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Should NGO Involvement be Restricted?**

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Public-private Partnerships in Micro-finance: Should NGO Involvement be Restricted?

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Abstract

This paper examines public-private partnerships in micro-finance, whereby NGOs can help in channelizing credit to the poor, both in borrower selection, as well as in project implementation. We argue that a distortion may arise out of the fact that the private partner, i.e. the NGO, is a *motivated* agent. We find that whenever the project is neither too productive, nor too unproductive, reducing such distortion requires *unbundling* borrower selection and project implementation, with the NGO being involved in borrower selection only. Further, we compare and contrast two alternative credit delivery mechanisms, the linkage mechanism (which is the focus of this paper), with the ‘Grameen’ one.

Keywords: Public-private partnerships; micro-finance; motivated agent; NGO; ownership.

JEL Classification: E62, G21, G28, H5, O17.

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1 Introduction

Micro-finance is an important tool in fighting poverty.¹ Scaling up micro-finance operations, one of the central challenges facing the micro-finance movement, is, however, often constrained by a lack of funds, particularly when the government, the banks and the recipients are not well connected. One possible solution is to use non-governmental organizations (henceforth NGOs) to channelize government credit to micro-finance recipients. Interestingly, under the self-help group (SHG) linkage program in India, the NGOs play precisely this role.² In fact, the SHG linkage program is rapidly turning into the dominant micro-finance paradigm in India, with the number of self help groups linked to banks increasing from 500 in the early 1990s, to over 8,00,000 by 2004 (Basu and Srivastava (2005)).³

In this paper we thus examine a public-private partnership (henceforth PPP) in micro-finance, whereby private agents, namely NGOs, link government banks to micro-finance recipients - the so called linkage model. In doing so we bring together two of the central strands in the PPP literature, namely the bundling/unbundling of tasks, as well as the issue of ownership. We shall argue that doing so yields some interesting new insights that add to both these literatures. First, it identifies a hitherto unexplored rationale for unbundling that relies crucially on the fact that the NGO is motivated. Second, irrespective of how motivated the NGO is, we find that providing ownership of the project to the bank is always optimal (contrast this with Besley and Ghatak (2001)). Further, the theoretical framework developed in this paper allows one to analyze the optimal design of such linkage schemes, as well as compare and contrast such schemes with the more traditional

¹A relatively recent and comprehensive survey of the literature is provided, among others, by Aghion and Morduch (2005).

²The SHG linkage program of course has many other interesting aspects, e.g. group-lending and an emphasis on savings (see, e.g. Aniket (2007) and Roy Chowdhury (2007)). For the sake of focus this paper abstracts from these issues.

³Harper (2002a) reports that SHG systems are also found in Indonesia, parts of South Asia, Africa and elsewhere. There are other examples where the government has delegated the management and delivery of public goods to NGOs, while retaining financial obligations, e.g. management of schools in Bolivia, agricultural extension in Columbia and Chile, and primary health in El Salvador (see, Bebbington (1997)).

Grameen one where the NGO functions more like a direct and independent source of finance.

Formally, we consider a model with a motivated NGO, who may be potentially involved in two stages of credit delivery, borrower selection, as well as their training. Besley and Ghatak (2005) define motivated agents as those “who pursue goals because they perceive intrinsic benefits from doing so” and give examples such as doctors, researchers, judges, soldiers and of course NGOs (see also Besley and Ghatak (1999)). The United Nations Interagency Committee on Integrated Rural Development for Asia and the Pacific (1992) (henceforth UNICIRDAP), for example, mentions motivation and commitment as one of the six key features of an NGO.

As to NGO involvement in delivery of services and public goods, Cernea (1988) quotes a World Bank report on the dramatic expansion of such services.⁴ Typically, the *raison d’être* of NGOs is government failure.⁵ While government failure can take different forms,⁶ in our model it comes from two sources that are common to many developing economies, first, a lack of information regarding borrower types, and second, an inability to provide training. In such a setting, an NGO can potentially provide both these services. Because of the closeness of NGOs to their clientele, something which the government, or profit-seeking organizations lack,⁷ an NGO can help in identifying good, i.e. relatively more efficient, borrowers. Second, it can help borrowers implement their projects more efficiently.⁸

⁴Cernea (1988) reports on the increase of NGO participation in providing developmental, financial and production-support to local people. Moreover, the said World Bank report indicates a high correlation between NGO involvement and success of World Bank financed projects.

⁵To quote Besley and Ghatak (1999), “In developing countries NGOs typically work in communities or settings where the reach of the government is weak or non-existent.”

⁶Besley and Ghatak (1999), for example, talks of non-democratic and/or non-sensitive governments.

⁷In the Indian SHG-linkage program, for example, the idea is to utilize NGOs who are already active in the area. See, e.g. Harper (2002b, pp.12).

⁸Fizsbein and Lowden (1999) argue that the NGOs’ ability to target and access the poor, as well as experience and knowledge in various fields have been the main reasons behind involving the NGOs. An interested reader may also see Harper (2002b) regarding NGO involvement in the SHG mode of micro-finance in India.

The question we address here is whether the NGO should be involved in both these stages, or in borrower selection alone. Empirical evidence on this issue is relatively scarce. In the Indian SHG-linkage program, for example, we find that the NGO may, or may not be involved in the implementation stage. Harper (2002a), for example, says that the “NGO may remain heavily involved, assisting the members to manage their affairs,..., or it may withdraw and work with other groups.”⁹

We thus take a theoretical approach to the problem. We consider a model with two borrowers, one efficient, the other one inefficient, both of whom have a project with setup costs that must be borrowed from a bank. The bank however is resource constrained, and can lend to at most one borrower, but does not know the identity of the borrowers. It can thus enlist the NGO, who is a motivated agent, to help with borrower selection, and possibly borrower training. In a contracting environment where contracts can only be contingent on the level of NGO involvement, but not on borrower types, we examine institutional designs that allow the implementation of the first best.

Turning to our main results, we find that whenever the project is neither too productive, nor too unproductive, attaining efficiency requires *unbundling* borrower selection and project implementation, with the NGO being involved in borrower selection only. One interesting implication is that providing ownership to the bank/government is optimal, since in that case the bank/government can design the institution optimally.

The essential trade-off in the model arises because the NGO is a motivated agent who maximizes the aggregate utility of the villagers and its own monetary income, while the government, which supports micro-finance that targets the poor, wishes to maximize a utilitarian social welfare function. This formulation captures one of the central themes in the literature on NGOs, that “the rural poor are given higher priority by NGOs” as compared to governments (see, UNICIRDAP (1992), page 20).

