responsible lenders since, by doing so, they can both benefit from the total premium for social responsibility $p_H\Delta\theta + \theta$ and from a higher expected revenue B_{11}^{S1*}. Moreover, it is easy to check that motivated borrowers prefer to trade with ethical banks even when $\underline{\Delta}_\theta \leq \Delta_\theta \leq \overline{\Delta}_\theta$.

Suppose now that $\Delta_\theta < \underline{\Delta}_\theta$. Motivated borrowers receive in this case a higher loan and a higher expected profit when they undertake a standard project contracting with standard lenders. However, they still prefer to trade with socially responsible banks if the total premium for social responsibility $p_H\Delta_\theta + \theta$ more than compensates the lower expected profit:

Lemma 6 *Motivated borrowers prefer to contract with ethical banks than with standard ones for* $\Delta_\theta \geq \widetilde{\Delta}_\theta(\theta)$, *where:*

$$\widetilde{\Delta}_\theta(\theta) = \max\left\{0, \underline{\Delta}_\theta - \frac{\Delta_p}{p_H^2 P}\left(1 - p_H\left(R^{S1} - \frac{P}{\Delta_p}\right)\right)\theta\right\} \tag{13}$$

with $\widetilde{\Delta}_\theta(\theta)$ *decreasing in* θ *when strictly positive, and* $\widetilde{\Delta}_\theta(\theta) \leq \underline{\Delta}_\theta \forall\theta$.

If $\theta = 0$, *then* $\widetilde{\Delta}_\theta(\theta) = \underline{\Delta}_\theta$ *and the necessary condition for motivated borrowers to trade with socially responsible lenders is more stringent.*

Proof. See the Appendix 7.4. ■

The previous Lemma shows that motivated borrowers will accept a loan from ethical banks if the premium for successful interaction Δ_θ is higher than the threshold value $\widetilde{\Delta}_\theta(\theta)$ which depends on θ. In particular, $\widetilde{\Delta}_\theta(\theta)$ is decreasing in θ and is always weakly lower than $\underline{\Delta}_\theta$. Namely, if $\Delta_\theta \geq \widetilde{\Delta}_\theta(\theta)$, the contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ can be indicated as $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ since it is signed only by standard borrowers. As a consequence the market is fully segmented in that case.

The following proposition summarizes results in Section 3:

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

- *When* $\Delta_\theta \geq \widetilde{\Delta}_\theta(\theta)$, *then the credit market is fully segmented and the contracts* $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ *and* $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ *are signed by standard and motivated borrowers respectively.*

1. *If* $\Delta_\theta \geq \overline{\Delta}_\theta$*, then the contracts are such that* $I_{11}^{1*} > I_{00}^{0*}$ *and* $B_{11}^{S1*} > B_{00}^{S0*}$.
2. *If* $\underline{\Delta}_\theta \leq \Delta_\theta \leq \overline{\Delta}_\theta$*, the contracts are such that:* $I_{11}^{1*} > I_{00}^{0*}$ *and* $B_{11}^{S1*} < B_{00}^{S0*}$.
3. *If* $\widetilde{\Delta}_\theta(\theta) < \Delta_\theta \leq \underline{\Delta}_\theta$*, the contracts are such that:* $I_{11}^{1*} < I_{00}^{0*}$ *and* $B_{11}^{S1*} < B_{00}^{S0*}$.

- *When* $0 \leq \Delta_\theta < \widetilde{\Delta}_\theta(\theta)$*, 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 for standard projects.*

Proposition 1 shows that, if $\Delta_\theta \geq \widetilde{\Delta}_\theta(\theta)$, two separated credit markets are created: one market for ethical projects where only agents aware of social issues trade with each other and one for standard projects where only standard agents operate. In fact, when the premium for successful interaction is sufficiently high (and θ is strictly positive), then the total premium for social responsibility $p_H\Delta_\theta + \theta$ more than compensates the worse contract conditions so that motivated borrowers prefer to undertake ethical projects contracting with ethical banks.

Interestingly, when $\theta = 0$, conditions for market segmentation are stricter $(\widetilde{\Delta}_\theta(\theta) \equiv \underline{\Delta}_\theta)$ since motivated borrowers trade with ethical banks only if they receive a contract at least characterized by higher borrowing capacity: $I_{11}^{1*} > I_{00}^{0*}$.

On the contrary, if $\widetilde{\Delta}_\theta(\theta) = 0$, meaning that θ is relatively large, then the ethical banks are always active because the premium for social responsibility is so high that the motivated borrowers always prefer an ethical project to a standard one, even if the premium for successful interaction is nought. We will discuss this possibility at the end of this section.

Note that, when the premium for successful interaction is sufficiently high $\left(\Delta_\theta \geq \overline{\Delta}_\theta\right)$, motivated borrowers obtain a contract that is more profitable than the one signed by the standard borrowers, since the matching between agents aware of social issues allows the inefficiency due to moral hazard to decrease. The result obtained for $\Delta_\theta \geq \overline{\Delta}_\theta$ is perfectly 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.

When $0 \leq \Delta_\theta < \widetilde{\Delta}_\theta(\theta)$, then the market for ethical projects does not exist since the total premium for social responsibility $p_H\Delta_\theta + \theta$ is not sufficient to compensate the lower expected profits from ethical projects. In such a case, motivated borrowers behave exactly as standard ones and both the efficiency gain from assortative matching and the social benefit from ethical projects are fully lost.[16]

Our results are summarized in Figure 1, where the relative expected profitability of standard and ethical projects is taken as given and the threshold

[16] This result is driven, among other things, by the discrete nature of the choice between profit maximizing and ethical projects and contrasts with Besley and Ghatak (2007) where caring consumers always delegate to firms the production of a positive amount of the public good, which is represented by a continuous variable.

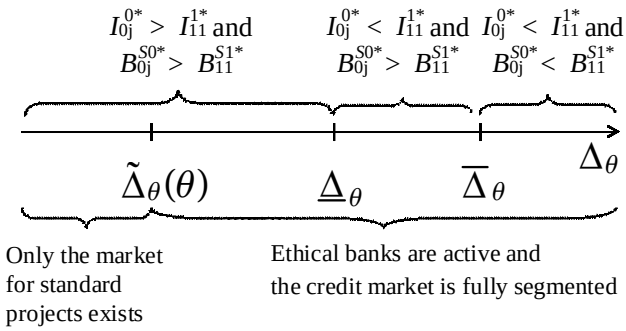

Figure 1: **Pure moral hazard (second-best)**: given the relative expected returns of standard and ethical projects, second-best contracts depend on the magnitude of the premium for successful interaction as illustrated in Proposition 1.

values characterized in Lemmas 5 and 6 are depicted. The second best contracts are compared and the market segmentation is illustrated as a function of the premium for successful interaction Δ_θ.

We conclude this section with some remarks on the role exerted by θ and Δ_θ in our model. Recall that the term $p_H\Delta_\theta + \theta$ represents the total premium for social responsibility possibly received by motivated borrowers. Since the premium for successful interaction Δ_θ is multiplied by the probability p_H, its contribution to the total premium for social responsibility is lower than the one of θ. However, note that the beneficial effect of the matching between agents aware of social issues is totally driven by the premium for successful interaction Δ_θ (see the incentive compatibility constraint IC_{11}^{B1} and conditions (11) and (12)). Indeed all our results still hold when $\theta = 0$, that is when motivated borrowers do not receive any premium for undertaking ethical projects with standard banks.[17] We can conclude that the premium for successful interaction has a low direct impact on expected utility of motivated borrowers, nevertheless it represents the crucial ingredient in our model.

Considering our results when $\theta = 0$, the region where ethical banks are not active always exists, in this case, and corresponds to $\Delta_\theta \in \left[0, \widetilde{\Delta}_\theta(\theta) = \underline{\Delta}_\theta\right]$. On the contrary, when the premium θ is strictly positive, in principle it can be $\widetilde{\Delta}_\theta(\theta) = 0$ implying that ethical banks are always active. However, the scenario where ethical banks always exist is not particularly interesting nor particularly reasonable, since motivated borrowers, in this case, are willing to invest in ethical projects "by definition". As it was mentioned in Section 2,

[17] $\theta = 0$ was precisely our assumption in a previous version of the paper.

we find it more realistic to assume that motivated borrowers are willing to undertake ethical projects as long as their social engagement is not too costly in terms of material payoffs. Put it differently, we expect motivated borrowers to behave as standard ones when the gains in profits are sufficiently high. This implies that, in our view, the premium θ should be sufficiently low with respect to the difference in projects' profitability to assure that a region where ethical banks are not active also exists when θ is strictly positive, or:

$$0 \leq \theta \leq \frac{p_H^2 P \left(R^{S0} - R^{S1}\right) A}{\Delta_p \left(1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)\right) \left(1 - p_H \left(R^{S1} - \frac{P}{\Delta_p}\right)\right)} = \theta_{\max},$$

where $\theta_{\max}$ is the value of the premium for social responsibility such that the threshold value $\widetilde{\Delta}_\theta(\theta)$ is zero.[18]

Our intuition that Δ_θ is relatively big with respect to θ seems in line with the recent empirical literature on ethical banks, which we discuss in Section 5. Ethical banks analyzed in that literature authorize loans of bigger dimension than commercial banks, which is consistent with the assumption that θ is not extremely relevant and that $\Delta_\theta > \underline{\Delta}_\theta$.

