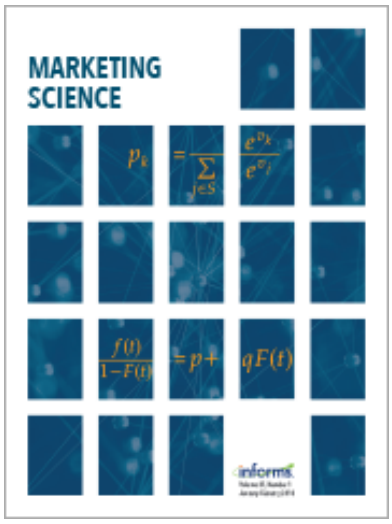

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Informal Lending in Emerging Markets

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Abstract. Microentrepreneurs in emerging markets often rely on informal lenders for their routine borrowing needs. This paper investigates informal lenders' and microentrepreneurs' incentives to participate in a lender–borrower relationship in a market in which repayments are neither law protected nor asset secured. We consider a borrower who seeks a short-term loan, invests in a project, and repays in full using her project earnings if the project is successful. If the project fails, the borrower uses her outside option to repay over a period of time. The analysis uncovers an interesting effect of the borrower's outside option on the loan rate offered by the lender—the loan rate first increases and then decreases with the borrower's outside option. An important policy implication is that an increase in the outside options of the poor microentrepreneurs might actually reduce their surplus. Finally, we find that lenders in emerging markets may be more likely to engage in informal lending compared to those in developed or poorer markets.

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Keywords: informal lending • microentrepreneurship • relational contact • emerging markets

> The sight of countless fruit and vegetable sellers standing side by side on street corners is common to cities in most developing countries. Each of the sellers (usually a woman) has a small cart or just a sheet of tarp on the pavement on which she has piled tomatoes, onions, or whatever she happens to be selling. *The vendors buy their stock in the morning from a wholesaler, usually on credit, and sell it during the day, reimbursing the wholesaler at night.*
>
> —Banerjee and Duflo (2011), *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty*

1. Introduction

The prevalence of entrepreneurship in emerging markets often comes as a great surprise for many people, and it raises hope for the world economy (Chandy and Narasimhan 2015). Both the vegetable sellers frequently seen on Indian streets and the online sellers at China's Taobao.com (Alibaba) engage enthusiastically in microentrepreneurship. Most of these entrepreneurs have no access to the formal banking system because of either the unavailability of formal banks in the neighborhood or the unwillingness of formal banks to lend to these entrepreneurs. Even if formal banks are accessible, these entrepreneurs find borrowing from formal banks unattractive because of the lengthy paperwork, verifications, and delays involved in the process. This reality induces the emergence and popularity of informal lending in emerging markets. For example, the vegetable sellers in India borrow from wholesalers; the Chinese online giants Alibaba and Tencent offer personal, collateral-free loans in minutes through their Mybank and WeChat apps, respectively. These informal lending activities are prevalent in most developing markets.[1] Although informal lending manifests itself in many different forms, our focus is specifically on traditional money lending, which is substantive in terms of both business activities and employment in these emerging markets (Banerjee and Duflo 2011).

Several features of moneylending distinguish it from other informal borrowing options, such as subprime lending, microfinance, and chit funds, available to microentrepreneurs in different markets. Moneylenders in emerging markets are usually not registered and therefore do not enjoy the legal protection that subprime lenders and microfinance firms do. This lack of legal protection puts moneylenders at a high risk of facing default. Interestingly, however, informal banking, including informal moneylending, has been growing in most emerging economies, and default rates are comparable to those in formal lending or even better (Banerjee and Duflo 2011). Unlike microfinance firms and chit funds that operate by organizing groups of borrowers to induce payments by peer pressure, the contract between the moneylender and the entrepreneur aims to sustain a long-term lender–borrower relationship in the absence of legal protection and without the use of collateral or peer pressure. Another feature of moneylenders in emerging markets is that they typically accumulate large sums of undeclared cash, which

they neither deposit in banks nor invest in formal investment options. We incorporate these features in our model.

