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State intervention and the microcredit market: the role of business development services

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Abstract We analyze in this paper how various forms of state intervention can impact microfinance institutions' lending behavior. Using a simple model where entrepreneurs receive individual uncollateralized loans, we show that, not surprisingly, state intervention through the loan guarantee increases the number of entrepreneurs receiving a loan. However, after modeling business development services (BDS) provided by the microfinance institution, we show that the loan guarantee can have a counterproductive effect by reducing the number of entrepreneurs benefiting from such services. We therefore analyze an alternative policy: BDS subsidization. We show that if BDS are efficient enough and are targeted toward less performing borrowers, then—for fixed government expenditures—such subsidies do better in terms of financial inclusion than the loan guarantee. Moreover, we argue that—under similar conditions—BDS subsidization alone does better in terms of financial inclusion than a mix of policies.

Keywords Microcredit · Loan guarantee · Business development services · Microfinance institution

JEL Classifications D82 · G20 · G21 · G28 · H21 · L26

1 Introduction

In this paper we examine the role of government intervention on the microcredit market. We analyze the case of nonprofit microfinance institutions that provide individual loans and benefit from state intervention through direct subsidies or loan guarantees.[1] This intervention seems to be mainly due to the positive effect of microcredit on employment and poverty alleviation through self-employment and

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[1] Individual lending, as well as state intervention, are classical in developed countries and are spreading in developing ones. For a discussion about government intervention in microfinance in Latin America see the article "Governments in microfinance: threat or opportunity?" by Bate at http://www.iadb.org/en/news/webstories/2007-11-09/governments-in-microfinance-threat-or-opportunity,4134.html, accessed 21 November 2013.

entrepreneurship. Facilitating the access to microcredit is in turn expected to benefit the state by reducing other social expenses. Although, to our knowledge, it has never been showed by rigorous evaluation methods, most of the actors of the sector expect microcredit to create externalities on social expenses. In this paper, we analyze and compare various forms of public subsidies.

Microcredit is generally defined as a small loan to individuals in poverty designed to encourage entrepreneurship or access to employment. Microborrowers often lack collateral, rarely have steady employment, and their credit history can hardly be verified. More generally, these individuals cannot meet the minimum requirements to access the traditional credit market, and microcredit is often considered to be a solution to exclusion from the traditional banking system and, consequently, to credit rationing.

According to the academic literature, state intervention via loan guarantees (as opposed to direct subsidies) is considered to be the most efficient measure in dealing with credit rationing. By participating in this specific market, government impacts both the *pure rationed* borrowers (who do not receive credit despite sharing the same characteristics with accepted borrowers and are willing to pay a higher interest rate) and the *redlined* borrowers (who do not receive credit at any interest rate because their projects do not generate a high-enough return to the lender).[2] In the case of small business lending, microfinance institutions (MFIs hereafter) are strongly involved in business development services (BDS). They entail devices offered in addition to loans that aim at increasing the chances for the project to succeed. These devices mostly consist in training programs, for example, in accounting or management. In this paper, we shed light on the impact of state intervention on BDS provision.

To do so, we base our work on Tirole's model of credit rationing in which borrowers are heterogeneous according to their project return and can enhance the probability of project success by exerting a costly and unobservable effort (Tirole 2005). To adjust to the case of microcredit, we model borrowers without any initial capital endowment and MFIs that lend without collateral requirements.

In this basic setting, we first introduce state intervention through the loan guarantee (which is common in microcredit mostly in developed countries[3]). We allow the state to pay back to the lending institution a proportion of the capital lost if the entrepreneur's project fails. Not surprisingly, we find that whatever the size of the guarantee, such a policy increases the number of entrepreneurs that receive a loan by widening the range of project returns optimally financed by the bank.

The key contribution of our work consists in analyzing how the loan guarantee interacts with BDS (or training more generally), another key feature of microcredit targeting small businesses. To develop the analysis, we allow MFIs to invest in a device that increases the probability of project success. In the absence of the state guarantee, BDS crowd-in a number of the excluded borrowers if and only if the relative gain generated by this measure is lower than its relative cost. However, when both BDS and the state guarantee are modeled, the loan guarantee can have a "perverse" effect, since it can reduce the incentive for the MFIs to provide BDS. In particular, assuming that project returns are uniformly distributed among borrowers, we show that the number of additional borrowers financed through BDS is larger when state does not guarantee loans. The intuition behind this result is that, from the point of view of the MFI, the loan guarantee decreases the expected return on BDS.

Such a counterproductive effect leads us to model an alternative policy that would consist in subsidizing BDS. To be able to compare between policies, we analyze under what circumstances a government with a fixed budget would prefer to subsidize BDS rather than to guarantee loans. We show that subsidizing BDS brings better results (in terms of financial inclusion) than the loan guarantee provided that the BDS are efficient enough and target the projects with the lowest return. Moreover, we find that by mixing policies (i.e., by providing both loan guarantee and BDS subsidization), the state can get rid of the perverse effect. Nevertheless, the largest financial inclusion is achieved when the entire state budget is

[2] For detailed definitions of different types of credit rationing (see Jaffee and Stiglitz 1990, pp. 847–849).

[3] For example, the European Commission and the European Investment Bank started providing loan guarantee for microcredits in the European Union by launching the European Progress Microfinance Facility in 2010.

allocated to BDS subsidization and when BDS target otherwise excluded borrowers.

We now provide an overview of the existing literature with reference to this paper. As we have already mentioned, microcredit provides a solution to the borrowers who are excluded from the traditional credit market. In the academic literature, these individuals are denoted as either "rationed" or "redlined" borrowers (see, e.g., Stiglitz and Weiss 1981; Jaffee and Stiglitz 1990). Stiglitz and Weiss (1981) show in particular that, for a given interest rate, there exists a critical value of return below which the bank does not finance the project. One of the aims of our paper is to analyze how such a threshold evolves depending on the state intervention in the case of microcredit (i.e., of uncollateralized loans). Note that we do not model explicitly "small" loans, which is unarguably an important characteristic of microcredit. Therefore, our model could be understood as a model of social banking (microfinance institutions being a particular example of social banks). Nevertheless, by modeling other important aspects of microfinance, such as the lack of collateral requirements, the presence of the loan guarantees, and business development services, we proceed in the following sections by applying our model to the microfinance field.