Given their motivations, from the view-point of the NGOs the more

⁹Moving away from micro-finance, Farrington and Lewis (1993) mention an NGO in Karnataka, India, that organizes and trains local groups to apply for government anti-poverty funds, but is not involved in fund disbursement.

efficient borrowers are ‘less needy’ (in a sense made formal later on), so that maximizing aggregate borrower utility may involve channelizing the loan to the less efficient borrowers. Doing so becomes more attractive if the NGO is also involved in the project implementation stage, since in that case the NGO can help out the less efficient borrowers with on-the-job training, thus reducing the inefficiency arising out of the loan going to the less efficient borrowers. With full NGO involvement, resolving this problem requires the rate of interest to be lower than the first best level. We show that this happens whenever the project is neither too efficient, nor too inefficient. Under these parameter conditions, implementing the first best therefore calls for restricting NGO involvement to borrower selection alone.

We further show that our results remain qualitatively robust across other environments, e.g. even if the government can use state-contingent contracts, or if the NGO has a soft budget constraint, etc. We also argue that competition amongst different NGOs does not change our main result.

As mentioned before, our framework also throws some light on the debate regarding alternative credit delivery mechanisms. In particular, we compare the ‘linkage’ mechanism studied in this paper with a ‘Grameen’ type institution, where the NGO acts more like a bank itself since now the bank provides the loan to the NGO who is directly responsible for repayment. Further, under the Grameen model, the NGO is necessarily involved in both borrower selection and project implementation. Our analysis suggests that ranking these two mechanisms in terms of welfare is not straightforward, and depending on various factors either one or the other may be preferable. The comparison depends, for example, on regulatory policy, in particular whether the concerned NGO has control over the factor of interest or not, the productivity of the projects, as well as the motivation levels of the NGOs. Further, an increase in motivation has an ambiguous effect on the relative attractiveness of these two mechanisms.

The rest of the paper is structured as follows. In Section 2 we provide a formal description of the environment. In Section 3 we discuss the first best outcome. Section 4 studies implementation of the first best and reports our main result. Alternative scenarios are discussed in section 5 to address robustness issues. In section 6 we compare the linkage mechanism with the

Grameen one. Section 7 relates our paper to the literature, while the paper concludes in section 8. Some proofs are provided in an appendix at the end.

2 A Linkage Model of Microfinance

A village consists of two individuals (henceforth villagers) and an NGO. The villagers plan to start a project each, which requires a start-up capital of 1 unit. The villagers have no money or assets, and hence require to borrow this amount from a government bank which has limited resources and can finance only one such project. We assume that 1 unit of capital yields 1 in its alternative use and denote $r \geq 1$ as the interest factor. Further, there is limited liability on part of these villagers.

Let $\theta \in \{h, l\}$ denote the skill level of a villager, with one of the villagers being high-skilled (h type), and the other one being low-skilled (l type). These types are common knowledge amongst the villagers, but are not known to the bank officials. This assumption is driven by the fact that, compared to bank officials, individuals coming from the same village have greater knowledge of each other. Further, the NGO, for some cost c_0 (≥ 0), can find out the borrower types.¹⁰ This presumes that the NGO has enough local knowledge and grass-root experience in the village, a natural assumption if the NGO has been already active in this village, but perhaps in other spheres of activities. While the bank can verify whether the NGO acquired this information or not, this information itself is non-verifiable by the bank. However, under proper incentives, the NGO can be made to incur this cost c_0 in order to select the required type of villager.

The difference in skill across villagers is manifested in two ways. First, a high skilled villager has a better outside option in so far as his reservation utility is $u > 0$, while that of the low skilled villager is 0. Second, the project is risky, yielding X (> 1) if it succeeds, and 0 if it fails. We further assume that the h type villager is always successful, while the l type villager has a success rate that is less than 100 percent. The probability of success for a low skilled villager is λ' if the NGO is involved in project implementation, and λ otherwise, where $1 > \lambda' > \lambda > 0$. Thus the success probability of the

¹⁰Our results are qualitatively independent of this cost unless it is prohibitively large.

l type is higher if there is NGO involvement, where NGO involvement can be interpreted as on-the-job training that the villagers may receive when the NGO is involved at the project implementation stage. Moreover, output is observable by all parties.

If the lending scheme includes the NGO, it may be involved in either or both of two stages, 0 and 1. Stage 0 requires the NGO to choose the villager to whom the loan is given out by the bank. This allows for the greater knowledge of the NGOs regarding borrower types to come into play. In stage 1, the NGO may be directly involved in on-the-job training of the selected villager. This involves a monetary cost of c_1 (≥ 0) for the NGO.

Let the level of involvement be denoted by I , $I \in \{0', 0, 1', 1\}$ where $I = 0'$ if the NGO is not involved in any stage, $I = 0$ if the involvement is in stage 0 alone, $I = 1'$ if the involvement is in stage 1 alone, and $I = 1$ if the involvement is in both the stages. Similarly, let the NGO's training decision be captured by $T \in \{0, 1\}$, with $T = 0$ if the NGO decides not to impart training (given $I \in \{1', 1\}$), while $T = 1$ if the NGO imparts this training and incurs the cost c_1 .

If the loan is sanctioned to a villager and the factor of interest is r , the NGO receives a fraction $r\beta_I$ if the involvement level is I .¹¹ This amount is used by the NGO to meet its monetary costs, namely c_0 and c_1 , if any.

At the helm of this environment sits the government who sets up the institution denoted by the triple (I, r, β_I) .

The timing of decisions and outcomes are as follows: First, the government chooses the institution (I, r, β_I) that becomes common knowledge amongst all agents. The bank then selects the villager (either with or without the help of the NGO, depending upon the institution set up by the government) to whom the loan is sanctioned. The selected villager then implements the project (either with or without on-the-job training from the NGO, as specified by the government). Finally, output is produced and all payments are made.

We assume that all agents are risk-neutral expected utility maximizers.

¹¹We later show that allowing for contingent contracts where the NGO's payoff depends on whether the project succeeds or not (see Section 5), has no qualitative effect on our results.

Given this, the payoffs of the various agents are as follows. Let $V_\theta(I, r, \beta_I, T)$ denote the payoff of a type- θ villager *who actually obtains a loan* given the institution (I, r, β_I) and training decision T . Then,

$$V_\theta(I, r, \beta_I, T) = \begin{cases} X - r, & \text{if } \theta = h, \\ \lambda(X - r), & \text{if } \theta = l, \text{ and either } I \in \{0', 0\}, \\ & \text{or } I \in \{1, 1'\} \text{ and } T = 0, \\ \lambda'(X - r), & \text{if } \theta = l, I \in \{1, 1'\} \text{ and } T = 1. \end{cases} \quad (1)$$

These expressions capture the fact that the probability of project success, and hence the payoff, of the low-skilled villager depends on whether the NGO is involved in training her or not. A villager who does not obtain the loan earns her reservation utility.