There are several characteristics of microentrepreneurs that we also capture in our model. First, their needs are often short term and immediate. For example, vegetable sellers need money in the morning for the day, farmers need money in the harvesting season until crops are ready to sell, tailors need money to buy fabric and sewing machines every season, and many rickshaw pullers (and pedicab drivers) get their rickshaws on credit when they start their day. For these microentrepreneurs, delays in securing loans are very costly because they result in missed opportunities. Second, their borrowing needs are repetitive. Vegetable sellers need to borrow every day, farmers need to borrow every season, tailors need to borrow whenever demand arrives, and rickshaw pullers need to borrow whenever they want to pull rickshaws. Third, these entrepreneurs often do not have any assets to offer as collateral and need collateral-free loans. Fourth, these entrepreneurs find saving money difficult. They are struggling to support the basic needs of their families and even when they make above-average returns on their investment, they are back to borrow money from the moneylender when the next investment opportunity arrives. Informal banks, and moneylenders in particular, satisfy this market demand by offering short-term, collateral-free loans to microentrepreneurs.

We study the lender–borrower relationship using a model in which an entrepreneur seeks to borrow funds to finance her single-period projects, the success of which is stochastic.[2] A lender who does not enjoy any legal protection offers immediate, collateral-free loans. The borrower borrows funds, invests them in the project, and decides whether to repay or default at the end of the project if the project is successful. If the project fails, the borrower decides whether to repay over a period of time by using her outside option, for example, by selling labor or default.

An important objective of this analysis is to show a self-enforcing stationary contract exists that sustains the lender–borrower relationship even in the absence of collateral and legal protection. Indeed, we show that a self-enforcing relational contract exists in which the lender offers loans if the borrower has repaid previous loans. The borrower repays in full if her project is successful, and over a period of time using her outside option if the project fails. The expected future income from investing in subsequent projects, once the current loan is fully repaid, works as collateral and induces the borrower to repay even when her project fails. The lender forfeits the borrower's expected future income from microentrepreneurship by not offering her any loans in the future if the current loan is not fully repaid. Intuitively and as expected, a sufficiently large borrower's outside option drives down the equilibrium interest rate because the lender worries about the borrower defaulting and taking her outside option going forward if her project fails. If the borrower's outside option becomes too large, the relationship cannot be sustained at any positive loan rate. However, it is interesting to note that an increase in the borrower's outside option from an initial low level results in a higher interest rate. If the borrower's outside option is small, the lender is not concerned about default. Instead, she is concerned about the borrower repaying over a period of time using her outside option when she can actually repay in full when her project is successful. An increase in the borrower's outside option makes the borrower more likely to repay in full instead of using her outside option for repayment. As a result, the equilibrium loan rate increases.

Investigation of the implications for the borrower if her project fails leads to an important discovery. We find the repayment period set by the lender, during which the borrower repays all of her earnings from her outside option, could be much longer in emerging markets (where the worker's outside options are in the intermediate range) compared to poor or developed markets. This is because in poor markets, lenders prefer that borrowers quickly return to investing in the next project after an unsuccessful project, whereas in developed markets, a long repayment period makes default attractive to borrowers. Note that borrowers in emerging markets either choose to work at a factory as a daily wage worker or (if required by the lender) sell their labor to the lender to repay when their project fails. We believe our finding about the equilibrium repayment period for the case in which the borrower works for the lender to repay the outstanding loan may be one of the reasons for the persistence of the practice of "bonded labor" in some emerging markets.

The outside option of the borrower captures routine income opportunities available to the borrower in the market. A policymaker may seek to create better income opportunities by creating employment opportunities, implementing employment guarantee schemes, or increasing the minimum wage that factories pay to workers. Our finding about the effect of the borrower's outside option on her expected surplus has important policy implications. We show that a small increase in the borrower's outside option, from an initial low, can reduce her surplus. The implication is that the efforts to create better income opportunities or reduce poverty in emerging markets should be large enough to ensure the welfare of microentrepreneurs actually improve.

Our finding also sheds light on the prevalence of informal banking in emerging markets. We show the

lender's value function is highest in the intermediate range of the borrower's outside option. Lenders can set the highest loan rates for short-term and long-term loans in this intermediate range. Because workers' outside options in emerging markets are higher than in poor economies but lower than in developed economies, informal moneylending is likely to be more prevalent in emerging markets.