Our paper is not the first to study the effect of the loan guarantee. Craig et al. (2007) analyze empirically the case of Small Business Administration, a program providing small firm loan guarantees in the USA, and find a positive and significant link between the level of SBA lending and local economic growth. In a subsequent paper, Craig et al. (2008) find a positive link between the average annual level of employment in the local market and SBA lending. These papers present a rationale for government intervention in small firm lending in general, but especially in microcredit lending that directly promotes self-employment and small start-ups.

The importance of government intervention in credit rationing is also highlighted in the case of France in a paper by Aubier and Cherbonnier (2007). They show evidence that credit rationing was significant during the 2001–2004 period for small- and medium-sized enterprises. State intervention, mostly through loan guarantee, is presented as a mean to reduce credit rationing. Facilitating access to entrepreneurship then benefits the state by reducing other expenses (unemployment benefits, etc.) according to Brabant et al. (2009), in a report for the French Ministry for the Economy and Finance. From a theoretical point of view, Emran et al. (2011) analyze how microcredit market interacts with labor market in a macroeconomic model. In the present paper, we disregard the interactions with other markets and focus on partial equilibrium on the microcredit market. More precisely, we do not study the financial efficiency of state intervention and exogenously assume that the state's objective is to improve financial inclusion, which is to crowd-in more entrepreneurs.

Regarding the comparison of various policies on the credit market, Gale (1990) analyzes the effects of federal policies on credit allocation and economic efficiency in a model with adverse selection. He argues that the loan guarantee is more efficient than pure direct lending programs and pure interest subsidy as it operates through raising the return to the bank. Adding business development services to the analysis and focusing on moral hazard rather than adverse selection, we enrich this discussion regarding indirect subsidies. More precisely, we show that the loan guarantee might be less efficient than other indirect subsidies that can impact the (expected) return to the bank. However, contrarily to Gale (1990), we do not analyze the effects in terms of welfare.

The relationship between microcredit and subsidies is historical. Grameen Bank, for example, has constantly benefited from subsidies despite reporting profits (Morduch 1999).[4] Moreover, subsidized programs perform better (than unsubsidized ones) in outreaching the poorest borrowers (Morduch 2000). Unsubsidized MFIs sacrifice one dimension of their social performance either by setting higher interest rates, targeting richer clients or decreasing the share of female borrowers (D'Espallier et al. 2013).

Still, the academic literature on microfinance subsidization remains relatively scarce, mainly due to difficulties in obtaining high quality data. One exception is Hudon and Traça (2011) who find that subsidies generally increase the efficiency of MFIs. This may be related to the concept of "smart subsides" defined by Armendariz and Morduch (2010, p. 333) as

[4] Cull et al. (2007) confirm the existence of MFIs having achieved the "ultimate promise of microfinance" (i.e., self-sustainability and large outreach to the poor). However, according to this study such MFIs are mainly exceptions.

"carefully designed interventions that seek to minimize distortions, mistargeting and inefficiencies while maximizing social benefits". Mieno and Kai (2012) also advocate the use of such subsidies. They find that subsidies received at the early stage reduce the cost pressure for start-up MFIs and therefore allow them to achieve economies of scale. Finally, Armendariz et al. (2011) argue that subsidization is efficient as long as there is no uncertainty regarding the timing or the amount of subsidies.

More generally, academic literature on microcredit design is mainly about developing countries where group lending was—until recently—both the norm and the explanation for the success of microcredit. Townsend (2003), however, questions this idea and argues that the choice between individual and group lending is not simple. Particularly, group-lending prevalence depends on the economy-wide average wealth: richer economies should experience less group lending. This analysis might explain why individual lending is prevalent in developed countries. Still, the key role of peer-lending in explaining high repayment rates in microcredit in developing countries has been recently challenged by Giné and Karlan (2009) and individual lending now also spreads in developing countries (for example in Grameen Bank in Bangladesh[5] and in BancoSol in Bolivia).

The originality of our work lies mostly in the modeling of business development services (i.e., training of the entrepreneurs by the MFI) that complements microcredit as a tool of financing excluded individuals. Non-financial services provided by MFIs are termed "Microfinance-Plus" in Lensink and Mersland (2009). These kinds of programs are very popular in developed countries where they generally take the form of entrepreneurial training. In developing economies, however, this "plus" services often take the form of social trainings, including health or educational services.

Several papers empirically assess the impact of these types of non-financial services. One example is Karlan and Valvidia (2011) who study training programs in Peru using randomized controlled trials and show that they have little effect for borrowers in this context. Another example is Lensink et al. (2011) who use data for MFIs in 61 countries. They show that MFIs providing both finance and business development services have similar performance as MFIs providing no "plus" services. However, MFIs with social services do significantly better in terms of outreach.[6]

The rest of the paper is structured as follows. In the next section, we lay out the basic model and analyze the "laissez-faire" benchmark. We then introduce successively the state guarantee (Sect. 3) and business development services (Sect. 4). After having shown that the state guarantee can have a counterproductive effect on business development services, we analyze the alternative policy of business development services subsidization in Sect. 5. In Sect. 6 we model a mix of policies where state both guarantees loans and subsidizes BDS. Section 7 concludes and presents some possible extensions and limitations of the model.

2 The model

Our modeling is based on the classical corporate finance model (see, e.g., Tirole 2005). It consists of a continuum of risk-neutral entrepreneurs,[7] each endowed with a project that needs a financing D (identical for all agents). Each project can either succeed and generate a return of ρD or fail and give zero return (the invested capital is then lost). The return on investment (ρ) is assumed to be heterogeneous among agents (and distributed on $[\underline{\rho}, \overline{\rho}]$). To increase the probability of success, an entrepreneur must exert a costly effort (unobserved by the MFI). For simplicity, we assume that there are only two possible levels of effort, high (the entrepreneur behaves) and low (the entrepreneur misbehaves). The probability of success with high effort ($\overline{p}$) is higher than the probability of success with low effort ($\underline{p}$): $\overline{p} > \underline{p}$. However, if an entrepreneur chooses to exert a low effort, he receives a private benefit, ψ. If the entrepreneur behaves, he receives no private benefit.