The NGO maximizes a weighted sum of its own monetary income, i.e. expected payment from the bank minus monetary costs, and aggregate borrower utility, with a weight μ attached to the aggregate borrower utility. This reflects the degree of motivation, to be made precise below. Let $N_\mu(I, r, \beta_I, \theta, T)$ denote the payoff of the NGO with motivation μ if the selected villager is of type θ and the training decision is T . In writing this payoff function we shall incorporate the following facts: (a) $\beta_{0'} = 0$, which implies that the NGO receives no monetary payment from the bank if it is not involved at all in the lending protocol, and (b) If $I \in \{0', 0\}$ or $\theta = h$, then $T = 0$, which comes from the fact that if the NGO is not allowed to be involved in stage 1, then it cannot impart on-the-job training and in case it is involved but selects a high-skilled villager, it is rational for the NGO not

to impart costly training that has no benefit. Thus,

$$N_\mu(I, r, \beta_I, \theta, T) = \begin{cases} \mu(X - r), & \text{if } \theta = h, I = 0', \\ \mu[\lambda(X - r) + u], & \text{if } \theta = l, I = 0', \\ r\beta_0 - c_0 + \mu(X - r), & \text{if } \theta = h, I = 0, \\ r\beta_0 - c_0 + \mu[\lambda(X - r) + u], & \text{if } \theta = l, I = 0, \\ r\beta_{1'} + \mu(X - r), & \text{if } \theta = h, I = 1', \\ r\beta_{1'} + \mu[\lambda(X - r) + u], & \text{if } \theta = l, I = 1', T = 0, \\ r\beta_{1'} - c_1 + \mu[\lambda'(X - r) + u], & \text{if } \theta = l, I = 1', T = 1, \\ r\beta_1 - c_0 + \mu(X - r), & \text{if } \theta = h, I = 1, \\ r\beta_1 - c_0 + \mu[\lambda(X - r) + u], & \text{if } \theta = l, I = 1, T = 0, \\ r\beta_1 - c_0 - c_1 + \mu[\lambda'(X - r) + u], & \text{if } \theta = l, I = 1, T = 1. \end{cases} \quad (2)$$

Further, the NGO is subject to an *ex ante* budget constraint¹² that requires that the monetary earning $r\beta_I, I \neq 0'$, covers any costs incurred by the NGO.¹³

We then consider the payoff of the bank denoted as $\pi_B(I, r, \beta_I, \theta, T)$. Under an institution I , the bank receives $(1 - \beta_I)r - 1$ if the selected villager is high skilled. If the borrower is low skilled, then it receives $\lambda'r - r\beta_I - 1$ if the borrower receives NGO training, and $\lambda r - r\beta_I - 1$ otherwise.

3 The First Best

We begin by solving for the first best outcome. We consider a purely utilitarian social welfare function that equals the sum of individual payoffs of the two villagers, the bank and the NGO.¹⁴ The government maximizes this social welfare subject to a non-negative profit constraint for the bank and the budget constraint of the NGO.

¹²In Section 5 we later argue that very similar results go through even if the NGO is not subject to such a budget constraint.

¹³Aniket (2006), among others, mention that the NGO remuneration comes out of the amount repaid by the borrowers.

¹⁴Our analysis, not reported here, suggests that very similar results go through even if the government only takes the monetary income of the NGO into account, and ignores the utility externality enjoyed by the NGO.

In order to focus on the case of interest, we assume that the project payoff in case of success, X , is sufficiently large compared to u , c_1 and c_0 .

Assumption 1. $X > \max\{1 + c_0 + \frac{c_1}{\mu(\lambda' - \lambda)}, \frac{2c_0 + u}{1 - \lambda}, \frac{u + 2c_0 - c_1}{1 - \lambda'}, \frac{c_1}{\lambda' - \lambda}\}$.

Proposition 1 below characterizes the first best outcome (FB for short).

Proposition 1. *Let Assumption 1 hold. Then the first best requires the NGO to be involved in borrower selection, so that the loan goes to the high-skilled borrower and there is no on-the-job training. Moreover, (a) $r^{FB} = 1 + c_0$, and (b) $\beta_0^{FB} = \frac{c_0}{1 + c_0}$.*

While the formal proof can be found in the Appendix, here we provide a sketch of the argument. Consider the case where the NGO is only involved in borrower selection (that is $I = 0$) and the high skilled borrower is selected. It is easy to see that the social welfare in this case is

$$\begin{aligned} W^0(h, r, \beta_0) &= r\beta_0 + (1 + \mu)(X - r) + (1 - \beta_0)r - 1 - c_0 \\ &= (1 + \mu)X - \mu r - 1 - c_0. \end{aligned} \quad (3)$$

The government chooses (r, β_0) so as to maximize $W^0(h, r, \beta_0)$ subject to the ex ante budget constraint of (a) the NGO, i.e. $r\beta_0 \geq c_0$, and (b) the bank, i.e. $(1 - \beta_0)r \geq 1$. Combining the two, we obtain $r - 1 \geq r\beta_0 \geq c_0$. Since $W^0(h, r, \beta_0)$ is decreasing in r (and independent of β_0), optimality implies that

$$r = 1 + c_0, \quad \beta_0 = \frac{c_0}{1 + c_0}. \quad (4)$$

Let us use the notation $\underline{W}^I$ to denote the optimal social welfare given that the level of involvement is I . Consequently, the social welfare, evaluated at this optimal r , equals

$$\underline{W}^0(h) = (1 + \mu)(X - 1 - c_0). \quad (5)$$

This is quite intuitive. Given (4), the bank's net expected payoff is zero and there is budget balancing by the NGO. Thus the aggregate borrower utility is equal to the total "surplus" in the system, i.e. $X - 1 - c_0$. Given that the utility function of the NGO has a weight of μ on aggregate borrower utility, the expression follows. Note that given A1, $\underline{W}^0(h) > 0$.

A similar argument shows that when the NGO is involved in borrower selection alone (that is $I = 0$), *and the low skilled borrower is selected*, then the optimal social welfare is

$$\underline{W}^0(l) = (1 + \mu)(\lambda X + u - 1 - c_0). \quad (6)$$

Form A1, note that $X - 1 - c_0 > 0$ and $X > \lambda X + u$. Thus, given that the NGO does borrower selection, it is optimal to give the loan to the high skilled borrower, i.e. $\underline{W}^0(h) > \max\{0, \underline{W}^0(l)\}$.

A similar argument establishes that selecting the high-skilled borrower is optimal even when the NGO is involved in both the stages (that is $I = 1$), so that $\underline{W}^1(h) > \underline{W}^1(l)$. Further note that

$$\underline{W}^0(h) = \underline{W}^1(h). \quad (7)$$

Similarly, if $I = 0'$, that is the NGO is not involved in any of the stages, then the optimal social welfare equals

$$\underline{W}^{0'} = (1 + \mu) \left[\frac{X(1 + \lambda) + u}{2} - 1 \right]. \quad (8)$$

Finally, suppose the NGO is involved in training alone (that is $I = 1'$). Then the optimal social welfare equals

$$\underline{W}^{1'} = (1 + \mu) \left[\frac{X(1 + \lambda') + u}{2} - 1 - \frac{c_1}{2} \right]. \quad (9)$$

Given Assumption 1, it is easy to see that

$$\underline{W}^0(h) = \underline{W}^1(h) > \max\{\underline{W}^{0'}, \underline{W}^{1'}\}. \quad (10)$$

Thus, the first best necessitates that (a) the bank call upon the NGO to select the borrower, and (b) the high skilled borrower obtains the loan.