4 Loan Agreements under Moral Hazard and Adverse Selection

We consider here the following information 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 environment is interesting since, when the premium for successful interaction is sufficiently high, motivated borrowers trading with ethical banks obtain better contract conditions than standard borrowers trading with standard lenders (see Proposition 1 above). Thus, standard borrowers could take advantage of their private information by pretending to be motivated. In this latter case ethical banks could obtain negative profits, since standard borrowers mimicking motivated ones possibly misbehave, which amount to saying that the contract $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ is not necessarily incentive compatible for standard borrowers.

Lenders here 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.

[18] In particular, the value $\theta_{\max}$ satisfies:

$$\underline{\Delta}_\theta - \frac{\Delta_p}{p_H^2 P}\left(1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F\right)\theta = \widetilde{\Delta}_\theta(\theta) = 0$$

(see the end of Appendix 7.4).

To solve the model with both moral hazard and adverse selection on the borrowers' type we proceed as follows. (i) We show that the third-best contract corresponds to the second best when $\Delta_\theta < \overline{\Delta}_\theta$. (ii) We characterize the self-selecting contracts for $\Delta_\theta \geq \overline{\Delta}_\theta$ and we show that, at the equilibrium, standard borrowers receive the second-best contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ whereas motivated ones receive the third-best contract $(B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**})$, which is distorted with respect to $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$. (iii) We find a sufficient condition such that the equilibrium contracts $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ and $(B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**})$ are (constrained) efficient. Finally, (iv) we conclude that also existence of the competition game equilibrium is assured when the previous condition is met.

Notice that borrowers are the informed party. Therefore we are considering a case similar to that of contract design by an informed principal (see Maskin and Tirole 1992 and also Tirole 2006, page 264). However, our problem is slightly different. On the one hand, our setting is more complicated because we also have moral-hazard and two types of banks (agents) exist. On the other hand our model is simpler, because competition among banks allows us to focus on optimal contracts, as discussed in the end of the section, that is, we can restrict our attention to what Tirole (2006, page 264) defines the "low-information-intensity optimum".

Since borrowers' motivation is part of the borrowers' private information, in the new set-up we have to consider also the self-selection constraint. Obviously, if second-best contracts $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ and $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ defined before verify such a self-selection constraint, then those contracts can also be offered in third-best (they are envy free).

From Proposition 1, all borrowers' types prefer contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ in the second best, if $\Delta_\theta < \widetilde{\Delta}_\theta(\theta)$. In this case ethical banks are not active and the two borrowers' types become identical since motivated borrowers do not receive any premium for social responsibility. Therefore, Proposition 1 implies straightforwardly that, when $\Delta_\theta < \widetilde{\Delta}_\theta(\theta)$, standard lenders offer the second-best contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ to all borrowers, also in the third best.

Let us consider now higher levels of the premium for successful interaction and check whether borrowers have incentive to lie. From Proposition 1 we know that, in second-best, motivated borrowers prefer contract $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ to contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ when $\Delta_\theta \geq \widetilde{\Delta}_\theta(\theta)$**.** Moreover, standard borrowers prefer contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$ to contract $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ when $\Delta_\theta \leq \overline{\Delta}_\theta$ since, with the first contract, they receive a higher expected utility than with the latter one. In fact:

$$p_H \Delta_{B_{0j}^{0*}} + B_{0j}^{F0*} - A > p_H \Delta_{B_{11}^{1*}} + B_{11}^{F1*} - A$$

where $\Delta_{B_{0j}^{0*}} > \Delta_{B_{11}^{1*}}$.

Summarizing, from the previous reasoning we know that when $\widetilde{\Delta}_\theta(\theta) \leq \Delta_\theta \leq \overline{\Delta}_\theta$, the second best contracts $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}) \equiv (B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ and $(B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*})$ are envy free and can also be offered in third-best. In this case the credit market is fully segmented and no distortions are necessary to

separate borrowers' types. Whereas, when $\Delta_\theta < \widetilde{\Delta}_\theta(\theta)$, 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 $\Delta_\theta \geq \overline{\Delta}_\theta$, that is, the premium for successful interaction more than compensates ethical projects' low profitability. Here both borrowers' types prefer contract ($B_{11}^{S1*}, B_{11}^{F1*}, I_{11}^{1*}$) since the latter leads to a higher expected utility than (B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}).

Again, because of the assumption of Bertrand competition among (both types of) lenders, borrowers are endowed with all the bargaining power and obtain all the surplus from trade in equilibrium. Thus, we can solve the model as in Section 3. In particular, here we will find the optimal contract for the borrowers under both their incentive compatibility and their self-selection constraint.

Note that in third-best, also when $\Delta_\theta > \overline{\Delta}_\theta$, commercial banks still offer the second-best contract ($B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}$) since all borrowers are the same when trading with standard lenders and no adverse selection issues arise:

Lemma 7 *In third-best, standard banks offer the second-best contract* (B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}) *whatever the size of the premium for successful interaction,* Δ_θ.

Instead, when $\Delta_\theta \geq \overline{\Delta}_\theta$, ethical banks must offer a self-selecting contract to prevent standard borrowers from mimicking motivated ones and possibly misbehaving.

The "low-information-intensity optimum" (see Tirole 2006, page 264) in our setting corresponds to the separating allocation with no cross subsidization between types of borrowers offered by ethical banks, namely the contract (B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**}) for motivated borrowers and the second-best contract (B_{10}^{S1*}, B_{10}^{F1*}, I_{10}^{1*}) for standard ones[19]. The contract (B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**}) maximizes motivated borrowers' payoff subject to the motivated borrower's incentive compatibility constraint, the ethical lender's participation constraint and subject to standard borrowers not preferring (B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**}) to (B_{10}^{S1*}, B_{10}^{F1*}, I_{10}^{1*}).

A detailed discussion on the self-selection constraint will follow. The standard self selection constrain is:

$$p_H B_{10}^{S1*} \geq p_L \Delta_{B_{11}^1} + B_{11}^{F1} + PI_{11}^1 \qquad (SS_1^{B1})$$

However, from Lemma 2 a standard borrower always prefers contract (B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}) to contract (B_{10}^{S1*}, B_{10}^{F1*}, I_{10}^{1*}), since standard projects have higher expected returns. Thus, a standard borrower will never choose the second-best contract (B_{10}^{S1*}, B_{10}^{F1*}, I_{10}^{1*}) in the third-best equilibrium, it will instead sign

[19] Note that the second-best contract (B_{10}^{S1*}, B_{10}^{F1*}, I_{10}^{1*}) was not part of the second-best equilibrium described in Proposition 1 since standard borrowers always prefer to undertake standard projects with standard banks when their type is observable. Nevertheless, here we are looking for the self-selecting contracts offered by ethical banks and thus we must consider the two contracts that ethical banks design for the two types of existing borrowers. However, in order to decrease distortions necessary for separation of types, in a few lines we will consider again the contract obtained in the second-best equilibrium (B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*}) (see constraint 14).

the preferred contract (B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}) with standard banks. For this reason we can consider the following modified self-selection constraint where B_{0j}^{S0*} is substituted to B_{10}^{S1*} in the l.h.s. of the inequality $\left(SS_1^{B1}\right)$:

$$p_H B_{0j}^{S0*} \geq p_L \Delta_{B_{11}^1} + B_{11}^{F1} + PI_{11}^1 \tag{14}$$

Since $B_{0j}^{S0*} > B_{10}^{S1*}$, the previous substitution allows us to impose a lower distortion to contract (B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**}) in order to obtain separation.

Note that, both in the self-selection constraints $\left(SS_1^{B1}\right)$ and in inequality (14), the mimicker misbehaves ($a = 0$), so that, in the right-hand-side of the inequality, the probability of a successful investment is only p_L. To understand why, consider that an ethical bank is in principle indifferent with respect to the type of investors that are undertaking ethical projects. In other words, if the contract (B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**}) is signed by either a standard or a motivated borrower, the ethical bank is equally satisfied, provided that the borrower behaves. The necessity to design a separate contract for motivated and for standard borrowers only arises if standard borrowers misbehave when choosing (B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**}).[20]

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

Lemma 8 *If $\Delta_\theta \geq \overline{\Delta}_\theta$, in the optimal separating contract with no cross subsidization standard borrowers obtain the second-best contract. Motivated borrowers obtain a 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 7.5. ■

When $\Delta_\theta \geq \overline{\Delta}_\theta$, the equilibrium contracts described in the previous Lemma imply that the "better" types pay the cost of separation from the "worst" agents by receiving a distorted allocation. These contracts share this property with the Rothschild and Stiglitz (1976) ones, although they are obtained in a different setup.