[5] For a discussion on the reasons of shifting from group lending to individual lending see the article by Yunus "Grameen Bank II: Lessons Learnt Over Quarter of A Century" at http://www.grameen.com/index.php?option=com_content&task=view&id=30&Itemid=0, accessed 22 November 2013.

[6] For detailed examples of MFIs providing (themselves or not) non-financial services (see Dunford 2001).

[7] Risk aversion of borrowers won't impact our results, as there are no first derivative effects.

The principal (an MFI, or more generally a social bank) then chooses the projects she invests in (that is the borrowers she lends D to) and sets the interest rate (r). We assume that the expected profit of the MFI has to be zero for each contract. This framework corresponds well to situations where MFIs are not for profit or face important competition.[8] However, this setting is less appropriate for markets where competition is low and MFIs claim for profit objectives [for example Compartamos of Mexico (see Rosenberg 2007)].

The moral hazard issue comes from the unobservability of entrepreneurs' effort by the MFI.[9] For an entrepreneur to exert high effort, the interest rate has to be incentive compatible. The zero expected profit condition together with the incentive compatibility constraint will therefore give the minimum project return threshold to receive financing and the interest rate.

In contrast to Tirole (2005), we assume that entrepreneurs have no capital to invest in their project. This difference allows our model to capture the specific feature of the microcredit market where borrowers often lack collateral.

Moreover, in line with Tirole (2005), we assume that the projects are only viable when the entrepreneur behaves, meaning that (1) the net present value (NPV) in this case is positive, i.e., $\overline{p}\rho > 1\ \forall\rho$, or $\overline{p}\underline{\rho} > 1$ and (2) the NPV of the projects is negative if the borrower misbehaves, meaning that $\underline{p}\rho < 1 - \frac{\psi}{D}\ \forall\rho$ or $\underline{p}\overline{\rho} < 1 - \frac{\psi}{D}$.[10]

Let us first solve the model under "laissez-faire", that is without state intervention. The entrepreneur receives the total return of the project net of the capital due to the bank. He receives $\rho D - (1+r)D$ if the project succeeds and zero if it fails. We assume that $\rho > 1 + r$. Therefore, the entrepreneur will face the following incentive compatibility constraint:

$$\overline{p}[\rho D - (1+r)D] \geq \underline{p}[\rho D - (1+r)D] + \psi \tag{1}$$

This amounts, for a given interest rate, to the minimum return for which the borrower exerts high effort:[11]

$$\rho_{\min} = \frac{\psi}{D\Delta p} + (1+r) \tag{2}$$

where $\Delta p = \overline{p} - \underline{p}$.[12]

When borrowers exert high effort, the expected profit of the MFI writes (note that it is independent of project return):

$$E(\pi) = \overline{p}(1+r)D - D \tag{3}$$

and the zero-profit condition gives the benchmark interest rate:

$$\overline{r} = \frac{1-\overline{p}}{\overline{p}} \tag{4}$$

Introducing the latter expression for the interest rate in (2), we find that the bank will invest in all the projects generating a return higher or equal to the threshold $\rho_{\min}$:

$$\rho_{\min} = \frac{\psi}{D\Delta p} + \frac{1}{\overline{p}} \tag{5}$$

Up to now, our modeling of microcredit was limited to a classic loan without collateral. However, at least two other major aspects are key to microcredit: state guarantee and business development services. Let us successively include these two patterns starting with the loan guarantee.

[8] Cull et al. (2011) argue that microfinance industry faces increasing competition and McIntosh and Wydick (2005) show that competition among MFIs decreases their capacity to use cross-subsidization.

[9] We, however, assume here that the actual investment and the success of the project are verifiable. In other words, we do not consider the case where delinquent borrowers cannot be compelled to reimburse their credit (see Anderson et al. 2009).

[10] We keep these assumptions on the viability of the project for the rest of this paper. The presentation of the conditions on NPV changes when the loan guarantee and BDS are introduced. Because of their limited interest we do not present them for each model. Note that they do not alter our results.

[11] Note that the minimal threshold for the project return is indeed always $>1 + r$. This will always be the case in the rest of the paper.

[12] A stronger moral hazard issue consists in the incentive for the borrower not to leave with the cash. In our model, this constraint would correspond to $\overline{p}$ being high enough. Still, it seems that in real world such an incentive is driven by future borrowing opportunities and sustainable financial inclusion (for example through the inclusion in the mainstream banking sector by the creation of a credit history). A more complete model would therefore include the value of future opportunities—from the viewpoint of the borrower—in case of success. This will not change our results. More precisely, in the case of a net present value of future borrowing opportunities V, independent of project's present return ρ, this would just add a term $-V/D$ to Eq. (2). This term being present in all the models presented hereafter, it does not impact our comparisons and conclusions.

3 The introduction of the loan guarantee

The loan guarantee is an essential tool for the expanding microcredit market.[13] By reducing the risk taken by the MFI, such a policy aims at crowding in a part of the initially excluded borrowers.

In accordance with real world experience (see previous footnote), we assume that the state guarantees a proportion $\gamma < 1$ of the outstanding loan if the project fails. As it only impacts the consequence of project failure for the MFI, it changes neither borrowers' return nor their incentive compatibility constraints. However, the zero expected profit condition then becomes:

$$E(\pi) = \overline{p}(1 + r_\gamma)D + (1 - \overline{p})\gamma D - D = 0 \quad (6)$$

leading to an interest rate equal to:

$$r_\gamma = \frac{1 - \overline{p}}{\overline{p}}(1 - \gamma) \quad (7)$$

which is, not surprisingly, lower than the benchmark interest rate. We end up [using (2)] with

$$\rho_\gamma = \frac{\psi}{D\Delta p} + \frac{1 - \gamma(1 - \overline{p})}{\overline{p}} \quad (8)$$

where ρ_γ represents the minimum return that a project should generate to be financed by the MFI, in the presence of the state guarantee.