4 Implementing the First Best

We then examine whether the first best can be implemented under the appropriate mechanism. Given Proposition 1, it is sufficient to restrict attention to institutions with $I \in \{0, 1\}$ that utilize the NGO in borrower selection. We begin by studying the behavior of the NGO under such institutions.

Consider the institution $(0, r, \beta_0)$ with the NGO being involved only in borrower selection. Given eqn. (2), the NGO selects the high skilled borrower, i.e. $N_\mu(0, r, \beta_0, h, 0) \geq N_\mu(0, r, \beta_0, l, 0)$, if and only if

$$X - \frac{u}{1 - \lambda} = \hat{r} \geq r. \quad (11)$$

We thus have the following observation:

Observation 1. Suppose there is no stage 1 involvement and the NGO selects a borrower in order to maximize its own utility. Then:

(i) For $r > \hat{r}$, the low skilled borrower is selected. Thus $V_l(0, r, \beta_0, 0) = \lambda(X - r)$, $N_\mu(0, r, \beta_0, l, 0) = r\beta_0 + \mu[\lambda(X - r) + u] - c_0$ and $\pi_B(0, r, \beta_0, l, 0) = \lambda r - \beta_0 r - 1$.

(ii) For $r \leq \hat{r}$, the high skilled borrower is selected. Thus $V_h(0, r, \beta_0, 0) = X - r$, $N_\mu(0, r, \beta_0, h, 0) = r\beta_0 + \mu(X - r) - c_0$ and $\pi_B(0, r, \beta_0, h, 0) = (1 - \beta_0)r - 1$.

Now consider the institution $(1, r, \beta_1)$ where the NGO selects the borrower and is allowed to provide on-the-job training during the implementation of the project. Clearly it must be true that $\beta_1 \geq \beta_0$ in equilibrium. From (2), it is also straightforward to see that the NGO will train a low skilled borrower if and only if

$$X \geq r + \frac{c_1}{\mu(\lambda' - \lambda)}. \quad (12)$$

Given Assumption 1, this is clearly satisfied for $r = 1 + c_0$.

Suppose eqn. (12) is satisfied. Given eqn. (2), the NGO selects the high skilled borrower, i.e. $N_\mu(1, r, \beta_1, h, 0) \geq N_\mu(1, r, \beta_1, l, 1)$, if and only if

$$X - \frac{\mu u - c_1}{\mu(1 - \lambda')} = \tilde{r} \geq r. \quad (13)$$

This brings us to

Observation 2. Suppose there is stage 1 involvement, the NGO selects a borrower in order to maximize its own utility, and that $r \leq X - \frac{c_1}{\mu(\lambda' - \lambda)}$. Then:

(i) For $r > \tilde{r}$, the low skilled borrower is selected. Thus $V_l(1, r, \beta_1, 1) = \lambda'(X - r)$, $N_\mu(1, r, \beta_1, l, 1) = r\beta_1 + \mu[\lambda'(X - r) + u] - c_0 - c_1$ and $\pi_B(1, r, \beta_1, l, 1) = \lambda' r - \beta_1 r - 1$.

(ii) For $r \leq \tilde{r}$, the high-skilled borrower is selected. Thus $V_h(1, r, \beta_1, 0) = (X - r)$, $N_\mu(1, r, \beta_1, h, 0) = r\beta_1 + \mu(X - r) - c_0$ and $\pi_B(1, r, \beta_1, h, 0) = (1 - \beta_1)r - 1$.

We are now in a position to address the central concern of this paper, i.e. the effect of institutional structure on the feasibility of implementing the first best outcome.

4.1 The Main Result

In order to focus on the case of interest, in assumption 2 below we assume that the productivity of the project is neither too large, nor too small. Notice that for μ large enough, a range of X satisfying Assumption 2 necessarily exists (this follows since $\lambda' > \lambda$).

Assumption 2. $1 + c_0 + \frac{u}{1-\lambda} \leq X < 1 + c_0 + \frac{\mu u - c_1}{\mu(1-\lambda')}$.

First consider an institution with both stage 0 and stage 1 involvement. Given A1, this implies that there will be training in case the low skilled borrower is selected. Hence given Proposition 1, to implement the first best it is necessary and sufficient that

$$X - \frac{\mu u - c_1}{\mu(1-\lambda')} \geq 1 + c_0. \quad (14)$$

Given A2, this is not possible.

Now consider an institution without stage 1 involvement. An analogous argument establishes that implementing the first best now requires

$$X - \frac{u}{1-\lambda} \geq 1 + c_0. \quad (15)$$

Given Assumption 2, this is feasible.

Summarizing the above discussion we obtain our main result.

Proposition 2. *Suppose Assumptions 1 and 2 hold. The first best can be implemented if and only if the NGO is involved in borrower selection, but not in on-the-job training. Moreover, $r = r^{FB} = 1 + c_0$ and $\beta_0 = \beta_0^{FB} = \frac{c_0}{1+c_0}$.*

Proposition 2 above captures the central trade-off discussed in this paper. Since the NGO maximizes the aggregate utility of the villagers, it may have

an incentive to channelize loan to the low-skilled villager. This is because the high-skilled villagers are “less needy”, in the sense that they have a higher reservation utility, i.e. $u > 0$. The incentive for such socially sub-optimal selection is higher in case the NGO is also involved in project implementation since in that case the NGO can utilize its own expertise to increase the productivity of the low skilled villager. Due to this, if the NGO is allowed to get involved in stage 1 also, then the NGO selects the high-skilled type if and only if the interest factor is very low. In that case the objectives of the government and the NGO get aligned, so that the loan goes to the high skilled villager. Such low rates of interest would, however, violate the feasibility conditions. This follows since from A2, X is not too large. Hence under the appropriate parameter values the optimal project design is to not involve the NGO in the second stage, even though doing so is *ex post* efficient.

Moreover, note that the fact that the NGO is motivated is central to our argument. Suppose, for example, that the NGO is just money-minded so that $\mu = 0$. It is then straightforward to see that Assumption 2 cannot be satisfied, so that the problem discussed here vanishes.

Note that this result has some implications for Hypothesis 2 in Besley and Ghatak (1999) which states that “NGO provision will be more prevalent in projects where the NGO cares more about the beneficiaries.” Proposition 2 in this paper, however, suggests that the argument for restricting NGO participation may get stronger, as the NGOs become more motivated. Consider Assumption 2. As the motivation index, μ , gets larger, it is more likely to be the case that $X < 1 + c_0 + \frac{\mu u - c_1}{\mu(1-\lambda')}$, so that involving the NGO in stage 1 becomes counter-productive. Of course, in contrast to Besley and Ghatak (1999), we are concerned with the provision of credit, rather than a public good.

For completeness we then briefly consider what happens in case either Assumption 1, or 2, does not hold.