Notice that the separating contracts described in the previous lemma assure that motivated borrowers trade with ethical banks whereas standard ones trade with standard banks. Thus, in the third-best, the credit market is fully segmented not only when $\widetilde{\Delta}_\theta(\theta) \leq \Delta_\theta \leq \overline{\Delta}_\theta$, as we established before, but also when $\Delta_\theta \geq \overline{\Delta}_\theta$.

The following proposition summarizes all results in this section:

Proposition 2 ***Moral hazard and adverse selection on the borrowers' side: optimal separating contracts with no cross subsidy.***

[20] In Appendix 7.5.1 we show that the optimal separating contracts with self-selection constraint (14) dominate the solution of an alternative program we could consider here; that is a program where a pooling contract is offered to both types of borrowers and where the incentive compatibility constraint also holds for standard borrowers.

- *When* $\Delta_\theta \geq \overline{\Delta}_\theta$*, standard borrowers sign the second-best contract* $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ *with standard lenders. Motivated borrowers sign the 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* $\widetilde{\Delta}_\theta(\theta) \leq \Delta_\theta \leq \overline{\Delta}_\theta$*, 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* $\Delta_\theta < \widetilde{\Delta}_\theta(\theta)$ *then both borrowers' types obtain the second-best contract* $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$. *Ethical banks are not active and the market for ethical projects does not exist.*

Recall that, when $\Delta_\theta \geq \overline{\Delta}_\theta$, the premium for successful interaction more than compensates ethical projects low profitability and, in second-best, motivated borrowers receive a more profitable contract. Thus, in third-best, standard borrowers are willing to mimic motivated ones and a self-selecting contract is offered to motivated entrepreneurs who are worse off with respect to the second-best. In particular, motivated borrowers 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 $\underline{\Delta}_\theta \leq \Delta_\theta \leq \overline{\Delta}_\theta$ (see Proposition 1). When, instead, the premium for social responsibility is characterized by an intermediate size ($\widetilde{\Delta}_\theta(\theta) \leq \Delta_\theta \leq \overline{\Delta}_\theta$), adverse selection has no bite so that contracts designed for motivated borrowers in second-best are not attractive for standard ones. Finally, when standard projects profitability more than compensate the total premium for social responsibility ($\Delta_\theta < \widetilde{\Delta}_\theta(\theta)$) all borrowers become equivalent to standard entrepreneurs and no adverse selection issues arise.

Exactly as in the second-best, for $\Delta_\theta \geq \widetilde{\Delta}_\theta(\theta)$ the market is fully segmented whereas, for $\Delta_\theta < \widetilde{\Delta}_\theta(\theta)$, the market for ethical projects does not exist since all borrowers invest in standard projects. The important difference with respect to the second-best is in the distortion that characterizes the third-best contract for motivated borrowers when $\Delta_\theta \geq \overline{\Delta}_\theta$. Such a distortion is necessary to separate borrowers' types and obviously decreases the efficiency arising in second-best from assortative matching between agents characterized by sensitivity to social issues. More precisely, in third-best the large premium for successful interaction does not allow any more to solve the moral hazard problem at a lower cost, because of the informational rent appropriated by standard borrowers. In other words, Δ_θ still leads to higher borrowing capacity, but motivated borrowers loose the benefit of better contract conditions.

The previous results are summarized in Figure 2. The third-best contracts are compared and the market segmentation is illustrated as a function of the premium for successful interaction Δ_θ.

We now consider conditions assuring the (constrained) efficiency and the existence of the third-best equilibrium when $\Delta_\theta \geq \overline{\Delta}_\theta$.

In order to prove the (constrained) efficiency of the equilibrium described in Lemma 8 when $\Delta_\theta \geq \overline{\Delta}_\theta$, we have to verify that there is no preferred allocation

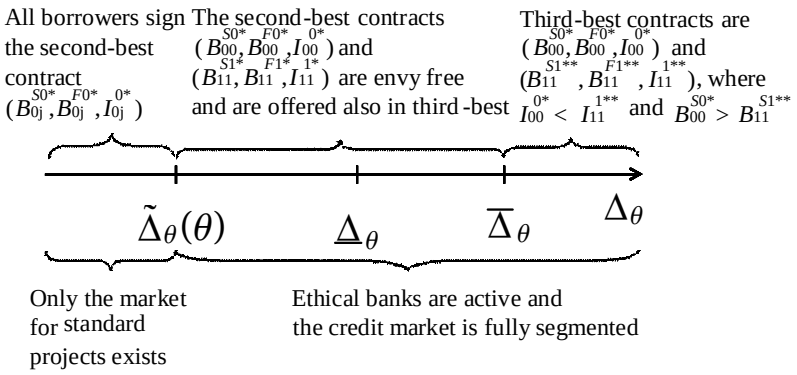

Figure 2: **Moral hazard and screening (third-best)**: given the relative expected returns of standard and ethical projects, third-best contracts depend on the magnitude of the premium for successful interaction as illustrated in Proposition 2

characterized by a separating contract with cross-subsidizations between the two types of borrowers or, more generally, characterized by cross-subsidizations between the two types of banks.[21] In fact, in principle, ethical banks could find it preferable to increase the expected profit of the standard borrower in order to lower the distortions of the ethical borrower's contract.

Notably, when the third-best equilibrium is efficient, then no profitable deviations exists. In particular, neither Pareto improving pooling allocations nor Pareto improving separating allocations with cross subsidies between borrowers or between banks can be obtained, so that the existence of the equilibrium is assured. Thus, efficiency implies existence.

In the following we prove efficiency. In our setting, the optimal self-selecting allocation offered by ethical banks and without cross-subsidy between borrowers types would be the couple of contracts (B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**}) for motivated borrowers and (B_{10}^{S1*}, B_{10}^{F1*}, I_{10}^{1*}) for standard ones. Since, in the incentive compatible constraint (14), we replaced the contract offered by ethical banks to standard borrowers (B_{10}^{S1*}, B_{10}^{F1*}, I_{10}^{1*}) with the dominant contract (B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*}) offered by standard lenders (thus decreasing the distortion necessary for separation), the contract characterizes in Lemma 8 is already more efficient than that previously mentioned.[22] However we can prove a stronger result about efficiency with quite weak assumptions. In fact, we can prove that the third-best contract derived in Lemma 8 is constrained Pareto efficient, provided that q is

[21] Note that we already proved in Appendix 7.5.1 that a pooling contract is dominated by a separating one in our setting. See also the previous footnote.

[22] Thus, our third-best equilibrium allocation is a particular and more efficient version of the "low-information-intensity optimum" defined in Tirole (2006, page 264).

lower than $\frac{1}{2}$. That is, under this condition, there is no cross-subsidizing scheme among banks (and a fortiori among borrowers) which can sustain a better set of contracts. Moreover, if the allocation derived in Lemma 8 is constrained efficient, all the third-best contracts described in Proposition 2 are constrained efficient too, whatever the value of Δ_θ.

The proof of Proposition 3 is built as follows. As mentioned before, the self-selecting equilibrium derived in Lemma 8 is constrained efficient if an (alternative) pair of Pareto dominating contracts with cross-subsidies between ethical and standard banks does not exist. In order to check this, in a first step, we characterize the profit maximizing (loss minimizing) contract for a standard bank when providing an expected profit to the standard borrower which is equal to the second best profits plus R. This R is the transfer that has to be paid by ethical banks to standard ones. Cross subsidization between different types of banks is possible if ethical banks make positive profits on an alternative contract $(B_{11}^{S1^\circ}, B_{11}^{F1^\circ}, I_{11}^{1^\circ})$ that motivated borrowers prefer to $(B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**})$. Thus, in the second step, we verify whether a Pareto improving new contract $(B_{11}^{S1^\circ}, B_{11}^{F1^\circ}, I_{11}^{1^\circ})$ can be offered to motivated borrowers by ethical banks that also allow to pay the transfer R to standard lenders. We show that for $q < \frac{1}{2}$ this is not possible and hence no Pareto improving contracts with cross-subsidy between types of banks exists.