Therefore, as expected, the minimum project productivity threshold required for financing decreases due to the loan guarantee ($\rho_\gamma < \rho_{\min}$). The intuition behind this result is simple: the interest rate represents an "insurance" for the bank against high-risk agents. With the loan guarantee, the government will bear a part of this costly "insurance". The MFI will provide microcredits at a lower interest rate. Hence, a higher number of the entrepreneurs will optimally exert high effort and a higher number of the projects will be financed. Thus, the loan guarantee reduces credit rationing and can therefore allow the state to save on other social expenses, such as unemployment benefits.[14] It is important to emphasize that we do not investigate the financial efficiency of a loan guarantee program. The total gains from successful microcredit cannot indeed be easily identified as it may lead to lower unemployment benefits, better education for children or better health for example. Obviously, there is a range of non-appropriable benefits ignored by the single market approach that should be taken into account. However, the cost–benefit analysis is beyond the scope of this paper.[15]

4 Modeling business development services (BDS)

As we have already noted, business development services are another key feature of small business microfinance. MFIs often provide services that aim at increasing the probability of entrepreneurs' projects to succeed (for example accounting or management trainings that help microborrowers to run their business).

We model business development services as an action provided by the MFI (at a fixed cost K per contract) that increases by an amount ε the probability of entrepreneur's project to succeed. For the sake of simplicity, BDS are modeled as uniformly increasing the probability of project success.[16] If the MFI provides BDS, the probability of success with high and low effort becomes, respectively, $\overline{p}_\varepsilon = \overline{p} + \varepsilon$ and $\underline{p}_\varepsilon = \underline{p} + \varepsilon$. The independence of the increase in the probability of success as a result of BDS from borrower's effort considerably simplifies the model. It implies that entrepreneur's behavior does not depend on the choice of MFI to provide BDS (it does not change Δp). Therefore, the incentive compatibility constraint in the presence of BDS remains the same

[13] For example, in France, several public organisms guarantee capital in case of loss: the "Fonds de Cohésion Sociale" or Caritas (50 % of the outstanding principal and unpaid interest) for consumer loans (that aim at financing goods that contribute to job seeking, such as cars, computers, business suits) and "France Active Garantie" (70 % of the outstanding principal) for self-employment or small business loans. These guarantees are free from the MFI's point of view. More recently the European Commission and the European Investment Bank started providing up to 75 % guarantee for microcredits in the European Union through the European Progress Microfinance Facility.

[14] According to Brabant et al. (2009), it is cheaper—in the case of France—to subsidize entrepreneurship than to pay welfare benefits to microborrowers.

[15] Such an analysis would still be very difficult to implement, as noted in Armendariz and Morduch (2010).

[16] In a broader model, BDS could be correlated with the level of effort put in the project, its intrinsic quality or the entrepreneur's ability.

[inequality (1)], and the minimum project return compatible with effort is still defined by Eq. (2). However, relaxing this assumption—and allowing for some complementarity between BDS and effort—will loosen the incentive constraint of the borrowers. This will therefore tend to increase the range of borrowers financed in the presence of business development services.

4.1 In the laissez-faire case

Let us assume for now that the lending institution bears the cost of the business development services, K (independent from the project productivity ρ). In case it provides BDS, the expected profit of the MFI is:

$$E(\pi) = (\overline{p} + \varepsilon)(1 + r_\varepsilon)D - D - K = 0 \tag{9}$$

and the equilibrium interest rate charged to clients receiving BDS is:

$$r_\varepsilon = \frac{1 - (\overline{p} + \varepsilon)}{\overline{p} + \varepsilon} + \frac{K}{(\overline{p} + \varepsilon)D} \tag{10}$$

Note that it is not straightforward to compare the equilibrium interest rate in the presence of BDS and the benchmark interest rate $\bar{r}$. Finally, using (2) and (10), we find the minimum return required by the MFI when it engages in BDS:

$$\rho_\varepsilon = \frac{\psi}{D\Delta p} + \frac{1}{\overline{p} + \varepsilon} + \frac{K}{(\overline{p} + \varepsilon)D} \tag{11}$$

Lemma 1 *The availability of business development services will increase the financial inclusion of borrowers (i.e., $\rho_{\min} > \rho_\varepsilon$) if and only if*

$$\frac{\varepsilon}{\overline{p}} > \frac{K}{D} \tag{12}$$

that is if and only if the relative gain in probability of success generated by business development services exceeds its relative cost.

In other words, the condition in Lemma 1 states that BDS will be provided only in case where the cost of the training is not too high to the MFI.[17] If the latter condition is not satisfied, i.e., if $\rho_{\min} < \rho_\varepsilon$, no BDS will be provided as they will not crowd-in any additional borrower. On the contrary, if $\rho_{\min} > \rho_\varepsilon$, all the entrepreneurs with projects generating a return belonging to the interval $[\rho_\varepsilon, \rho_{\min})$ will be financed and will receive BDS. Regarding the entrepreneurs with project return higher than $\rho_{\min}$, the MFI is indifferent between providing them BDS (and charging them the interest rate r_ε) or not (and charging them the interest rate $\overline{r}$). However, one can imagine that the presence of capacity constraints (for training groups for example) insures that only borrowers who need BDS in order to be financed (those with $\rho < \rho_{\min}$) will receive these services.

4.2 In the presence of the state guarantee

Let us now study how business development services interact with the state guarantee. This is a promising analysis as intuition suggests that state intervention might lower the incentive for the MFI to provide such services.

When the state guarantees a proportion γ of the loan, the zero-profit condition of an MFI providing BDS writes:

$$E(\pi) = (\overline{p} + \varepsilon)\left(1 + r_{\gamma\varepsilon}\right)D + (1 - (\overline{p} + \varepsilon))\gamma D - D - K = 0 \tag{13}$$

implying:

$$r_{\gamma\varepsilon} = \frac{1 - (\overline{p} + \varepsilon)}{\overline{p} + \varepsilon}(1 - \gamma) + \frac{K}{(\overline{p} + \varepsilon)D} \tag{14}$$

While it is easy to note that $r_{\gamma\varepsilon} < r_\varepsilon$ (the state guarantee decreases the interest rate), the comparison of $r_{\gamma\varepsilon}$ with r_γ is not trivial. Put differently, as in the previous section, depending on their cost, business development services may increase the interest rate.