1.1. Related Research

Fundamental to the success of microentrepreneurship is the microentrepreneur's ability to source funds for investment (Banerjee and Duflo 2011). Informal lending plays a key role in addressing this market need for funds. Allen et al. (2005) document the important role of the informal financial system in the fast growth of Chinese private firms. Straub (2005) points out that informal lending may be better suited for small entrepreneurs, and Gennaioli et al. (2013) argue that shadow banking systems can be welfare enhancing. Turvey and Kong (2010) provide empirical evidence that most farm households tend to use informal banking to finance their businesses.

Poor entrepreneurs are often unable to offer any collateral. Because default is one of the major concerns, theoretical literature on informal banking has focused on describing mechanisms that can be used to create repayment incentives in the absence of any collateral. Stiglitz (1990) argue the likelihood of repayment is enhanced if a peer who is in a good position to monitor the borrower be required to pay a penalty if the borrower defaults. Hoff and Stiglitz (1997) claim that private moneylenders in developing countries ensure enforcement by a combination of costly collection efforts and reputational effects that punish defaulters. Ghatak and Guinnane (1999) show how joint liability for the borrowing group reduces enforcement costs and increases repayment rates. Cheung and Sundaresan (2006) examine the role of monitoring by the lender and the loan maturity period on the loan rate and default likelihood. Kowalik and Martinez-Miera (2010) study the impact of an entrepreneur's outside option (income) on her loan-repayment incentives in the context of borrowing from a microfinance institution, such as Grameen Bank, and find that a lower outside option creates higher repayment incentives. In our model, there is no group borrowing, reputational concerns, or monitoring. We show that a lender–borrower relationship can still be sustained in equilibrium because expected returns from potential future investment opportunities act as collateral and induce repayments.

An evolving literature in marketing explores informal lending and its effect on entrepreneurship. Galak et al. (2011) investigate microfinance lending decisions and find that informal lenders prefer to lend to individuals who are socially proximate to themselves. Zhang and Liu (2012) examine herding behavior in online peer-to-peer loan auctions and report that lenders infer creditworthiness of a borrower by observed peer lending decisions. Agrawal et al. (2017) exploit the link between informal lending and entrepreneurship to explore how slack time influences entrepreneurial experimentation. Hu et al. (2017) develop an empirical model to investigate the risk of informal banking, using a comprehensive data set of detailed loan and deposit information of several representative Chinese informal banks. Kim et al. (2016) examine the relational capital that a microfinance bank sales force earns from customers and provide implications for sales force management plan design. We contribute to this growing marketing literature by examining the informal lender's and microentrepreneur's incentives to engage in a lender–borrower relationship and sustain informal lending even in the absence of collateral and legal protection.

Our paper is also related to the literature on marketing of financial products. Li et al. (2005) examine cross-selling in consumer banking services and find that women and older consumers are more sensitive to their satisfaction with the bank when deciding whether to purchase additional financial services. Amar et al. (2011) show that consumers with multiple debt accounts display debt-account aversion and prefer to pay off the smallest loan first instead of the one with the highest interest rate. Navarro-Martinez et al. (2011) show that increasing the minimum required payment on a credit card has a positive impact on consumers' repayment decisions. Like Li et al. (2005), we study cross-selling of the second loan to the borrower in the case of likely default on the first loan. Similar to Amar et al. (2011) and Navarro-Martinez et al. (2011), we focus on repayments. However, we make an important contribution to this literature by studying cross-selling of financial products to microentrepreneurs and their repayment decisions in the context of emerging markets.

Our work also contributes to research on emerging markets in the recent marketing literature. Both Narasimhan et al. (2015) and Sudhir et al. (2015) call for research related to emerging markets where economic activities are often characterized by (1) unique social and institutional market environments, (2) credit constraints, and (3) lack of legal protections. The existing research in the area has focused on the implications of unique social and institutional market environments and the lack of legal protection (Qian et al. 2014, Sudhir and Talukdar 2015, Zhang 2015, Desai et al. 2016, Ni and Srinivasan 2015, Singh 2017). We contribute to this growing literature by investigating informal lenders' incentives to engage in a lender–borrower relationship with credit-constrained microentrepreneurs.[3]