Proposition 3 ***Moral hazard and adverse selection on the borrowers' side: efficiency.*** *$q < \frac{1}{2}$ is a sufficient condition such that the equilibrium of third-best with no cross-subsidization between banks is constrained efficient. However, larger values of q are still compatible with efficiency.*

Proof. See Appendix 7.6. ■

As already explained, efficiency implies existence:

Corollary 1 ***Moral hazard and adverse selection on the borrowers' side: existence.*** *$q < \frac{1}{2}$ is a sufficient condition such that the equilibrium of third-best exists. However, larger values of q are still compatible with existence.*

Thus, if we do not expect that motivated borrowers represent a majority in the population of investors, the third-best equilibrium described in Proposition 2 exists and it is efficient.[23]

[23] Suppose, on the contrary, that q is so large that our third-best equilibrium is not efficient. In such a case the government should intervene to allow for a cross subsidy between banks. In particular, ethical banks should pay a transfer to standard banks so that standard borrowers can receive a contract which strictly dominates $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$; hence, the self-selection constraint (14) in the third-best program can be relaxed and a contract that is better than $(B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**})$ can be offered to motivated borrowers (see the proof of Proposition 3 for more details). Note that the credit market would be fully segmented also under this scenario; however, here the financial activity of ethical banks would partially subsidize standard lenders and the market for standard projects.

5 Discussion

In this section we refer to the recent empirical literature on ethical banks and discuss how our results fit the evidence documented in those works.

At least three empirical papers study ethical banks in Europe: Becchetti and Garcia (2011) and Becchetti *et al.* (2011) analyze data from *Banca Popolare Etica* in Italy while Cornée and Szafarz (2012) data from *La Nef* in France.

Interestingly, Cornée and Szafarz (2012) show that loans provided by *La Nef* are characterized by larger size than the ones offered by commercial banks. This result not only is consistent with our finding, but it also suggests an approximate measure for the real value of the premium for successful interaction. In fact, our model indicates that ethical banks offer larger loans with respect to standard banks if $\Delta_\theta \geq \underline{\Delta}_\theta$. Thus, we could guess that French motivated borrowers are characterized by a premium for successful interaction larger than $\underline{\Delta}_\theta$.

Moreover, Cornée and Szafarz (2012) show that *La Nef* charges below market-interest rates to its borrowers. For sufficiently high values of the premium for successful interactions this again is in line with the prediction of our model where the interest rate corresponds to $\frac{IR^S - B^S}{I-A} - 1$. In particular, in second-best and for $\Delta_\theta \geq \overline{\Delta}_\theta$, motivated borrowers trading with ethical banks unambiguously pay a lower interest rate.

In our model optimal contracts require the same collateral for all borrowers, while they specify different amounts of investment for different types of entrepreneurs. We could alternatively assume a fixed investment for all the borrowers/projects that would lead to a different collateral for different types of borrowers. For this reason we may say that the assortative matching between agents aware of social issues provides motivated borrowers with an additional collateral that we could call "ethical collateral". To this respect and again consistently with our model, both Becchetti and Garcia (2011) and Cornée and Szafarz (2012) show that ethical banks require, on average, lower collateral than standard lenders.

Becchetti and Garcia (2011) and Cornée and Szafarz (2012) together with Becchetti *et al.* (2011) also show that borrowers financed by ethical banks have a significantly lower probability of default. In the equilibrium of our model all borrowers are characterized by the same probability of default. However, one could conceive a more general moral hazard model where, for instance, the probability of success depends continuously on borrowers' behavior. In this case, the higher efficiency of ethical banks and motivated borrowers in solving the moral hazard problem could result in a lower default rate of ethical projects, even if these projects provide lower expected revenue than standard ones. In this sense and again, our results do not seem to contradict the empirical evidence.

Other empirical papers deal with the issue of credit constraint to small borrowers. For example Bonaccorsi and Gobbi (2001) show that entry, concentration and mergers in the credit market negatively affect credit supply to small borrowers. Interpreting again the higher borrowing capacity of motivated borrowers when contracting with ethical lenders as lower collateral required by the

latter banks, our model suggests that ethical lenders are supplying credit to smaller entrepreneurs (who, generally, have less collateral available). In this sense ethical banks may contribute to partially reduce credit rationing in high-income countries.

Finally, our paper is also somehow related to the literature on relationship lending (as an example Berger and Udell 2002) and on cooperative banks (among others Banerjee *et al.* 1994). It has been argued that the specific characteristics of ethical banks and cooperative banks provided a degree of protection against the effects of the crisis in many countries (see the International Cooperative Bank Association declaration, ICBA March 9, 2009[24]). For example Becchetti *et al.* (2011) show that the average proportion of nonperforming loans in the Italian banking system was approximately 4% in the period 1999-2006, while it was less than 1% in Banca Popolare Etica, despite the latter's share of uncollateralized loans is much higher than the average.

6 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 two different credit markets exist: 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 financing only ethical projects so that they are not interested in operating in the markets for standard projects. Motivated borrowers, instead, obtain a general benefit (a premium for social responsibility) when they undertake ethical projects and also an additional benefit 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. Under different information structures, we investigate how ethical banks and motivated borrowers interact together when credit markets are competitive and also standard banks and borrowers are active. 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). We show that all optimal contracts are high incentives ones and we fully characterize them in the two information structures.

In equilibrium, standard borrowers always prefer to invest in the market for standard projects, whereas motivated borrowers invest in ethical projects if the additional premium for successful interaction is high enough. In such a case, only standard agents operate in the market for standard projects and only agents aware of social issues trade in the market for ethical projects, implying

[24] Available on http://icba.free.fr/IMG/pdf/G_20_MARCH_09.pdf, consulted in April 2009).

that the market is fully segmented. Moreover, when ethical banks are active and the premium for successful interaction is sufficiently high, motivated entrepreneurs have a larger borrowing capacity. Importantly, when the premium for successful interaction is even higher, it more than compensates the lower profitability of ethical projects allowing ethical banks and motivated borrowers to implement better contract conditions. This implies that ethical banks can induce repayment of their loan at a lower cost by providing funds to motivated borrowers and, when this occurs, the improvement of market efficiency provided by ethical lenders is the largest as possible. Under screening, instead, motivated borrowers pay the cost of separation from standard entrepreneurs**.** Therefore they are not anymore able to obtain better contract conditions as they were obtaining in second-best for sufficiently high values of the successful interaction premium. However, they maintain the larger borrowing capacity.

The policy implication we can derive from our results is that financial institutions and bank authorities should try to deal with the issue of borrowers' private information and strategic corporate social responsibility as much as possible, since a large part of the social benefit induced by the assortative matching between agents aware of social issues is lost when ethical banks must screen borrowers.

As already mentioned in the previous section, in our model, optimal contracts require the same collateral for all borrowers, while they specify different amounts of investment for different borrowers. If, alternatively, we assume a fixed investment for all the borrowers/projects we obtain a different collateral for different type of borrowers. In this alternative case and for values of the premium for successful interaction sufficiently high, our model predicts that motivated borrowers are asked to provide a lower collateral with respect to standard borrowers. In different words, motivated borrowers can provide their collateral in the form of "ethical collateral".

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 would never exist. Thus, our results suggest that, in the real world, ethical banks can be welfare improving not only because (i) they allow motivated borrowers to benefit from the premium for social responsibility, (ii) they can lead to higher loan size and (iii) they can solve more efficiently the moral hazard problem, but also because they allow the financing of projects exerting a positive externality to the society.

7 Appendix

7.1 Proof of Lemmas 1 and 3

We prove simultaneously the two lemmas, since the proof is identical. For this reason, we generally refer here to contract $(B_{0j}^{S0}, B_{0j}^{F0}, I_{0j}^{0})$. In fact, as we explain

in Subsection 3.2.1 (see Lemma 3), $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*}) = (B_{01}^{S0*}, B_{01}^{F0*}, I_{01}^{0*})$.

The proof is quite standard (see Tirole 2006, chapter 3), however we prefer to insert it since it turns out to be useful to understanding results in Section 3.3.

Before presenting the program and always following Tirole (2006), we assume that:

$$p_H \left(R^{S0} - \frac{P}{\Delta_p} \right) < 1. \tag{15}$$

Therefore I_{00}^0 has to be finite:

$$I_{0j}^0 \leq \frac{A - B_{0j}^{F0}}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p} \right)}. \tag{16}$$

The previous inequality expresses the borrowing capacity of the entrepreneur when contracting with a profit maximizing lender in the case of a standard project.