As previously, our simplifications ensure that borrowers' behavior is not impacted by BDS. Therefore, using Eq. (2), we obtain the minimum return required by the bank in the presence of both

[17] Assuming complementarity between BDS and effort, the condition in Lemma 1 becomes weaker $\frac{\varepsilon}{\overline{p}} + \frac{\psi}{D} \cdot \frac{\Delta p_\varepsilon - \Delta p}{\Delta p \Delta p_\varepsilon}(\overline{p} + \varepsilon) > \frac{K}{D}$, where $\Delta p_\varepsilon > \Delta p$ represents the difference between the probabilities of success with and without effort in the presence of BDS. Moreover, if $\Delta p < \Delta p_\varepsilon$, then $\rho_\varepsilon < \rho_{\min}$ would not necessarily imply $r_\varepsilon < \overline{r}$.

business development services and the state guarantee:

$$\rho_{\gamma\varepsilon} = \frac{\psi}{D\Delta p} + \frac{1-\gamma(1-(\overline{p}+\varepsilon))}{\overline{p}+\varepsilon} + \frac{K}{(\overline{p}+\varepsilon)D} \quad (15)$$

We therefore have $\rho_{\gamma\varepsilon} < \rho_{\varepsilon}$ and obviously, in the presence of BDS, the state guarantee increases the range of borrowers who are financed. However, it is not clear whether BDS are actually used in the presence of the state guarantee (that is if $\rho_{\gamma\varepsilon} < \rho_{\gamma}$). Lemma 2 provides the condition under which BDS crowd-in additional borrowers when loans are guaranteed.

Lemma 2 *In the presence of the state guarantee, the provision of BDS by the MFI will increase the financial inclusion (i.e., $\rho_{\gamma\varepsilon} < \rho_{\gamma}$) if and only if*

$$\frac{\varepsilon}{\overline{p}} > \frac{K}{(1-\gamma)D} \quad (16)$$

Under condition (16), the MFI will provide BDS to borrowers with project returns between $\rho_{\gamma\varepsilon}$ and ρ_{γ}, and will be indifferent between providing or not BDS to borrowers with $\rho > \rho_{\gamma}$. Still, in the presence of capacity constraints for training programs, it is consistent to assume that BDS are only offered to borrowers with $\rho < \rho_{\gamma}$, who would not be financed otherwise. Comparing Lemma 1 and Lemma 2, it appears that condition (12) is weaker than condition (16). This might indicate that BDS crowd-in less borrowers when the state guarantees loans. This is clearly the case when $\frac{K}{D} < \frac{\varepsilon}{\overline{p}} < \frac{K}{(1-\gamma)D}$ as then no borrowers are crowded-in in the presence of the state guarantee through BDS, contrarily to what would happen without state intervention. Whether this is also the case when BDS are used in the presence of loan guarantee (that is when $\frac{\varepsilon}{\overline{p}} > \frac{K}{(1-\gamma)D}$) depends on the distribution of project returns. Business development services then crowd-in borrowers with project returns in between ρ_{ε} and $\rho_{\min}$ in the absence of state intervention; and in between $\rho_{\gamma\varepsilon}$ and ρ_{γ} if the state guarantees loans.

In the simple case of a uniform distribution of project returns, less borrowers will be financed through BDS in the presence of the state guarantee if $\rho_{\gamma} - \rho_{\gamma\varepsilon} < \rho_{\min} - \rho_{\varepsilon}$. As we have

$$\rho_{\gamma} - \rho_{\gamma\varepsilon} = \frac{\varepsilon D(1-\gamma) - K\overline{p}}{\overline{p}(\overline{p}+\varepsilon)D} \quad (17)$$

and

$$\rho_{\min} - \rho_{\varepsilon} = \frac{\varepsilon D - K\overline{p}}{\overline{p}(\overline{p}+\varepsilon)D}. \quad (18)$$

Proposition 1 holds.

Proposition 1 *Under condition (16) , if the distribution of the project returns is uniform, the number of additional entrepreneurs financed through business development services is larger without the state guarantee.*

The intuition behind this finding relies on the return to the MFI from BDS in the presence of the state guarantee which writes:

$$\varepsilon D[(1+r)-\gamma]$$

and is decreasing in γ. This negative relation explains why the MFI is less incited to provide BDS if it benefits from the loan guarantee. As a result, less borrowers are crowded-in through BDS under the loan guarantee compared with no state intervention. Proposition 1 can be related to classical results in the insurance literature. In our context, BDS can indeed be understood as a self-protection effort (an effort that decreases the probability of incurring a loss) exerted by the MFI. The loan guarantee can be interpreted as a (free) insurance for the MFI (by decreasing the size of the potential loss). Therefore, our result is related to the substitutability between insurance and self-protection, found when the price of insurance is independent of the effort of self-protection (Ehrlich and Becker 1972).

Proposition 1 might, however, not hold if the distribution of the project returns is not uniform. In particular, if project returns are highly concentrated on the interval $[\rho_{\gamma}, \rho_{\gamma\varepsilon}]$, then a smaller interval would not necessarily result in a smaller number of financed projects. Moreover, Proposition 1, only holds under condition (16) implying that the cost of BDS should be low enough.

5 An alternative policy: business development services subsidization

The possible perverse effect that the state guarantee can have on business development services leads us to analyzing an alternative policy that consists of BDS subsidization. Such a policy encompasses both the direct subsidization of the cost of BDS paid by the MFI and the subsidization of NGOs or associations that offer BDS to microborrowers. Our approach can again be related to papers in the insurance field that analyze subsidies or the public provision of preventive goods (see, e.g., Arnott and Stiglitz 1986; Lee 1992). However, all these papers mainly discuss the effect of such policies on the price of insurance which is absent in our model (as we assume that the loan guarantee is free from the viewpoint of the MFI).