Finally, our paper is closely related to the economic literature on relational contracts. Levin (2003) studies self-enforced relational contracts in the context of hidden information, moral hazard, and subjective performance measures and shows the optimal contract can be stationary. Brown et al. (2004) investigate how the absence of a third-party enforcement affects relational contracts and the nature of market interactions. Li and Matouschek (2013) study how relational contracts help resolve the conflicts between the manager and the workers in a company. Macchiavello and Morjaria (2015) study the supply relationships in the Kenyan rose export sector and provide empirical evidence that in emerging markets, sellers' reputation for reliability helps sustain the transactions and increases the trade volume when formal contract enforcement is absent. We contribute to this active area of research by examining the optimal relational contract in informal lending in emerging markets. Both the borrower and the lender use the ongoing lender–borrower relationship to discipline the partner's behavior. We show that in this relationship-based informal lending, the borrower may repay via installments to avoid termination of the relationship when she cannot repay immediately.

2. The Model

We develop a model in which a lender and a borrower (a microentrepreneur) interact in an emerging market. At time t, which is continuous, the borrower seeks to borrow unit funds to invest in a risky project. Once the investment is made, the project lasts for a unit time period at the end of which the outcome is realized. The borrower undertakes only one project at a time. The project yields the borrower a return of $1 + R$ (where $R > 0$) if it is successful and 0 otherwise. The probability with which the project is successful is $p \in (0, 1)$. We assume the expected return from the project is large enough, $p(1 + R) > e^z$, where z is the continuous compounding interest rate. If the expected returns from the project are too small, the borrower does not undertake the project. The borrower does not have any physical assets that can be pledged as collateral.

The outcome of the project is the private information of the borrower. The borrower, instead of investing in the project, can choose to take a regular job (e.g., work at a factory or as domestic help), which brings her a risk-free and continuous income stream $w > 0$. We refer to w as the outside option of the borrower. Consistent with the findings from the literature on microentrepreneurs in emerging markets, we assume the borrower does not have any savings and cannot self-finance the project. In other words, any income from previous successful projects is not available to the microentrepreneur for investing in subsequent projects.

The lender has access to one unit of funds, at unit cost, which she can lend to the borrower. The outside option of the lender is zero.[4] The lender sets the loan interest rate $r > 0$, which dictates the amount of money the borrower must return at the end of the project. Note that the borrower has no savings, and the payoff in the case of a failed project is zero; therefore, the borrower is able to return the money back to the lender only if the project is successful. If the project fails, the lender refuses to offer any more loans to the borrower unless the borrower repays in full using her outside option. The lender sets the repayment period x, during which the borrower repays at a continuous rate w using her outside option.[5] Once the borrower has repaid, she can once again borrow from the lender. We assume a project is always available to be picked up by the microentrepreneur subject to funding availability.

Now we describe possible states S_t of the lender–borrower relationship. This relationship has three states: continuation (*CON*), suspension (*SUS*), and termination (*TER*). At any time t, if the borrower has no outstanding loan, the state is *continuation*. In this state, the lender offers the borrower funds at rate r. If the borrower has not fully repaid but is paying back using her outside option, the state is *suspension*. During the suspension state, the lender does not offer any additional loans to the borrower. Last, if the borrower has neither paid in full at the end of the project nor used her outside option, the state is *termination*. Once the termination state is reached, the lender does not offer any loans to the borrower, and the two parties never again engage in the lender–borrower relationship. The borrower in this case takes her outside option for the rest of her life. Because most microentrepreneurs live in small communities, the borrower may have difficulty securing a loan if she has defaulted in the past. Both the borrower and the lender live forever and share the same continuous compounding interest rate z. Both players are risk neutral.

The borrower makes two decisions. The first is whether to accept the funds at loan rate r. The second is whether to repay in full if possible, repay w for a time period x using her outside option, or default. The borrower can repay in full only if her project is successful. However, the borrower can choose to repay using her outside option in both cases when her project is successful and she can actually repay in full and when her project fails and she can repay only using her outside option. The borrower can choose to default at any time.