From Tirole (2006), the problem of a borrower contracting a loan for a standard project with a standard lender becomes**:**

$$\begin{array}{lll} \max\limits_{\Delta_{B_{0j}^0}, B_{0j}^{F0}, I_{0j}^0} & p_H \Delta_{B_{0j}^0} + B_{0j}^{F0} - A & \\ s.t. & \Delta_{B_{0j}^0} \geq \frac{P I_{0j}^0}{\Delta_p} & \left(IC_{0j}^{B0}\right) \\ & \left(p_H R^{S0} - 1\right) I_{0j}^0 - p_H \Delta_{B_{0j}^0} & \left(IR_{0j}^{L0}\right) \\ & -B_{0j}^{F0} + A \geq 0 & \end{array} \tag{17}$$

It is easy to prove that $\left(IR_{0j}^{L0}\right)$ 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 $\left(IC_{0j}^{B0}\right)$ satisfied, but increasing the expected utility. Hence we have a contradiction. Notice that, since $\left(IR_{0j}^{L0}\right)$ is binding :

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

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

$$\max \ \left(p_H R^{S0} - 1 \right) I_{0j}^0$$

which implies that the borrower wishes to increase the investment, I_{0j}^0, as much as he can. However, according to expression (16), I_{0j}^0 must be finite. Thus, to assure that the highest as possible value of I_{0j}^0 is reached, also $\left(IC_{0j}^{B0}\right)$ 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:

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

In this case $\left(IR_{0j}^{L0}\right)$ is still satisfied, U_j^0 is unchanged but, since B_{0j}^{S0} increases while B_{0j}^{F0} decreases, $\left(IC_{0j}^{B0}\right)$ is now slack, a contradiction. Hence

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

Substituting the above result in (16) and recalling that this last inequality is satisfied with equality if $\left(IC_{0j}^{B0}\right)$ and $\left(IR_{0j}^{L0}\right)$ are, we obtain:

$$I_{0j}^{0*} = \frac{A}{1 - p_H\left(R^{S0} - \frac{P}{\Delta_p}\right)} \tag{18}$$

Finally, substituting in $\left(IC_{0j}^{B0}\right)$ we obtain the equilibrium revenues of the borrower in the good state.

The very same procedure also allows to characterize the contract $(B_{0j}^{S1*}, B_{0j}^{F1*}, I_{0j}^{1*})$ which shares the same features with $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$, except for the fact that ethical projects have a lower expected revenue.

Note that, both standard and motivated borrowers trading with a commercial bank receive a contract with higher borrowing capacity and higher expected profit if they undertake a standard project. However, since motivated borrowers investing in an ethical project with a standard bank also receive the premium θ, they could nevertheless prefer an ethical project with worse borrowing condition $(B_{0j}^{S1*}, B_{0j}^{F1*}, I_{0j}^{1*})$ to a standard one under the contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$. A sufficient condition for preferring an ethical project to a standard one when trading with a standard bank is that the social responsibility parameter θ is high enough, in particular:

$$\theta \geq p_H^2 \frac{P}{\Delta_p} \frac{A}{1 - p_H\left(\Delta_{R_0} - \frac{P}{\Delta_p}\right) - R^F} \frac{\Delta_{R_0} - \Delta_{R_1}}{1 - p_H\left(\Delta_{R_1} - \frac{P}{\Delta_p}\right) - R^F} = \underline{\theta} \tag{19}$$

Condition (19) is obtained from:

$$p_H \Delta_{B_{01}^1} + B_{01}^{F1} + \theta - A \geq p_H \Delta_{B_{00}^0} + B_{00}^{F0} - A$$

after substituting the values appearing in the optimal contracts $(B_{00}^{S0*}, B_{00}^{F0*}, I_{00}^{0*})$ and $(B_{01}^{S1*}, B_{01}^{F1*}, I_{01}^{1*})$.

7.2 Proof of Lemma 4

The problem of a representative motivated borrower trading with an ethical bank in order to undertake an ethical project is**:**

$$\begin{array}{ll} \max\limits_{\Delta_{B_{11}^1}, B_{11}^{F1}, I_{11}^1} & p_H \Delta_{B_{11}^1} + p_H \Delta_\theta + \theta + B_{11}^{F1} - A \\ s.t. & \Delta_{B_{11}^1} + \Delta_\theta \geq \frac{P I_{11}^1}{\Delta_p} \qquad \left(IC_{11}^{B1}\right) \\ & \left(p_H R^{S1} - 1\right) I_{11}^1 - p_H \Delta_{B_{11}^1} - B_{11}^{F1} + A \geq 0 \qquad \left(IR_{11}^{L1}\right) \end{array} \tag{20}$$

As before $\left(IR_{11}^{L1}\right)$ should be satisfied with equality and substituting it in the objective function this implies that the borrower wishes to set I_{11}^1 as large as possible. If we can prove that $\left(IC_{11}^{B1}\right)$ implies finite I_{11}^1, the proof can follow the same lines as in the previous case. Using $\left(IC_{11}^{B1}\right)$ in $\left(IR_{11}^{L1}\right)$ we obtain:

$$I_{11}^1 \leq \frac{A - B_{11}^{F1} + \Delta_\theta p_H}{1 - p_H\left(R^{S1} - \frac{P}{\Delta_p}\right)} \tag{21}$$

The denominator of the rhs is positive because of (15). Hence I_{11}^1 has to be finite. Since the borrower wishes to set I_{11}^1 as large as possible, $\left(IC_{11}^{B1}\right)$ 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 $B_{11}^{F1} = 0$. Substituting $B_{11}^{F1} = 0$ in (21) and in $\left(IC_{11}^{B1}\right)$, where (21) is taken with equality since both $\left(IC_{11}^{B1}\right)$ and $\left(IR_{11}^{L1}\right)$ are taken with equality, we obtain:

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

7.3 Proof of Lemma 5

The inequality $I_{11}^{1*} \geq I_{0j}^{0*}$ holds if and only if:

$$\frac{A + p_H\Delta_\theta}{1 - p_H\left(R^{S1} - \frac{P}{\Delta_p}\right)} \geq \frac{A}{1 - p_H\left(R^{S0} - \frac{P}{\Delta_p}\right)}$$

that is:

$$\Delta_\theta \geq \frac{A\left(R^{S0} - R^{S1}\right)}{1 - p_H\left(R^{S0} - \frac{P}{\Delta_p}\right)} = I_{0j}^{0*}\left(R^{S0} - R^{S1}\right)$$

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

$$\frac{P}{\Delta_p}\frac{A + p_H\Delta_\theta}{1 - p_H\left(R^{S1} - \frac{P}{\Delta_p}\right)} - \Delta_\theta \geq \frac{P}{\Delta_p}\frac{A}{1 - p_H\left(R^{S0} - \frac{P}{\Delta_p}\right)}$$

or:

$$\frac{\Delta_\theta\left(p_H R^{S1}-1\right)}{1-p_H\left(R^{S1}-\frac{P}{\Delta_p}\right)}\geq$$
$$\frac{PA}{\Delta_p}\frac{p_H\left(R^{S0}-R^{S1}\right)}{\left(1-p_H\left(R^{S1}-\frac{P}{\Delta_p}\right)\right)\left(1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)\right)}$$

and finally:

$$\Delta_\theta\left(p_H R^{S1}-1\right)\geq\frac{P}{\Delta_p}p_H\left(R^{S0}-R^{S1}\right)I_{0j}^{0*}$$

which is equivalent to (12). It is easy to prove that

$$\frac{p_H P}{\Delta_p\left(p_H R^{S1}-1\right)}>1$$

and hence (12) implies (11).

7.4 Proof of Lemma 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:

$$p_H\Delta_{B_{11}^{1*}}+p_H\Delta_\theta+\theta+B_{11}^{F1*}-A\geq p_H\Delta_{B_{0j}^{0*}}+B_{0j}^{F0*}-A$$

which implies:

$$p_H\Delta_\theta+\theta\geq p_H\left(\Delta_{B_{0j}^{0*}}-\Delta_{B_{11}^{1*}}\right)=p_H\left(B_{0j}^{S0*}-B_{11}^{S1*}\right)$$

By substituting B_{0j}^{S0*} and B_{11}^{S1*} as from Lemma 3 and Lemma 4 we find:

$$p_H\Delta_\theta+\theta\geq p_H\frac{P}{\Delta_p}\frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}-p_H\left(\frac{P}{\Delta_p}\frac{A+p_H\Delta_\theta}{1-p_H\left(R^{S1}-\frac{P}{\Delta_p}\right)}-\Delta_\theta\right)$$

Rearranging:

$$\frac{\theta}{p_H^2}\frac{\Delta_p}{P}\left(1-p_H\left(R^{S1}-\frac{P}{\Delta_p}\right)\right)+\Delta_\theta\geq I_{0j}^{0*}\left(R^{S0}-R^{S1}\right)=\underline{\Delta}_\theta$$

where $\frac{\theta}{p_H^2}\frac{\Delta_p}{P}\left(1-p_H\left(R^{S1}-\frac{P}{\Delta_p}\right)\right)>0$.