The aim of this section is to identify when BDS subsidization will do better in terms of financial inclusion compared with the loan guarantee coupled with unsubsidized BDS. To do so, we compute the minimum project return required by the MFI when the government subsidizes business development services and compare it with the one with the state guarantee and unsubsidized BDS. This comparison will then allow us to define the most effective policy when the objective of the government is to increase the number of the entrepreneurs financed under a fixed budget constraint.

We assume that if the government chooses to subsidize BDS, it bears the total cost of the program. Under subsidization, the MFI benefits from the increase in the probability of success of the projects without paying the cost of BDS. The zero-profit constraint for subsidized borrowers writes:

$$E(\pi) = (\overline{p} + \varepsilon)(1 + \widetilde{r})D - D = 0 \tag{19}$$

which gives as interest rate:

$$\widetilde{r} = \frac{1 - (\overline{p} + \varepsilon)}{\overline{p} + \varepsilon} \tag{20}$$

Using (2), the minimum project productivity threshold is then:

$$\widetilde{\rho} = \frac{\psi}{D\Delta p} + \frac{1}{\overline{p} + \varepsilon} \tag{21}$$

that we compare with the minimum project return threshold under the state guarantee and unsubsidized BDS, (i.e., $\rho_{\gamma\varepsilon}$).

Lemma 3 *The necessary conditions for BDS subsidization to increase the financial inclusion with respect to loan guarantee (i.e., $\widetilde{\rho} < \rho_{\gamma}$ and $\widetilde{\rho} < \rho_{\gamma\varepsilon}$) are*

$$\frac{\varepsilon}{\overline{p} + \varepsilon} > \gamma(1 - \overline{p}) \tag{22}$$

and

$$K > \gamma D(1 - (\overline{p} + \varepsilon)) \tag{23}$$

The above Lemma states that BDS subsidization will crowd-in more borrowers than the loan guarantee if (1) BDS are efficient enough and (2) the amount spent on BDS subsidization (for the borrowers with lowest project returns) is greater than the expected amount spent on the loan guarantee.

Lemma 3 provides conditions under which subsidizing BDS for borrowers with a return $\rho < \rho_{\min}$ will crowd-in more borrowers than guaranteeing a proportion γ of all the loans. An interesting question consists in analyzing to what extent these conditions can be fulfilled when the state budget is held fixed among the two policies. To answer this question, we assume that the government faces a fixed budget equal to $n_s K$, where n_s is the number of borrowers benefiting from BDS subsidization. We infer the rate of guarantee $\overline{\gamma}$ corresponding to the fixed budget condition.[18] Letting n be the total number of financed borrowers, and n_ε be the number of borrowers financed through unsubsidized BDS,[19] the fixed budget condition writes:

$$[n_\varepsilon(1 - (\overline{p} + \varepsilon)) + (n - n_\varepsilon)(1 - \overline{p})]\overline{\gamma}D = n_s K \tag{24}$$

[18] For the sake of simplicity we assume that the guarantee rate adjusts such that the total expected expenditure in the case of the loan guarantee is equal to the total expenditure in the case of full subsidization of BDS. An alternative strategy could be considering partial subsidization of BDS.

[19] n_ε is smaller or equal to n as we have seen in Sect. 4.2 that the MFI is indifferent between offering or not BDS to clients with project returns higher than ρ_γ. The MFI might have an incentive not to offer BDS to all the borrowers due to capacity constraints.

leading to

$$\overline{\gamma} = \frac{n_s K}{[n_\varepsilon(1-(\overline{p}+\varepsilon)) + (n-n_\varepsilon)(1-\overline{p})]D}. \quad (25)$$

When $n_s = n_\varepsilon = n$, i.e., when all the borrowers receive BDS and BDS are fully subsidized, we have:

$$\overline{\gamma} = \frac{K}{D(1-(\overline{p}+\varepsilon))} \quad (26)$$

implying $\widetilde{\rho} = \rho_{\gamma\varepsilon}$. Therefore, provided that BDS are efficient enough in the presence of the loan guarantee [i.e., inequality (22) holds[20]], when all the borrowers are offered BDS and BDS are fully subsidized, BDS subsidization is exactly equivalent to loan guarantee in terms of financial inclusion.

However, as $\overline{\gamma}$ is increasing in both n_s and n_ε, as soon as either $n_\varepsilon < n$ or $n_s < n$, that is as soon as BDS or subsidies are targeted toward borrowers with the lowest returns, we have:

$$\overline{\gamma} < \frac{K}{D(1-(\overline{p}+\varepsilon))} \quad (27)$$

implying that condition (23) holds. In this case two effects are at stake. First, if in the presence of the loan guarantee the MFI chooses not to provide BDS to all the borrowers ($n_\varepsilon < n$), the probability of failure for projects without BDS will be equal to $1-\overline{p}$. The expected cost of guaranteeing them would then amount to $\gamma D(1-\overline{p}) > \gamma D(1-(\overline{p}+\varepsilon))$ per project. Second, if the state does not subsidize BDS for all the borrowers ($n_s < n$), it will save K on $n - n_s$ borrowers while it would still spend some money on them in the case of the loan guarantee. These two effects corroborate that the loan guarantee is more expensive than BDS subsidization when the total number of financed borrowers is held constant. We summarize our results in the following proposition:

Proposition 2 *If BDS are efficient enough* [*that is if condition* (22) *is satisfied*] *and are targeted toward the borrowers with the lowest project returns* (*either directly by the MFI or through subsidies*), *then the state can crowd-in more borrowers with the same budget by subsidizing BDS rather than guaranteeing loans*.

[20] Note that inequality (22) (implying that $\widetilde{\rho} < \rho_\gamma$) is equivalent to inequality (16) (implying that $\rho_{\gamma\varepsilon} < \rho_\gamma$) when $\widetilde{\rho} = \rho_{\gamma\varepsilon}$.