Corollary 1 (i) *Suppose $X \geq 1 + c_0 + \frac{\mu u - c_1}{\mu(1-\lambda')}$ so that Assumption 2 is violated but Assumption 1 holds. Then the first best outcome can be implemented irrespective of whether the NGO is involved in training or not.*

(ii) Suppose $X < 1 + c_0 + \frac{u}{1-\lambda}$ so that Assumption 2 is violated but Assumption 1 holds. Then there is no institutional design that implements the first best.

(iii) Suppose $X < \max\{\frac{u+2c_0}{1-\lambda}, \frac{u+2c_0-c_1}{1-\lambda'}\}$ so that both Assumption 1 and Assumption 2 are violated. Then the first best outcome can be implemented irrespective of whether the NGO is involved in training or not.

The above corollary comes from the following observations. Suppose X is large in the sense that $X \geq 1 + c_0 + \frac{\mu u - c_1}{\mu(1-\lambda')}$ and Assumption 1 holds (so that Proposition 1 goes through). In this case the first best can always be implemented irrespective of institutional design. This is because with a very high X , the interest factor is low enough (relatively speaking) to correct the incentives of the NGO. On the other hand, if X is very low in the sense that $X < 1 + c_0 + \frac{u}{1-\lambda}$ (and A1 holds), then the linkage mechanism cannot implement the first best. Finally, if $X < \max\{\frac{u+2c_0}{1-\lambda}, \frac{u+2c_0-c_1}{1-\lambda'}\}$, then it is easy to check that the first best involves giving the loan to the low-skilled villager, so that the trade-off between social welfare and aggregate villager utility, which is the focus of this paper, goes away. This is in line with Hypothesis 3 in Besley and Ghatak (1999) and some empirical evidence reported in Farrington and Lewis (1993).

Our analysis suggests that full involvement of NGOs is optimal if the projects are either very productive, or very unproductive, while there are intermediate cases where it is socially optimal to keep the NGOs away from project implementation. Under the assumption that project productivity is linked to the average income level of the villagers, our analysis suggests that *there should be full involvement of NGOs in villages that are either relatively rich, or relatively poor. Otherwise, NGO involvement should be restricted to borrower selection alone.*

4.2 On Ownership

We then briefly turn to the issue of project ownership.¹⁵ Should the project be owned by the NGO, or the bank, with the project owner having the

¹⁵We are indebted to Dilip Mookherjee and three anonymous referees for encouraging us to work on this sub-section, and the next three sections.

right to select the level of NGO involvement? In a preliminary analysis, we examine the outcome under bank/government ownership to show that this cannot lead to inefficiency. For simplicity, we consider the case where the bank acts as an agent of the government, maximizing welfare subject to the break-even constraints of the NGO and the bank itself. We analyze a game form that is an extremely simplified version of that in Besley and Ghatak (2001):

Suppose the bank is the owner of the project. In stage 1, the bank decides on the level of NGO involvement, and the levels of r and β are contracted upon. In Stage 2, the NGO decides on borrower selection in case it is involved at this stage. In the next stage, again the NGO decides upon training in case it is involved at this stage, and if the type l borrower is selected in Stage 2. In the final stage there is a possible renegotiation between the NGO and the bank regarding r and β . For simplicity we consider a bargaining process whereby the bank makes a take-it-or-leave-it offer to the NGO. Since the bank is the owner, it can offer the first-best contract and involve the NGO (now as its employee) in borrower selection alone. In this case there should be no incentive to renegotiate and the first best is implemented.

For a complete analysis one should of course examine the outcome under NGO ownership. This, however, raises many conceptual issues, e.g. should we allow for renegotiation before, or after the NGO decides on both selection and training, what happens if training is not strictly on-the-job but performed before the start of the project, etc. While these questions are certainly of interest, doing full justice to these issues would be quite likely to take us too far afield and must wait for future work. Even so, the analysis here is of interest since it shows that the presumption in this literature, that the agent with greater valuation for the project should have ownership, needs to be qualified.

5 Discussion: Some Robustness Issues

We then briefly discuss if the central results in this paper, i.e. Propositions 1 and 2, are robust to some extensions of the basic model.¹⁶

Contingent Contracts for the NGO: We first consider the case where the NGO's payment can be made contingent on whether the project is successful, or not. Let $r\beta_S$ (respectively zero) denote the NGO's payoff in case the project is successful (respectively unsuccessful). We can mimic the argument in Proposition 1 to show that even in this case the first best involves the loan going to the high-skilled type, with $r^{FB} = 1 + c_0$ and $\beta_S^{FB} = \frac{c_0}{1+c_0}$.

Straightforward calculations show that in case $I = 0$, the NGO selects the high skilled borrower if and only if

$$X - \frac{u}{1-\lambda} \geq \frac{r}{\mu}(\mu - \beta_S). \quad (16)$$

Whereas in case $I = 1$, the NGO selects the high-skilled borrower if and only if¹⁷

$$X - \frac{\mu u - c_1}{\mu(1-\lambda')} \geq \frac{r}{\mu}(\mu - \beta_S). \quad (17)$$

We then have an analogue of Proposition 2 for this case.

Proposition 2'. *Suppose Assumption 1 holds, $X > \mu c_0 + \frac{c_1}{\mu(\lambda' - \lambda)} - \frac{c_1}{\mu}$ and $(1 + c_0)[1 - \frac{c_0}{\mu(1+c_0)}] + \frac{u}{1-\lambda} \leq X < (1 + c_0)[1 - \frac{c_0}{\mu(1+c_0)}] + \frac{\mu u - c_1}{\mu(1-\lambda')}$.*

(i) *The first best outcome is as described in Proposition 1.*

(ii) *The first best can be implemented if the NGO is only involved in borrower selection, but not if the NGO is involved in both the stages.*

Note that our central result, that NGO involvement in project implementation may be sub-optimal, goes through *qualitatively* in this case also.

NGO motivation: We next try to capture the notion that NGOs may not be very profit oriented. Suppose the NGO's utility function puts a weight of γ on its monetary payoff, where $\gamma \leq 1$. Thus, under the case where the NGO is only involved in Stage 0, and borrower h is selected, the NGO's payoff

¹⁶We are indebted to Dilip Mookherejee and three anonymous referees for encouraging us to work on this section.

¹⁷The NGO opts to train provided $X > \mu c_0 + \frac{c_1}{\mu(\lambda' - \lambda)} - \frac{c_1}{\mu}$.

would be $\gamma r \beta_0 + \mu(X - r) - c_0$. It is straightforward to see that allowing for this does not affect the NGO's decision regarding borrower selection in any way. Will this affect the welfare calculations? Suppose that Assumption 1 earlier is replaced by

Assumption 1'. $X > \max\{1 + c_0 + \frac{\gamma c_1}{\mu(\lambda' - \lambda)}, \frac{1}{1 - \lambda}[u + 2c_0(1 + \frac{1 - \gamma}{1 + \mu})], \frac{u + 2c_0 - c_1}{1 - \lambda'}, \frac{c_1}{\lambda' - \lambda}\}$

It is then straightforward to show that the first best outcome will be as described in Proposition 1. Thus whether the NGO is more or less non-profit, does not have a qualitative affect on the analysis.