Thus, motivated borrowers prefer to trade with ethical banks if:

$$\Delta_\theta\geq\underline{\Delta}_\theta-\frac{\theta}{p_H^2}\frac{\Delta_p}{P}\left(1-p_H\left(R^{S1}-\frac{P}{\Delta_p}\right)\right)=\widetilde{\Delta}_\theta\left(\theta\right)<\underline{\Delta}_\theta$$

Note that, if $\theta = 0$, then it must be:

$$\Delta_\theta \geq \underline{\Delta}_\theta = \frac{A\left(R^{S0} - R^{S1}\right)}{1 - p_H\left(R^{S0} - \frac{P}{\Delta_p}\right)}$$

We now derive the value of θ such that $\widetilde{\Delta}_\theta(\theta) > 0$. Substituting the value for $\underline{\Delta}_\theta$ in the previous expression:

$$\widetilde{\Delta}_\theta(\theta) = I_{0j}^{0*}\left(R^{S0} - R^{S1}\right) - \theta\frac{\Delta_p}{p_H^2 P}\left(1 - p_H\left(R^{S1} - \frac{P}{\Delta_p}\right)\right) > 0$$

Solving for θ we find that $\widetilde{\Delta}_\theta(\theta) > 0$ when:

$$\theta < \frac{p_H^2 P\left(R^{S0} - R^{S1}\right) A}{\Delta_p\left(1 - p_H\left(R^{S0} - \frac{P}{\Delta_p}\right)\right)\left(1 - p_H\left(R^{S1} - \frac{P}{\Delta_p}\right)\right)}$$

7.5 Proof of Lemma 8

Remember that the relevant self-selection constraint is the one where the standard borrower misbehaves. In fact, if the mimicker behaves, then the ethical bank has no reason to avoid the standard borrower signing the contract designed for the ethical one. Moreover we relax the self-selection constraint by considering expected profits the borrower obtains when trading with a standard bank in second-best. Therefore, the problem to be solved is the following:

$$\begin{array}{lll} \max\limits_{\Delta_{B_{11}^1}, B_{11}^{F1}, I_{11}^1} & p_H\Delta_{B_{11}^1} + p_H\Delta_\theta + \theta + B_{11}^{F1} - A & \\ s.t. & \Delta_{B_{11}^1} + \Delta_\theta \geq \dfrac{P}{\Delta_p} I_{11}^1 & \left(IC_{11}^{B1}\right) \\ & \left(p_H R^{S1} - 1\right) I_{11}^1 - p_H\Delta_{B_{11}^1} - B_{11}^{F1} + A \geq 0 & \left(IR_{11}^{L1}\right) \\ & p_H B_{0j}^{S0*} \geq p_L\Delta_{B_{11}^1} + B_{11}^{F1} + PI_{11}^1 & \left(SS_1^{B1}\right) \end{array} \tag{22}$$

Notice that in this program $\left(SS_1^{B1}\right)$ 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

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

That is:

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

Let us make the working assumption that the optimal contract is a contract with: $B_{11}^{F1} = 0$. We first characterize the optimal satisfying this property. Then we prove that no other contract can do better than the optimal one with

$B_{11}^{F1}=0$. Notice that the three constraints in Program 22 can be written as:

$$\begin{aligned} I_{11}^{1} &\leq \frac{\Delta_p}{P}\Delta_{B_{11}^{1}}+\frac{\Delta_p}{P}\Delta_\theta \quad \left(IC_{11}^{B1}\right) \\ I_{11}^{1} &\geq \frac{p_H\Delta_{B_{11}^{1}}-A}{\left(p_H R^{S1}-1\right)} \quad \left(IR_{11}^{L1}\right) \\ I_{11}^{1} &\leq \frac{p_H}{P}B_{0j}^{S0*}-\frac{p_L}{P}\Delta_{B_{11}^{1}} \quad \left(SS_{1}^{B1}\right) \end{aligned}$$

In the space $\left(\Delta_{B_{11}^{1}}, I_{11}^{1}\right)$ the boundary of the sets are straight lines. That of $\left(SS_1^{B1}\right)$ is negatively sloped while those of the other two are positively sloped. Suppose now that $\left(IC_{11}^{B1}\right)$ is binding and hence holds with equality. Then substituting $\left(IC_{11}^{B1}\right)$ into $\left(SS_1^{B1}\right)$ (which is binding) we obtain:

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

that is:

$$\begin{gathered} I_{11}^{1}=\frac{\Delta_p}{P}B_{0j}^{S0*}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\Delta_\theta= \\ \frac{\Delta_p}{P}\frac{P}{\Delta_p}\frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\Delta_\theta= \\ \frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\Delta_\theta \end{gathered}$$

and substituting back into $\left(IC_{11}^{B1}\right)$ we have the motivated borrower income:

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

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:

$$\begin{gathered} \left(p_H R^{S1}-1\right)I_{11}^{1}-p_H\Delta_{B_{11}^{1}}+A= \\ \left(p_H\Delta_{B_{11}^{1}}-1\right)\left(\frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}+\frac{\Delta_p}{P}\frac{p_L}{p_H}\Delta_\theta\right)- \\ p_H\left(\frac{P}{\Delta_p}\frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}-\frac{\Delta_p}{p_H}\Delta_\theta\right)+A= \\ -p_H\frac{R^{S0}-R^{S1}}{1+\frac{P}{\Delta_p}p_H-p_H R^{S0}}A+\left(p_H R^{S1}-1\right)\frac{\Delta_p}{P}\frac{p_L}{p_H}\Delta_\theta+\Delta_p\Delta_\theta\geq 0 \end{gathered}$$

or:

$$\left(p_H R^{S1} - 1\right) \frac{\Delta_p}{P} \frac{p_L}{p_H} \Delta_\theta + \Delta_p \Delta_\theta \geq A p_H \frac{R^{S0} - R^{S1}}{1 + \frac{P}{\Delta_p} p_H - p_H R^{S0}}$$

Recall that, from inequality (12), we are considering the following set of parameter values:

$$\Delta_\theta \geq \frac{p_H P}{\Delta_p} \frac{\left(R^{S0} - R^{S1}\right) I_{0j}^{0*}}{p_H R^{S1} - 1} = \frac{p_H P}{\Delta_p} \frac{\left(R^{S0} - R^{S1}\right)}{p_H R^{S1} - 1} \frac{A}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)}$$

Hence the participation constraint is surely satisfied if:

$$\left(p_H R^{S1} - 1\right) \frac{\Delta_p}{P} \frac{p_L}{p_H} \frac{p_H P}{\Delta_p} \frac{\left(R^{S0} - R^{S1}\right)}{p_H R^{S1} - 1} \frac{A}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)} +$$

$$p_H P \frac{\left(R^{S0} - R^{S1}\right)}{p_H R^{S1} - 1} \frac{A}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)} \geq$$

$$A p_H \frac{R^{S0} - R^{S1}}{1 + \frac{P}{\Delta_p} p_H - p_H R^{S0}}$$

which boils down into

$$\frac{p_H P}{p_H R^{S1} - 1} \geq p_H - p_L = \Delta_p$$

or

$$p_H \frac{P}{\Delta_p} - \left(p_H R^{S1} - 1\right) = 1 + \frac{P}{\Delta_p} p_H - p_H R^{S1} \geq 0$$

which is certainly satisfied for (10). Hence the participation constraint of the lender is satisfied. This implies that the two constraints, $\left(IR_{11}^{L1}\right)$ and $\left(IC_{11}^{B1}\right)$, are compatible with each other. That is, $\left(IR_{11}^{L1}\right)$ (taken with equality) crosses $\left(SS_1^{B1}\right)$ at a lower investment level, I_{11}^1, and (more importantly) at a bigger borrower's revenue, $\Delta_{B_{11}^1}$, with respect to $\left(IC_{11}^{B1}\right)$ (again taken with equality). This means that the former is characterized for the highest $\Delta_{B_{11}^1}$, 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.

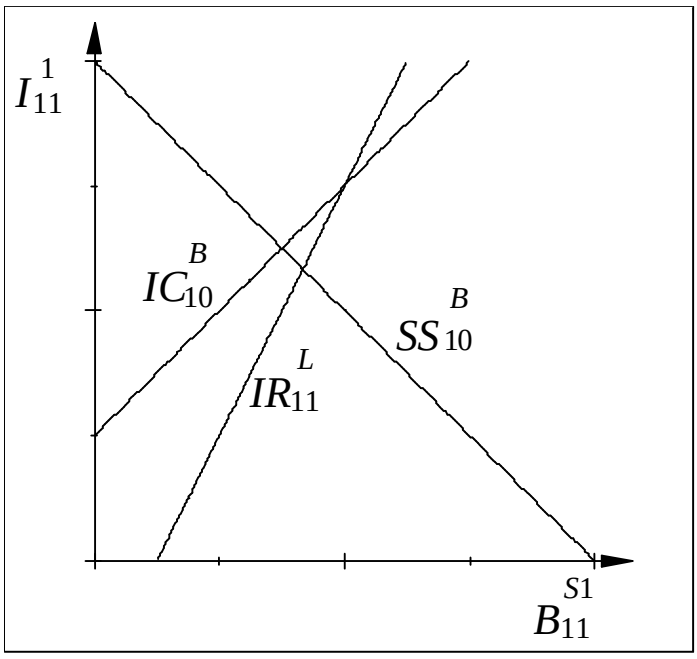

Figure 3: The three constraints in the third-best program

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

$$\left[\begin{array}{cc} \left(p_H R^{S1}-1\right) & -p_H \\ P & p_L \end{array}\right]\left[\begin{array}{c} I_{11}^1 \\ \Delta_{B_{11}^1} \end{array}\right]=\left[\begin{array}{c} -A \\ p_H B_{0j}^{S0*} \end{array}\right]$$

with solutions:

$$\begin{aligned} I_{11}^1 &= \frac{p_H^2 B_{0j}^{S0*}-p_L A}{p_L\left(p_H R^{S1}-1\right)+p_H P} \\ \Delta_{B_{11}^1} &= \frac{\left(p_H R^{S1}-1\right) p_H B_{0j}^{S0*}+AP}{p_L\left(p_H R^{S1}-1\right)+p_H P} \end{aligned}$$