The sequence of actions is as follows. At time t, the lender sets the loan rate r for full repayment and the time period x for which the borrower will repay w if she chooses not to repay in full at the end of the project. The borrower decides whether to borrow funds given the lender's offer. If the borrower borrows funds, she invests them in a project. At time $t + 1$, the outcome of the project is realized. The borrower observes the outcome privately and decides whether to repay in full,

repay using her outside option, or default. If the borrower repays in full, the same sequence that started at time t follows. If the borrower decides to repay using her outside option for a period x, the sequence of actions that started at time t follows once the lender receives the full repayment. If the borrower chooses to default at any time, the lender–borrower relationship terminates.

2.1. Analysis and Results

If the borrower invests in the project at time t, the outcome is realized at time $t+1$. After learning the outcome of her project, the borrower chooses one of three repayment strategies depending on the outcome of the project: (1) repay in full, (2) repay using her outside option, or (3) default. The borrower can repay in full only if her project is successful. Suppose the project indeed succeeds and the borrower chooses to repay $1+r$ in full. The relationship status remains at *CON*. The borrower can invest in her next project at this time. We represent the borrower's expected value of continuing the relationship at the time of investing in a new project (i.e., the time 0 expect utility) by U. The borrower's expected payoff, if she repays in full, can be written as $U-(1+r)$.

Now consider the possibility in which either the borrower's project fails or she spends the earnings from her successful project on other emergency needs. In this case, the borrower cannot repay the lender in full. She either defaults or repays by selling labor to the lender for a time period x.[6] If the borrower repays by selling labor, the relationship status changes to *SUS*, and the borrower makes nothing for the next time period x. However, once the outstanding loan is fully repaid, the relationship status updates to *CON*, and the borrower can once again invest in a project. Therefore, her expected payoff is simply $e^{-zx}U$. If the borrower chooses to default, she makes w for the rest of her life and receives an expected payoff of $w\int_0^\infty e^{-zt}\,dt$.

We characterize the stationary equilibrium in which the borrower repays in full at the end of her project if the project is successful and by using her outside option if the project fails. Because the borrower repays in full when her project is successful, she must be better off paying $1+r$ for the potential benefit U of future borrowing compared to defaulting. The following equation captures this constraint:

$$U-(1+r)\geq w\int_0^\infty e^{-zt}\,dt. \tag{1}$$

Recall that the lender does not observe the outcome of the project. Therefore, the borrower can pretend the project has failed even when it is successful. The lender prefers the borrower to repay immediately if her project is successful. Because the borrower repays in full when her project is successful, she must be better off paying back $1+r$ and getting back to investing in her next project immediately rather than waiting for a period x. Therefore, we get the following condition:

$$U-(1+r)\geq e^{-zx}U. \tag{C1}$$

If the project fails, the borrower can choose to either default or repay using her outside option. If she defaults, she takes her outside option for the rest of her life; however, if she repays using her outside option, she gets back to investing in a project once she has fully repaid. The borrower chooses to repay using her outside option instead of defaulting if she finds expected payoffs from potential future projects to be more attractive compared to taking the outside option for the rest of her life. The comparison leads us to the following condition:

$$e^{-zx}U\geq w\int_0^\infty e^{-zt}\,dt. \tag{C2}$$

Lemma 1. *If the borrower* (1) *prefers to repay in full compared to repay using her outside option when her project is successful and* (2) *prefers not to default when her project fails, she also prefers not to default if her project is successful.*

Lemma 1 follows directly from the comparison of the above three constraints. The constraint given by Equation (1) is redundant. The intuition is as follows. The borrower's repayment decision is based on the expected future payoffs regardless of the history. If the borrower prefers to repay in full rather than repay using her outside option and prefers to repay using her outside option rather than default, as a result of transitivity of her preferences, she also prefers to repay in full rather than default. Therefore, we focus our attention on conditions (C1) and (C2) that must be satisfied for the lender–borrower relationship to be sustained.