An NGO with a soft budget: We then consider a scenario where the NGO is not subject to any budget constraint. Clearly, this does not affect the NGO's borrower selection process. Given that the NGO's budget constraint does not bind, the first best outcome involves selecting the high-skilled type, and $r^{FB} = 1$ and $\beta_0^{FB} = 0$. We can thus obtain the following analogue of Proposition 2.

Proposition 2''. *Suppose $1 + \frac{u}{1 - \lambda} \leq X < 1 + \frac{u - c_1/\mu}{1 - \lambda'}$ and Assumption 1 holds.*

- (i) *The first best outcome is as described in Proposition 1.*
- (ii) *The first best can be implemented if the NGO is only involved in borrower selection, but not if the NGO is involved in both the stages.*

Competition among NGOs: Suppose there are n (> 1) NGOs with identical motivation parameter μ who are competing among themselves. To begin with note that this does not affect welfare calculations in a qualitative sense.¹⁸

We first consider the case where the government involves a single NGO in the project (if at all). Clearly, irrespective of which NGO is selected, its decision is described by Observations 1 and 2, so that Proposition 2 goes through as well.

We then consider the case where two different NGOs may be involved in stages 0 and 1. Rather interestingly, even in this case the main result

¹⁸All that happens is that in (5), (6), (7), (8) and (9), the term $(1 + \mu)$, will be replaced by $(1 + n\mu)$. This does not affect Proposition 1 qualitatively.

goes through. Since the NGOs are only interested in aggregate borrower welfare, borrower selection by the first NGO is going to be biased as long as it knows that the inefficient borrowers are going to be helped out in the project implementation stage. Thus this problem cannot be resolved by involving two different NGOs.

It may be argued though, that since the NGOs are *motivated*, there are unlikely to be several such NGOs working in the same area, and even if there are, the other NGOs are likely to be less efficient/motivated. In fact, this consideration also suggests that even under a dynamic framework our results may go through under reasonable parameter configurations, since the threat of switching to a different NGO in case of under performance is unlikely to be very effective.

Pro-poor Government objectives: Finally, suppose that social welfare function puts greater weight on the welfare of the less skilled (who is also relatively poorer in terms of her outside option), so that the first best involves the loan going to the low skilled. Given Proposition 2, this outcome can be achieved under stage 1 involvement by the NGO, but not without stage 1 involvement. In this case involving the NGO in both the stages has two benefits, first it increases the incentive to select the low skilled type, and second, given that the low skilled borrower has been selected, it increases the success probability of the borrower. This result is clearly the mirror image of Proposition 2.

6 Comparison with the Grameen Model

From a policy, as well as theoretical standpoint, there is an important debate on the relative efficiency of alternative credit delivery mechanisms, in particular the ‘linkage’ model studied in this paper,¹⁹ vis-a-vis the ‘Grameen’ model, where the NGO acts more like an independent source of finance with the bank giving loans directly to the NGO. The Grameen is formalized as

¹⁹This debate is of particular relevance to India where, while the SHG-linkage mechanism is the dominant paradigm, the Grameen replicator mechanism is also widely used (see Basu and Srivastava (2005)).

an institutional setup where (a) the decision on borrower selection, as well as on-the-job training, is taken by the concerned NGO, and (b) the bank loan is given directly to the NGO who is liable for repayment to the bank. Even in this simplified framework, however, the comparison turns out to be quite nuanced.

Note that under the Grameen approach, there are two kinds of transfers involved. The first is from the NGO to the bank, call it B , and the second is from the selected borrower to the NGO, call it N . The first issue is whether, under the Grameen model, the NGO can condition this N on villager types. It is quite possible that political considerations mandate that this transfer N be fixed by the government, so that such conditional transfer is not possible.²⁰ In that case the first best involves the government setting $B = 1$, and $N = 1 + c_0$. It is easy to see that this is equivalent to the linkage model with $r = 1 + c_0$, $\beta_1 = \frac{c_0}{1+c_0}$, and the NGO being involved in both the stages. Given Proposition 2, it is not surprising that in this case the Grameen model cannot implement the first best.

We then examine the case where the NGO *can* condition N on the identity of the borrowers. It turns out that in this case the answer depends on the degree of motivation, i.e. the value of μ . Without loss of generality let $B = 1$. There are two cases:

Case 1. Suppose the NGO is poorly motivated in the sense that $\mu < 1$. If the high-skilled borrower is selected then the utility of the NGO is $-1 - c_0 + N(h) + \mu(X - N(h))$ subject to the budget constraint, i.e. $X \geq N(h) \geq 1 + c_0$. It is easy to see that, $N(h) = X$, so that the utility of the NGO from selecting the high type is $X - 1 - c_0$. A similar argument establishes that $N(l) = X$, so that the utility of the NGO from selecting the low type is $\lambda'X - 1 - c_0 - c_1 + \mu u$.²¹ Given A1, the NGO necessarily selects the high skilled borrower. Thus the social welfare in this case is $X - 1 - c_0$

²⁰In the Indian scenario for example, numerous unfortunate cases of farmer suicides has led to wide-ranging demand that credit-oriented NGOs be regulated. In particular, there seems to be a *perception* that the interest rates charged under various schemes are too high.

²¹It is straightforward to show that the NGO will impart training in this case. Further, in this case, as well as case 2 (to follow), the NGO will prefer to find out about the identity of the borrowers.

(note that this is the same as NGO utility), which is less than the first best level under the SHG-linkage model.

This captures a very important trade-off. If the NGO is motivated, but not to a large extent, then even a motivated NGO may have an incentive to expropriate the villagers. While the effect is very stark in our framework, the effect should be qualitatively present even in richer and more realistic models.²²

Case 2. Finally suppose the NGO is very motivated in the sense that $\mu > 1$. In this case the NGO selects the minimum possible transfer, $N(\theta)$, that balances its budget in an ex ante sense. Thus $N(h) = 1 + c_0$ and $N(l) = 1 + c_0 + c_1$. Hence, the NGO selects the high type, and the first best is implemented, when the social welfare equals $(1 + \mu)(X - 1 - c_0)$. Consequently, if $X < 1 + c_0 + \frac{u}{1-\lambda}$ and $\mu > 1$, then, from Proposition 2, the first best can be implemented under the Grameen mechanism, but not under the linkage mechanism.

We collect the preceding analysis in the following Proposition.

Proposition 3 (i) *The linkage model of microfinance is likely to welfare dominate the Grameen one if either (a) the projects are reasonably productive and the NGO is not sufficiently motivated, or (b) there is a regulatory cap on the factor of interest.*

(ii) *However if the projects are not very profitable, and the concerned NGO is very motivated, then the Grameen model may welfare dominate the linkage one.*

Hence it appears that as the NGOs become more motivated, the case for a Grameen type mechanism becomes stronger.