This is the optimal contract with $B_{11}^{F1}=0$. Now we will prove that this is the best overall contract. Let us take the system $\left(IR_{11}^{L1}\right)$ and $\left(SS_{1}^{B1}\right)$ with equality and let us differentiate it with respect to B_{11}^{F1}, we find the following system:

$$\left[\begin{array}{cc} \left(p_H R^{S1}-1\right) & -p_H \\ P & p_L \end{array}\right] d\left[\begin{array}{c} I_{11}^1 \\ \Delta_{B_{11}^1} \end{array}\right]=\left[\begin{array}{c} 1 \\ -1 \end{array}\right] dB_{11}^{F1}$$

which implies that:

$$\frac{\partial \Delta_{B_{11}^1}}{\partial B_{11}^{F1}}=-\frac{P+p_H R^{S1}-1}{\left(p_H R^{S1}-1\right) p_L+P p_H} \tag{23}$$

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

$$\frac{dp_H R^{S1}}{dB_{11}^{F1}}=-\frac{\Delta_p\left(p_H R^{S1}-1\right)}{\left(p_H R^{S1}-1\right) p_L+p_H P}<0$$

Hence the best contract when $\left(SS_1^{B1}\right)$ and $\left(IR_{11}^{L1}\right)$ are binding is just a high incentive contract with $B_{11}^{F1}=0$.

If we assume instead that $\left(SS_1^{B1}\right)$ and $\left(IC_{11}^{B1}\right)$ are binding, we can solve $\left(IC_{11}^{B1}\right)$ for I_{11}^1 and obtain:

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

and substituting into $\left(SS_1^{B1}\right)$:

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

Hence the expected utility of the borrower is constant even if we let B_{11}^{F1} vary. However we already proved that for $B_{11}^{F1}=0$ the dominating allocation is that where $\left(IR_{11}^{L}\right)$ and $\left(SS_1^{B}\right)$ are binding, and that the latter is also the optimal contract. Therefore the best contract for this program is $B_{11}^{F1}=0$ and:

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

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

$$\begin{aligned}B_{11}^{S1**} &= \frac{p_L\left(p_HR^{S1}-1\right)+p_HP-\Delta_pp_H\left(R^{S0}-R^{S1}\right)}{p_L\left(p_HR^{S1}-1\right)+p_HP}\cdot\\ &\quad\frac{P}{\Delta_p}\frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}\end{aligned}$$

while the investment is:

$$I_{11}^{1**}=\frac{p_H^2B_{0j}^{S0*}-p_LA}{p_L\left(p_HR^{S1}-1\right)+p_HP}$$

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

$$\begin{aligned}I_{11}^{1**} &= \frac{p_L\left(p_HR^{S1}-1\right)+p_HP+p_Lp_H\left(R^{S0}-R^{S1}\right)}{p_L\left(p_HR^{S1}-1\right)+p_HP}\cdot\\ &\quad\frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}\end{aligned}$$

Note that B_{11}^{S1**} and I_{11}^{1**} do not depend on Δ_θ and, by comparison with expressions in Lemma 3, they are such that $B_{11}^{S1**}<B_{0j}^{S0*}$ and $I_{11}^{1**}>I_{0j}^{0*}$.

Moreover, since when condition (12) 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 contract is at the intersection between $\left(SS_1^{B1}\right)$ and $\left(IR_{11}^{L1}\right)$. The second-best contract is instead at the intersection between $\left(IC_{11}^{B1}\right)$ and, again, $\left(IR_{11}^{L1}\right)$. Moreover, we just proved that $\left(SS_1^{B1}\right)$ crosses $\left(IR_{11}^{L1}\right)$ at a lower I_{11}^{1**} than $\left(IC_{11}^{B1}\right)$. Since $\left(IR_{11}^{L1}\right)$ 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).

7.5.1 Ethical Banks Offer a Pooling Contract in Third-Best

An alternative possibility would be to consider a different program with no self-selection constraint and where the incentive compatibility constraint $\left(IC_{1j}^{B1}\right)$ instead of $\left(IC_{11}^{B1}\right)$ must be met, or $\Delta_{B_{1j}^1} \geq \dfrac{P}{\Delta_p} I_{1j}^1$. In fact, when $\left(IC_{1j}^{B1}\right)$ is verified, a fortiori also $\left(IC_{11}^{B1}\right)$ holds. In this case ethical banks would offer a pooling contract $(B_{1j}^{S1**},\ B_{1j}^{F1**},\ I_{1j}^{1**})$ that is potentially signed by both borrowers' types and the program to be solved would be the following:

$$\begin{array}{lll} \max\limits_{\Delta_{B_{1j}^1}, B_{1j}^{F1}, I_{1j}^1} & p_H \Delta_{B_{1j}^1} + p_H \Delta_\theta + \theta + B_{1j}^{F1} - A & \\ s.t. & \Delta_{B_{1j}^1} \geq \dfrac{P}{\Delta_p} I_{1j}^1 & \left(IC_{1j}^{B1}\right) \\ & \left(p_H R^{S1} - 1\right) I_{1j}^1 & \\ & -p_H \Delta_{B_{1j}^1} - B_{1j}^{F1} + A \geq 0 & \left(IR_{1j}^{L1}\right) \end{array} \tag{24}$$

However the two constraints in (24) are the same that must be considered in order to obtain the optimal second-best contract $(B_{i0}^{S1*}, B_{i0}^{F1*}, I_{i0}^{1*})$ that both types of lenders offer to standard borrowers undertaking ethical projects (see Subsection 3.1.2). Moreover, the premia $p_H \Delta_\theta + \theta$ for social responsibility appearing in the objective function of (24) do not affect the optimal contract. Thus, we observe that the solution of program (24) must be equivalent to $(B_{i0}^{S1*}, B_{i0}^{F1*}, I_{i0}^{1*})$, that is to the contract that is not chosen neither by standard nor by motivated borrowers at the second-best equilibrium. As a consequence, we can conclude that the more efficient allocation is the one derived by program (22).

7.6 Proof of Proposition 3

The self-selecting equilibrium derived in Lemma 8 is constrained efficient if an (alternative) pair of Pareto dominating contracts with cross-subsidies between ethical and standard banks does not exist. Thus, in a first step, we will derive the expected profits of a standard bank when providing a new contract $(B_{00}^{S0},\ B_{00}^{F0},\ I_{00}^{0})$ to a standard borrower which grants to the latter the second best expected profit plus an additional monetary transfer R; then we will check whether this additional transfer R can be paid by an ethical bank as a cross subsidy to the standard one. Cross subsidization between different types of banks is possible if ethical banks make positive profits on an alternative contract $(B_{11}^{S1}, B_{11}^{F1}, I_{11}^{1})$ that motivated borrowers prefer to $(B_{11}^{S1**}, B_{11}^{F1**}, I_{11}^{1**})$. Thus, in the second step, we will verify whether a Pareto improving new contract $(B_{11}^{S1}, B_{11}^{F1}, I_{11}^{1})$ can be offered to motivated borrowers by ethical banks that also allow to pay the transfer R to standard lenders.

First step. In this step we can define the expected profits of a standard

bank as a function of R. Expected profits are characterized as follows:

$$\begin{aligned} \max \quad & \left(p_H R^{S0} - 1\right) I_{00}^0 - p_H \Delta_{B_{00}^0} - B_{00}^{0F} + A \\ st. \quad & \Delta_{B_{00}^0} \geq \frac{P}{\Delta_p} I_{00}^0 \qquad (IC_{00}^0) \\ & p_H \Delta_{B_{00}^0} + B_{00}^{0F} \geq p_H \frac{P}{\Delta_p} \frac{A}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)} + R \quad (PC_{00}^0) \end{aligned}$$

where the right hand side of (PC_{00}^0) indicates the standard borrower's payoff when she receives the contract $(B_{0j}^{S0*}, B_{0j}^{F0*}, I_{0j}^{0*})$.