The time 0 expected utility U of the borrower can be written as follows:

$$U=e^{-z}[p(R-r+U)+(1-p)e^{-zx}U].$$

The first term captures the borrower's expected utility if her project is successful, and the second term captures expected utility if it fails. If the project is successful, with probability p, it offers the borrower a return of $1+R$, out of which the borrower returns $1+r$ to the lender. At this point, the borrower once again borrows from the lender to invest in her next project and gets an expected utility of U. If the project fails, the borrower does not make any money for the subsequent time period of x, because she offers all of her income from her outside option to the lender. However, once she has no outstanding debt, she can borrow again and invest in a new project. Solving the above expression for U, we get

$$U=\frac{p(R-r)}{e^{z}-e^{-zx}(1-p)-p}. \tag{2}$$

Next, we describe the lender's value function V, which is the time 0 value of the lender's payoff. The relationship status at time 0 is *CON*. With probability p, the project is successful and the borrower repays $1+r$. The relationship status remains at the *CON* state. Therefore, the expected payoff, if the project is successful, is $1+r+V$. However, if the project fails, the lender receives a continuous repayment of w for a period x, during which the relationship status is *SUS*. Once the borrower has fully repaid the loan, the relationship status updates to *CON*. Therefore, the expected payoff if the project fails is given by $w\int_0^x e^{-zt}\,dt + e^{-zx}V$. The lender's time 0 value function can be written as

$$V = e^{-z}\left[p(1+r+V)+(1-p)\left(w\int_0^x e^{-zt}\,dt + e^{-zx}V\right)\right]-1. \tag{3}$$

The lender sets the loan rate r and the repayment period x that maximizes her value function V subject to constraints (C1) and (C2). We introduce a threshold outside-option wage rate $\tilde{w}$ (derived in the appendix) for the borrower, below which ($w<\tilde{w}$) the lender sets the equilibrium loan rate such that only constraint (C1) binds. This is because if the borrower's outside option is small, the borrower is unlikely to default and take her small outside option for the rest of her time. The lender understands this trade-off the borrower faces and is therefore concerned only about getting the borrower to repay in full when her project is successful. Only when the borrower's outside option is large enough ($w>\tilde{w}$) does the lender start to worry about the borrower's likely default as well. Therefore, if $w>\tilde{w}$, sustaining the lender–borrower relationship requires both constraints, (C1) and (C2), to bind. The following proposition describes the equilibrium loan rate and the repayment period. All proofs are presented in the appendix.

Proposition 1. *In the equilibrium, the lender sets a loan rate*

$$r^* = \begin{cases} R - \dfrac{\sqrt{z(1-p)p(1+R)[zp(1+R)+w-e^z(z+w)]}}{zp} \\ \quad \text{if } w<\tilde{w}, \\ \dfrac{zp(1+R)+w-e^z(z+w)}{ze^z} \\ \quad \text{if } \tilde{w}\le w\le \dfrac{zp(1+R)-ze^z}{e^z-1}, \end{cases} \tag{4}$$

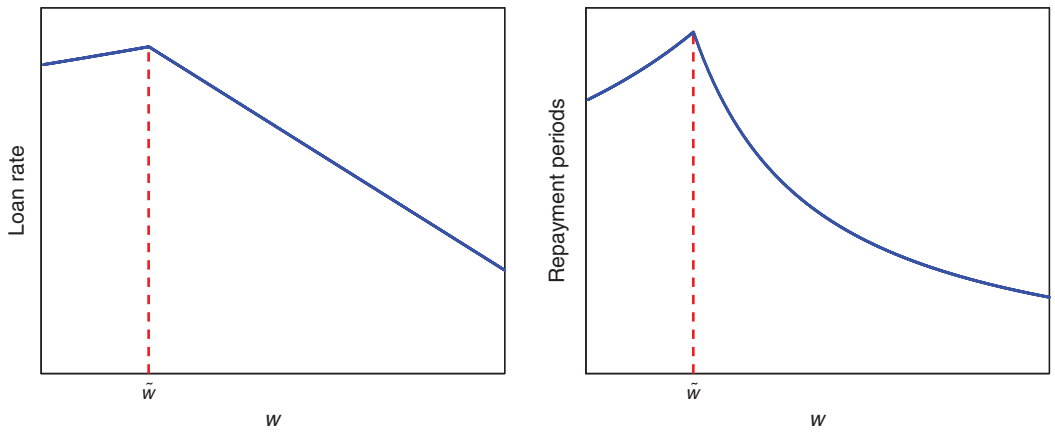
and if the project fails, requires the borrower to repay w for a period

$$x^* = \frac{1}{z}\ln\left(\frac{p(1+R)-(1+r^*)}{p(1+R)-e^z(1+r^*)}\right).$$

The contract specified in Proposition 1 sustains the lender–borrower relationship even in the absence of any collateral. If there is no outstanding debt, the lender offers funds to the borrower at a loan rate r^*. The borrower repays in full if her project is successful, and repays for period x^* using her outside option w if her project fails. The borrower does not default, because the future value of staying in the lender–borrower relationship acts as collateral and induces her to repay. It is intuitive that the relationship cannot be sustained if the wage rate w of the borrower is sufficiently high or if the expected return from the project is too small. In this case, the borrower finds default more attractive compared to repaying any positive interest for the option of investing in future projects.