We then introduce another institutional difference between the two schemes. It may be argued that an NGO may prefer the Grameen mechanism, since this involves direct NGO involvement in all phases of the project. One way to formalize this is to say that the magnitude of the two cost parameters, c_0^G and c_1^G under the Grameen approach, are lower compared to that under

²²Interestingly, even a regulated Grameen approach does not work in this case since if the government imposes a cap on the factor of interest, then we are essentially back to the linkage model with both stage involvement.

the linkage mechanism.

Interestingly, the effect of lower c_0^G and c_1^G move in different directions. Suppose that $c_0^G < c_0$, while $c_1^G = c_1$. If $1 + c_0^G + \frac{u}{1-\lambda} < X < 1 + c_0 + \frac{u}{1-\lambda}$, then mimicking the argument in Proposition 2, the first best can be implemented under the Grameen scheme, but not under the linkage program. Next suppose that $c_1^G < c_1$, while $c_0^G = c_0$. If $1 + c_0 + \frac{\mu u - c_1}{\mu(1-\lambda')} < X < 1 + c_0 + \frac{\mu u - c_1^G}{\mu(1-\lambda')}$, then from Proposition 2 the first best can be implemented under the linkage approach, but not under the Grameen model. Summing up, we have

Proposition 4 *Ceteris paribus, (i) a decrease in the borrower selection costs is likely to make the linkage model of microfinance less attractive, while (ii) a decrease in on-the-job training costs is likely to make the Grameen model less attractive.*

To sum up, the comparison between the linkage and the Grameen model turns out to be quite complex, and depends on a number of factors, namely regulatory issues, the productivity of the projects, as well as the motivation levels of the NGOs. Further, an increase in motivation levels has an ambiguous effect on this comparison.

7 Relation to Existing Literature

The literature on PPP can be organized around two broad themes (i) bundling versus unbundling of tasks and (ii) ownership issues. We refer the readers to Maskin and Tirole (2008) and Iossa and Martimort (2008) for a succinct introduction to the literature on PPP.

The baseline model in the bundling literature studies whether the design (and building) of infra-structure and its maintenance by *private* agents should be bundled or not. As is well understood, one argument for unbundling is that the “best developer might not also be the best operator” (Maskin and Tirole (2008)). A related argument is that, since the private agents are *profit-maximizers*, their choice may involve selection of poor quality (which may be cost-efficient). However, as argued by Iossa and Bennett

(2006) and Martimort and Pouyet (2008), in the presence of positive externalities, bundling may improve efficiency through a familiar internalization argument.²³

This literature is, in its turn, related to the large and substantial literature on delegation and intermediation, see, among others, Baron and Besanko (1992), Melumad *et al* (1995) and Mookherjee and Reichelstein (2001). The canonical problem here is one of procurement involving a single principal and multiple suppliers, all of whom have private information regarding their cost functions. The issue of interest is the comparison between centralization (or bundling), where the principal writes contracts with all the suppliers, and delegation, where the principal contracts with a subset of the suppliers, leaving them to write sub-contracts with the remaining suppliers. Recently, Mookherjee and Tsumagari (2004) and Laffont and Martimort (1998), extend the literature by allowing for collusion among the suppliers, examining the role of middleman delegation in such settings. The present paper may be thought of as a model of delegation to suppliers, with the NGO being more of a supplier rather than a pure middleman, where we do not allow for collusion possibilities among the NGO and the borrowers.

In contrast to the PPP literature, this paper examines a framework where (a) borrower selection is an intrinsic part of project design, (b) there is a *single* supplier, the NGO, potentially capable of borrower selection, as well as training,²⁴ and (c) the NGO is a motivated agent. Given that a basic reason for NGO involvement is their expertise in targeting and accessing the poor, neglect of borrower selection as a design element is somewhat surprising. Further, while the PPP literature does examine the case where the government indulges in pork-barrel politics, being motivated by loyalty

²³This argument is related to Hart (2003), who studies a model where a builder can perform two kinds of investments, productive and unproductive, where only the productive one raises quality. While making the developer fully accountable for the profit of the operator is another possible solution, this may not work if, for example, the developer is risk averse (Martimort and Pouyet (2008)).

²⁴Thus in this framework unbundling pertains to whether this single NGO is involved in both the tasks, or only in borrower selection. As we argue though, our results go through even if we allow for multiple NGOs.

to constituencies,²⁵ the role of motivated private agents has been relatively ignored.

Surprisingly enough, it turns out that unbundling is optimal despite the design stage having a positive externality on training costs later on. As we demonstrate, this result is critically dependent on the fact that the NGO is motivated, and does not hold in case the NGO only cares about its own profit. This shows that in the presence of borrower selection as a design element and motivated agents, being involved in the later stages may create incentives for inefficient borrower selection, since, with such involvement, *aggregate* borrower utility is higher in that case.

We next briefly discuss ownership issues in PPPs. The important contributions here are Besley and Ghatak (1999, 2001, 2005). Besley and Ghatak (2001) draws on the property rights literature to argue that ownership of a public project should go to the agent who has the highest valuation for the public good.²⁶ In related works, Besley and Ghatak (2005) examine the issue of motivated agents, focussing on the role of sorting in mitigating incentive problems, while Besley and Ghatak (1999) examine the holdup problem arising out of contractual incompleteness in specifying tasks.

Given that in our framework the NGO is a motivated agent, this would seem to imply that the NGO should necessarily be given property rights under PPPs. While a complete analysis of this issue is beyond the scope of this paper, our preliminary analysis suggests that providing ownership to the bank/government is always optimal. The reason behind this difference in result is quite intuitive. Recall that in our framework, the government cares about the budget constraint of the bank. Under bundling the NGO can select the inefficient type and invest in her, making it more difficult to satisfy the budget constraint of the bank. Thus, in contrast to Besley and Ghatak (2001), the central problem here is one of *over-investment* by the NGO, so it is not surprising that their result is qualified. While it is well known that in the presence of informational asymmetry, budget constraints may lead to inefficiency, most of this literature is in the context of non-motivated

²⁵Maskin and Tirole (2008) for example, study the role of spending caps in controlling the resultant distortion in such a scenario.

²⁶Francesconi and Muthoo (2006) examine a model with impure public goods.

agents. This paper shows that this problem continues to be relevant even when agents are motivated.

8 Conclusion

This paper examines public-private partnerships in micro-finance, whereby NGOs are used for channelizing credit to the poor. We find that there may be a distortion arising out of the fact that the NGO is a motivated agent, and its interest may diverge from that of the social welfare maximizer. Further, it turns out that controlling such distortion involves *unbundling* borrower selection and project implementation, with the NGO being involved in borrower selection alone. As argued earlier, these results contribute to two of the central debates in the PPP literature, that of bundling, as well as ownership.