The intuition behind this result is straightforward. It states that, by concentrating its effort on the otherwise excluded borrowers, the state can increase financial inclusion. This is easier to implement with BDS subsidization, as we have shown above that the MFI is indifferent between offering or not BDS to projects with the highest returns. Moreover, although it seems easy (for the state) to make subsidies to BDS scarce, guaranteeing only some of the loans (that would have the same effect) appears to be more difficult. Such a strategy is also in line with reality, where MFIs do not usually provide training to each client (for example due to capacity constraints) but all the loans are guaranteed. Finally, it should be noted that this analysis only holds under condition (22), that is if ε is high enough and γ is low enough. Therefore, if BDS technology is not efficient enough or if the level of guarantee is very high, BDS subsidization will not crowd-in more borrowers compared with the loan guarantee.

In this section, we have focused on a policy consisting of BDS subsidization and we have compared it with the loan guarantee. More generally, the government might choose to mix policies by both guaranteeing loans and subsidizing BDS. In the next section, we model a mix of these two policies and show that it can eliminate the perverse effect of the loan guarantee discussed in Sect. 4.2. Finally, we analyze its impact on the financial inclusion.

6 Mixing policies

In this section, we assume that the government both guarantees loans and subsidizes BDS. We analyze if this mix can remove the perverse effect previously identified and improve financial inclusion. To do so, we study a case where the state guarantees a proportion $\gamma' < 1$ of the outstanding loan if the project fails and partly subsidies BDS, in the sense that it finances a part $\alpha \leq 1$ of its cost. In line with reality, we assume that state keeps constant the guarantee rate across all the borrowers. Following the analogy with (health) insurance literature developed above, this study can be linked to papers analyzing the efficiency of contracts covering both disease prevention and treatment (Ellis and Manning 2007). Indeed, such a policy aims both at decreasing the financial loss for the MFI in case of project failure and at increasing its incentive to

provide BDS. Ellis and Manning (2007) find that it is always desirable to offer at least some insurance coverage for prevention when individuals ignore its impact on prices.

Let us first study to what extent the mix of policies can solve the perverse effect of the loan guarantee. To do so, we compute the project return interval for borrowers financed through BDS. Using Eq. (8), we derive that, without BDS, the MFI will finance all projects with a return higher or equal to:

$$\rho_1 = \frac{\psi}{\Delta pD} + \frac{1-(1-\overline{p})\gamma'}{\overline{p}} \tag{28}$$

If the state additionally finances a proportion α of BDS cost, the zero-profit condition for borrowers that benefit from both policies writes:

$$E(\pi) = (\overline{p}+\varepsilon)(1+r_2)D + (1-(\overline{p}+\varepsilon))\gamma D(1-\alpha) - D - (1-\alpha)K = 0 \tag{29}$$

and the optimal interest rate for these borrowers is given by:

$$1+r_2 = \frac{1+(K/D)(1-\alpha)-(1-(\overline{p}+\varepsilon))\gamma'}{\overline{p}+\varepsilon} \tag{30}$$

Therefore, under the mix of policies, the MFI finances all the projects with returns higher than

$$\rho_2 = \frac{\psi}{\Delta pD} + \frac{1+(K/D)(1-\alpha)-(1-(\overline{p}+\varepsilon))\gamma'}{\overline{p}+\varepsilon} \tag{31}$$

Note that ρ_2 is decreasing in both α and γ' suggesting that a higher α and γ' imply larger financial inclusion. The MFI will provide BDS under the mix of policies if $\rho_2 < \rho_1$.

Lemma 4 *Business development services will increase financial inclusion when the state guarantees loans and subsidizes a part of BDS (i.e., $\rho_2 < \rho_1$) if and only if:*

$$\frac{\varepsilon}{\overline{p}} > \frac{(1-\alpha)K}{(1-\gamma')D} \tag{32}$$

As in previous sections, the condition in Lemma 4 states that the relative gain from training has to be higher than its relative cost to the MFI. This condition will be easier to satisfy when α is large and γ' is small, meaning that subsidizing BDS is more efficient when the loan guarantee is low. Moreover, comparing (32) with (12), it appears that BDS are more likely to be used in the presence of a mix of policies than in the "laissez-faire" case [that is condition (32) is weaker than (12)] if and only if $\alpha > \gamma'$.

When $\rho_2 < \rho_1$, that is under condition (32), BDS crowd-in borrowers with project return between ρ_2 and ρ_1. Therefore, when project returns are uniformly distributed, the number of borrowers receiving a loan as a result of BDS subsidization is given by:

$$\rho_1 - \rho_2 = \frac{\varepsilon(1-\gamma') - \overline{p}(K/D)(1-\alpha)}{\overline{p}(\overline{p}+\varepsilon)} \tag{33}$$

Comparing this difference with $\rho_{\min} - \rho_\varepsilon$ [given in Eq. (18)], that is with the number of borrowers financed through BDS in the "laissez-faire" case, we find the condition under which a mix of policies eliminates the perverse effect of the loan guarantee.

Proposition 3 *If the distribution of the project returns is uniform, the perverse effect highlighted in Proposition 1 will be eliminated by the mix of the loan guarantee and BDS subsidization, if and only if*

$$\frac{\alpha K}{\gamma' D} > \frac{\varepsilon}{\overline{p}} \tag{34}$$

Condition (34) shows that the perverse effect of the state guarantee on the number of additional borrowers crowded-in through BDS can be avoided under the mix of policies. Again, it will be easier to satisfy when α is large and γ' is small. Moreover, using equation (32), it appears that a necessary condition for BDS subsidization to actually crowd-in more borrowers than in the "laissez-faire" case is $\alpha > \gamma'$. This means that the part of BDS cost subsidized by the state has to be larger than the part of the loan guarantee.

However, Proposition 3 does not show when the mix of policies will increase financial inclusion compared with the loan guarantee or BDS subsidization alone. To study financial inclusion under the mix of policies, let us compare ρ_2 to $\widetilde{\rho}$ and $\rho_{\gamma\varepsilon}$ (we restrict the analysis to the case where BDS are efficient enough, that is where $\rho_2 < \rho_1$ and $\rho_{\gamma\varepsilon} < \rho_\gamma$).