The participation constraint of the standard borrower must be binding. If not the lender can subtract a small and equal amount to B_{00}^{0S} and B_{00}^{0F} leaving $\Delta_{B_{00}^0}$ unchanged and increasing profits.

By substituting the participation constraint taken with equality into the objective function, the program becomes:

$$\begin{aligned} \max \quad & \left(p_H R^{S0} - 1\right) I_{00}^0 + \frac{1 - p_H R^{S0}}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)} A - R \\ st. \quad & \Delta_{B_{00}^0} \geq \frac{P}{\Delta_p} I_{00}^0 \qquad (IC_{00}^0) \end{aligned}$$

The objective function is thus increasing in I_{00}^0. Hence also the incentive compatibility constraint has to be binding: $\Delta_{B_{00}^0} = \frac{P}{\Delta_p} I_{00}^0$.

Now, suppose that $B_{00}^{0F} > 0$. Then one can decrease B_{00}^{0F} and increase B_{00}^{0S}, so that $p_H \Delta_{B_{00}^0} + B_{00}^{0F}$ is unchanged. The participation constraint still holds, the expected profit of the lender is unchanged, but now the incentive compatibility is slack: a contradiction. Hence it must be $B_{00}^{0F} = 0$. Thus we can study the simplified program:

$$\begin{aligned} \max \quad & \left(p_H R^{S0} - 1\right) I_{00}^0 - p_H \Delta_{B_{00}^0} + A \\ st \quad & \Delta_{B_{00}^0} = \frac{P I_{00}^0}{\Delta_p} \\ & p_H \Delta_{B_{00}^0} = p_H \frac{P}{\Delta_p} \frac{A}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)} + R \end{aligned}$$

from the (PC):

$$\Delta_{B_{00}^0}(R) = \frac{P}{\Delta_p} \frac{A}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)} + \frac{R}{p_H}$$

thus substituting in the (IC):

$$\begin{aligned} \frac{P}{\Delta_p} \frac{A}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)} + \frac{R}{p_H} &= \frac{P I_{00}^0}{\Delta_p} \\ I_{00}^0(R) &= \frac{A}{1 - p_H \left(R^{S0} - \frac{P}{\Delta_p}\right)} + \frac{\Delta_p}{P p_H} R \end{aligned}$$

substituting $\Delta_{B_{00}^0}(R)$ and $I_{00}^0(R)$ into the expected profit of the lender we derive the expected payoff as a function of the cost-minimizing transfer R :

$$\begin{aligned}\Pi_{L_0}(R) &= \left(p_H R^{S0}-1\right)\left(\frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}+\frac{\Delta_p}{Pp_H}R\right)- \\ &= p_H\left(\frac{P}{\Delta_p}\frac{A}{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}+\frac{R}{p_H}\right)+A \\ &= -\frac{\Delta_p}{P}\frac{R}{p_H}\left(1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)\right)\end{aligned}$$

thus $\Pi_{L_0}(R)<0$ if $R>0$ and $\Pi_{L_0}(R)=0$ if $R=0$.

Second step. The commercial bank makes negative profits when offering the transfer R to the standard borrower. Thus, the amount R can be paid to standard borrowers only if commercial banks receive it from ethical banks. In turn this is possible only if the ethical bank makes positive profits on motivated borrowers. Thus, we must verify whether a cross-subsidy between banks is feasible. This can be checked by solving the following program.

$$\begin{array}{lll}\max\limits_{\Delta_{B_{11}^1},B_{11}^{F1},I_{11}^1,R} & p_H\Delta_{B_{11}^1}+B_{11}^{F1}+p_H\Delta_\theta+\theta-A & \\ s.t. & \Delta_{B_{11}^1}+\Delta_\theta\geq\frac{PI_{11}^1}{\Delta_p} & \left(IC_{11}^{B1}\right) \\ & \left(\left(p_H R^{S1}-1\right)I_{11}^1-p_H\Delta_{B_{11}^1}-B_{11}^{F1}+A\right)q & \\ & -\frac{\Delta_p}{P}\frac{R}{p_H}\left(1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)\right)(1-q)\geq 0 & \left(IR_{11}^{L1}\right) \\ & p_H B_{0j}^{S0*}+R\geq p_L\Delta_{B_{11}^1}+B_{11}^{F1}+PI_{11}^1 & \left(SS_1^{B1}\right)\end{array}$$

where $\left(IR_{11}^{L1}\right)$ imposes that the cross subsidy R between the q ethical banks and the $1-q$ standard banks is feasible. Note that expected profits $\Pi_{L_0}(R)$ just derived before appears in the constraint.

We know that the solution when $R=0$ and derived in Lemma 1 lies in the intersection between $\left(IR_{11}^{L1}\right)$ and $\left(SS_1^{B1}\right)$ and corresponds to a debt contract $\left(B_{11}^{F1*}=0\right)$. Totally differentiating the previous two constraints we obtain:

$$\begin{bmatrix}-\left(p_H R^{S1}-1\right) & p_H \\ -P & -p_L\end{bmatrix} d\begin{bmatrix}I_{11}^1 \\ \Delta_{B_{11}^1}\end{bmatrix}= \begin{bmatrix}-\frac{\Delta_p}{Pp_H}\left(1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)\right)\frac{(1-q)}{q} \\ -1\end{bmatrix}dR$$

Hence:

$$\frac{d\Delta_{B_{11}^1}}{dR}=\frac{p_H\left(p_H R^{S1}-1\right)q-(p_H-p_L)\left(1-p_H\left(R^{S0}-\frac{P}{(p_H-p_L)}\right)\right)(1-q)}{p_H(Pp_H+(p_H R^{S1}-1)p_L)q}$$

Therefore $\frac{d\Delta_{B_{11}^1}}{dR} < 0$ iff:

$$q < \frac{1}{\frac{p_H(p_H R^{S1}-1)}{(p_H-p_L)\left(1-p_H\left(R^{S0}-\frac{P}{(p_H-p_L)}\right)\right)}+1} = \bar{q}$$

and since one can check that:

$$(p_H-p_L)\left(1-p_H\left(R^{S0}-\frac{P}{(p_H-p_L)}\right)\right) > p_H\left(p_H R^{S1}-1\right)$$

it must be: $\bar{q} > \frac{1}{2}$. Thus, $q < \frac{1}{2}$ is a sufficient condition for $\frac{d\Delta_{B_{11}^1}}{dR} < 0$. The previous inequality means that, as R increases, $B_{11}^{S1} - B_{11}^{F1}$ decreases. As a consequence, if $B_{11}^{F1} = 0$, we can conclude that the candidate equilibrium contract with cross-subsidy is not welfare improving.

The three constraints can be rewritten as:

$$\begin{array}{cc} I_{11}^1 \leq \frac{\Delta_p}{P}\Delta_{B_{11}^1} + \frac{\Delta_p}{P}\Delta_\theta & \left(IC_{11}^{B1}\right) \\ I_{11}^1 \geq \frac{p_H\Delta_{B_{11}^1}-A}{p_H R^{S1}-1} + \frac{\Delta_p}{P}\frac{R}{p_H}\frac{1-p_H\left(R^{S0}-\frac{P}{\Delta_p}\right)}{p_H R^{S1}-1}\frac{(1-q)}{q} & \left(IR_{11}^{L1}\right) \\ I_{11}^1 \leq \frac{p_H}{P}B_{0j}^{S0*} - \frac{p_L}{P}\Delta_{B_{11}^1} + \frac{R}{P} & \left(SS_1^{B1}\right) \end{array}$$

Notice that as R increases, the (SS) line in Figure 3 moves up, while line (IR) moves left. $\left(IC_{11}^{B1}\right)$ instead does not move. Hence, the equilibrium could lie on the intersection between $\left(IC_{11}^{B1}\right)$ and $\left(IR_{11}^{L1}\right)$, for R quite big. However from that point on it would still be true that $\frac{d\Delta_{B_{11}^1}}{dR} < 0$, because $\left(IC_{11}^{B1}\right)$ is unchanged and $\left(IR_{11}^{L1}\right)$ moves left.

It still remains to be verified whether, in the optimal contract with cross-subsidy, $B_{11}^{F1} = 0$. One can check that if the optimal contract is in the intersection between $\left(IR_{11}^{L1}\right)$ and $\left(SS_1^{B1}\right)$ the $\frac{\partial\Delta_{B_{11}^1}}{\partial B_{11}^{F1}}$ is identical to (23) and negative. Therefore an increase in B_{11}^{F1} lowers welfare. If the optimal contract is instead in the intersection between $\left(IC_{11}^{B1}\right)$ and $\left(IR_{11}^{L1}\right)$, it is easy to check that an increase in B_{11}^{F1} would leave the line $\left(IC_{11}^{B1}\right)$ unchanged in Figure 3, but move the line $\left(IR_{11}^{L1}\right)$ to the left, and cause a decrease in welfare.

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