Further, our results are of relevance to the micro-finance literature. First, the argument against involving NGOs sometimes revolve around the fact that they may be self-serving. Our analysis demonstrates that such self-serving behavior (if it exists), is not the only possible source of distortion, identifying a possible problem that may arise out of the fact that NGOs may be motivated.²⁷ From a policy perspective our analysis suggests keeping NGOs out of project implementation activities in villages that are neither too poor, nor too rich, and involving them fully otherwise.²⁸ Second, we use this framework to compare two alternative credit delivery mechanisms, the linkage approach vis-a-vis the Grameen model, and identify the factors that determine their relative efficiency.

Finally we suggest some avenues for future research. Consider divergence in NGO types so that there are several NGOs with different degrees of motivation, an extreme case being where some NGOs may be ‘self-serving’,

²⁷In the context of the Indian SHG-linkage program, Basu and Srivastava (2005) also argue that the fact that NGOs may value social objectives over commercial ones, may be problematic.

²⁸In this context the Indian SHG-linkage program is of interest. Not only does it explicitly encourage the borrowers to take up greater responsibilities as encapsulated in the title “self help”, it prohibits the NGOs from any financial intermediation. It may possibly be argued that both these aspects are in consonance with our theoretical prediction.

perhaps even corrupt, where such corruption may, or may not involve collusion with the borrowers. In such scenarios, it is of interest to design incentive schemes such that the ‘right’ NGO is selected. In particular, one can follow the mechanism design literature under collusion, e.g. Mookherjee and Tsumagari (2004), in studying the role of delegation in such a framework. One could also consider a dynamic setting where the NGO’s information regarding the borrowers improves with greater involvement, e.g. training. Other issues of interest include group-formation (i.e. the possibility of assortative matching), the process of empowerment of the recipients, etc.

9 Appendix

Proof of Proposition 1. The proof constitutes in solving for the optimal (r, β_I) combination under all possible institutions, and then comparing the optimal social welfare under the various institutions.

Case 1: The NGO is involved in Stage 0 only.

We first consider the case where the high skilled borrower obtains the loan. As we have already argued, the optimal social welfare in this case is given by

$$\underline{W}^0(h) = (1 + \mu)(X - 1 - c_0) > 0.$$

We then consider the case where the low skilled borrower obtains the loan. The social welfare in this case equals

$$\begin{aligned} W^0(l, r, \beta_0) &= r\beta_0 + (1 + \mu)[\lambda(X - r) + u] - r\beta_0 + \lambda r - 1 - c_0 \\ &= (1 + \mu)(\lambda X + u) - \lambda \mu r - 1 - c_0. \end{aligned} \quad (18)$$

The government chooses (r, β_0) so as to maximize $W^0(l, r, \beta_0)$ subject to: $r\beta_0 \geq c_0$ and $\lambda r - r\beta_0 \geq 1$. Clearly, the solution involves

$$r = \frac{1 + c_0}{\lambda}, \text{ and } \beta_0 = \frac{\lambda c_0}{1 + c_0}. \quad (19)$$

Thus the optimal social welfare

$$\underline{W}^0(l) = (1 + \mu)(\lambda X + u - 1 - c_0). \quad (20)$$

Given A1, recall that $\underline{W}^0(h) > \max\{0, \underline{W}^0(l)\}$.

Case 2: The NGO is involved in both stages (i.e. 0 and 1).

It is easy to see that in case the high skilled borrower is selected, the social welfare

$$\begin{aligned} W^1(h, r, \beta_1) &= r\beta_1 + (1 + \mu)(X - r) + (1 - \beta_1)r - 1 - c_0 \\ &= (1 + \mu)X - \mu r - 1 - c_0. \end{aligned} \quad (21)$$

The government maximizes $W^1(h, r, \beta_1)$ subject to $r\beta_1 \geq c_0$ and also $(1 - \beta_1)r \geq 1$, i.e. $r - 1 \geq r\beta_1 \geq c_0$. Mimicking the argument in Case 1, optimally

$$r = 1 + c_0, \text{ and } \beta_1 = \frac{c_0}{1 + c_0}, \quad (22)$$

and the optimal social welfare

$$\underline{W}^1(h) = (1 + \mu)(X - 1 - c_0). \quad (23)$$

Next consider the case where the low skilled borrower obtains the loan. First note that given Assumption 1, the NGO would provide training subject to the budget constraint being met. Consequently, the social welfare

$$\begin{aligned} W^1(l, r, \beta_1) &= r\beta_1 + (1 + \mu)[\lambda'(X - r) + u] + \lambda'r - r\beta_1 - 1 - c_0 - c_1 \\ &= (1 + \mu)X - \mu\lambda'r - 1 - c_0 - c_1. \end{aligned} \quad (24)$$

The government maximizes $W^1(l, r, \beta_1)$ subject to $r\beta_1 \geq c_0 + c_1$ and $\lambda'r - r\beta_1 \geq 1$. Mimicking the argument in case 1, optimally

$$r = \frac{1 + c_0 + c_1}{\lambda'}, \quad \beta_1 = \frac{\lambda'(c_0 + c_1)}{1 + c_0 + c_1}. \quad (25)$$

The optimal social welfare thus equals

$$\underline{W}^1(l) = (1 + \mu)(\lambda'X + u - 1 - c_0 - c_1). \quad (26)$$

Given A1, $\underline{W}^1(h) > \underline{W}^1(l)$.

Case 3: The NGO is not involved at all.

In this case there is an equal probability of the loan going to a high-skilled, and a low-skilled borrower. Consequently, the government maximizes

$$W'(r) = (1 + \mu)\left[\frac{(X - r)(1 + \lambda) + u}{2}\right] + \frac{r(1 + \lambda)}{2} - 1, \quad (27)$$

subject to $\frac{r(1 + \lambda)}{2} \geq 1$. Clearly, the solution involves

$$r = \frac{2}{1 + \lambda}. \quad (28)$$

The optimal social welfare evaluated at this factor of interest equals

$$\underline{W}' = (1 + \mu)\left[\frac{X(1 + \lambda) + u}{2} - 1\right]. \quad (29)$$

Case 4: The NGO is involved in stage 1 alone.

The bank randomly picks a borrower and then asks the NGO to train the low skilled borrower. The government maximizes the social welfare

$$W^{1'} = r\beta_{1'} + (1 + \mu)\left[\frac{(X - r)(1 + \lambda') + u}{2}\right] + \frac{r(1 + \lambda')}{2} - r\beta_{1'} - 1 - \frac{c_1}{2}, \quad (30)$$

subject to $\frac{r(1+\lambda')}{2} - r\beta_{1'} \geq 1$ and $r\beta_{1'} \geq \frac{c_1}{2}$. Clearly, the solution involves

$$r = \frac{2 + c_1}{1 + \lambda'} \text{ and } \beta_{1'} = \frac{c_1(1 + \lambda')}{2(c_1 + 2)}. \quad (31)$$

Hence the social welfare in this case equals

$$\underline{W}^{1'} = (1 + \mu) \left[\frac{X(1 + \lambda') + u}{2} - 1 - \frac{c_1}{2} \right]. \quad (32)$$

Given Assumption 1, Proposition 1 now follows from a comparison of the various optimal welfare levels derived above.

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