We first compare ρ_2 with $\rho_{\gamma\varepsilon}$, that is the project return threshold under the mix of policies (loan

guarantee at rate γ' and BDS subsidization at rate α) with the project return threshold under the loan guarantee (at a rate γ) and unsubsidized BDS. Using (15) and (31), we find that $\rho_2 < \rho_{\gamma\varepsilon}$ if and only if:

$$(1-(\overline{p}+\varepsilon))(\gamma-\gamma')D < \alpha K \tag{35}$$

Inequality (35) states that the amount saved by decreasing the guarantee rate should be lower than the cost of BDS subsidization (for a mix of policies to do better than loan guarantee). As in the previous section, when all the borrowers are offered BDS, under a fixed budget, both policies are equivalent in terms of financial inclusion [that is $\alpha K = (1-(\overline{p}+\varepsilon))(\gamma-\gamma')D$]. However, when some borrowers are not offered BDS, following our previous reasoning, a mix of policies will do better than the loan guarantee under a fixed budget. In this case, the government can crowd-in the same number of borrowers at a lower cost, as it saves the guarantee rate difference on borrowers that do not benefit from BDS (then, for borrowers who benefit from subsidies, we have $\alpha K > (1-(\overline{p}+\varepsilon))(\gamma-\gamma')D$, i.e., condition (35) holds). We stress that this will only be the case when BDS technology is efficient enough, that is under condition (32).

Similarly, when comparing the mix of policies with BDS subsidization alone, we find using (21) and (31) that $\rho_2 < \widetilde{\rho}$ if and only if

$$(1-(\bar{p}+\varepsilon))\gamma' D > K(1-\alpha) \tag{36}$$

Akin to the previous discussion, under a fixed budget, we find that both policies are equivalent (in terms of financial inclusion) when all the borrowers receive BDS. However, BDS subsidization does better than the mix of policies when some borrowers are financed without receiving BDS. Indeed, in this case (36) cannot be satisfied as for borrowers financed without BDS (with $\rho > \rho_1$) the mix of policies is costly from the point of view of the state (due to the loan guarantee that targets all the borrowers) contrarily to BDS subsidization. These results can be summarized in the following proposition.

Proposition 4 *When BDS are efficient* [*that is under condition* (22)] *the financial inclusion is maximized when the state subsidizes BDS* (*and does not guarantee loans*) *provided that BDS subsidies are targeted enough.*

Of course, there are mechanisms that might undermine Proposition 4. First, BDS have to be efficient enough. Second, the MFI has to finance projects that can be incentive compatible without BDS (that is projects with returns higher than $\rho_{\min}$). This notably involves that such projects are not financed by mainstream banks. This can be due to the presence of collateral requirements or the presence of rationed borrowers (who do not receive credit despite sharing the same characteristics as the accepted borrowers) highlighted by Stiglitz and Weiss (1981). If the MFI has no such clients in its portfolio, a mix of policies might do better. This is due to the loan guarantee that increases the range of project returns that are incentive compatible without BDS, by reducing the interest rate. Moreover, the state might guarantee loans offered by MFIs for exogenous reasons, such as possible correlations among project defaults that would jeopardize MFIs.

Proposition 4, related to the substitutability between the loan guarantee and BDS subsidization, seems to highly rely on the linearity of our model. Such a result is not typically obtained in the case of risk-averse individuals in the insurance literature. In our context, borrowers' risk aversion will not alter the findings as the loan guarantee does not change the consequences of project failure for them. However, results might change if the MFI is not risk neutral. This question echoes the literature on risk aversion of nonprofit organizations. Indeed both theoretical (Wedig 1994) and empirical (e.g., Preyra and Pink 2001, in the case of nonprofit hospitals) papers indicate that nonprofit organizations are risk-averse. Whether risk aversion applies to MFIs remains an open question.

Another extension that might modify our results is the possibility of cross-subsidization by the MFI. Cross-subsidization occurs when profits made from lending to profitable borrowers are being used to finance nonprofitable ones. Even though Armendariz and Szafarz (2011) identify cross-subsidization as one of the components of MFI's social objectives, McIntosh and Wydick (2005) show that the increasing competition faced by MFIs decreases their capacity to use cross-subsidization. Moreover, in our context, the study of the cross-subsidization would require assumptions on the distribution of ρ among the potential borrowers.

7 Concluding remarks

To conclude, we analyze in this paper the impact of state intervention on financial inclusion in the microcredit market where microfinance institutions offer individual loans and business development services. We focus on the interaction between the loan guarantee and the choice of the microfinance institution to provide BDS. Our motivation relies on the intuition that the loan guarantee might impact the MFI's involvement in business development services and probably deteriorate their efficiency in terms of financial inclusion. This intuition finds its roots in the substitutability between insurance and self-protection classically found in the insurance literature. Indeed, the loan guarantee can be understood as an insurance against project failure (for the MFI), whereas business development services act as a self-protection device by lowering the probability of project failure.

By extending Tirole's (2005) model to the microcredit market with the loan guarantee and business development services, we prove that the state guarantee can be counterproductive in terms of the number of entrepreneurs financed as a result of business development services (in particular when the distribution of the project returns is uniform). This central finding leads us to study an alternative solution: business development services subsidization and then to compare it with loan guarantee in terms of financial inclusion. We find that—for a fixed budget—BDS subsidization can lead to higher financial inclusion than the loan guarantee, provided that (1) BDS technology is efficient enough and that (2) BDS are targeted enough toward otherwise excluded borrowers. Finally, we show that, even though it can eliminate the counterproductive effect of the loan guarantee, a mix of the loan guarantee and BDS subsidization will not lead to higher financial inclusion compared with BDS subsidization alone if BDS are targeted and are efficient enough.

One of the limitations of our model concerns the interactions of the microcredit market with the missing markets. Indeed, state intervention in the credit market can have interesting implications for the labor market for example (see Emran et al. 2011). In the present paper, we focus on the "pure" impact of state intervention on the lending behavior of an MFI. The investigation of the financial efficiency of the public intervention is left for further research. This will in particular be needed to explain why the state chooses to participate in the microcredit market. Moreover, some of our results (mostly those on the mix of policies) seem to be driven by the linearity of our model. It might be interesting to challenge them in the case of a risk-averse MFI or an MFI using cross-subsidization.

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