Next, we examine the effect of changes in the borrower's outside option w, which she earns in case she chooses not to undertake the project, on the equilibrium loan rate and repayment period. We discover a nonmonotonic effect of w on both the loan rate and the repayment period as described in Proposition 2. The results are also presented graphically in Figure 1.

Figure 1. (Color online) Equilibrium Loan Rate and Repayment Period with the Borrower's Outside Option



Proposition 2. *If the borrower's wage rate w from her outside option*

(i) *is smaller than $\tilde{w}$, both the equilibrium loan rate r^* and repayment period x^* increase in w;*

(ii) *is greater than $\tilde{w}$, both the equilibrium loan rate r^* and repayment period x^*decrease in w.*

The loan rate first increases and then decreases with w. The intuition is as follows. If w is small ($w < \tilde{w}$), the constraint (C1) binds but the constraint (C2) does not. The lender's primary concern is that the borrower might pretend the project has failed when it has actually been successful. The borrower, in this case, does not repay in full at the end of the project. Instead, she keeps the project earnings and repays at rate w for a period x by working at an outside job. A small increase in w makes the borrower less willing to use w to repay. The equilibrium loan rate rises because the lender becomes less concerned about the deviation with the increase in the borrower's wage from her outside job. If w is sufficiently high ($w \geq \tilde{w}$), the constraints (C1) and (C2) bind. The lender is also concerned about the borrower defaulting and taking her outside option forever instead of repaying w for a period x when her project fails. An increase in w increases the likelihood of the borrower defaulting. Therefore, the lender reduces the loan rate to ensure the borrower still finds the expected payoff from her project to be higher than the payoff from default and taking w forever.

The equilibrium repayment period x^* also changes nonmonotonically with w. The length of the repayment period x captures the loan rate the lender offers if the borrower does not repay in full at the end of the project. It also imposes a cost on the lender. The lender faces the following trade-off while setting x. If x is small, the lender recovers less return on the funds she offered the borrower. However, if x is large, the lender keeps the borrower away from investing in a subsequent project longer after a failed project. If w is small ($w < \tilde{w}$), the lender prefers the borrower to undertake her next project sooner because the lender does not recover much money per unit time, because of small w. On the other hand, letting the borrower take her next project creates the possibility of making money on the next project. Therefore, the equilibrium repayment period x^* is small for a small w. If w is large ($w \geq \tilde{w}$), the constraint (C2) binds, and the lender becomes concerned about the borrower's likely default when her project fails. To keep the borrower in the relationship, in case the project fails, the lender offers a small x for large w. Only in the intermediate range of w is the repayment period set by the lender large. The intermediate region of outside options for borrowers may be representative of emerging markets where outside options are neither high, like in developed markets, nor very low, like in poor markets. Therefore, we expect the interest rates set by informal lenders to be higher in emerging markets compared to developed or poor markets.

Next, we discuss the effect of the net returns R of the successful project on the equilibrium contract. Intuitively and as expected, the loan rate r^* increases with R. The effect on the repayment period x^* is more interesting. The repayment period x^* first increases and then decreases with the increase in R. Although an increase in the repayment period is desired because it generates a higher repayment amount, it can also be disadvantageous because it keeps the borrower from investing for a longer period. If project returns are very attractive, the lender prefers the borrower to quickly return to investing and makes the repayment period shorter.

2.2. Incentives to Engage in Informal Lending

Informal lending is widespread in emerging markets. Most microentrepreneurs in emerging markets either do not have access to formal banks or they find them too costly. At the same time, many potential informal lenders have access to cash but do not find formal investment options attractive. Weak institutions and the inaccessibility of formal banks to microentrepreneurs creates an environment for informal lending to flourish in emerging markets. In this section, we examine a lender's incentives to engage in informal lending in a market.

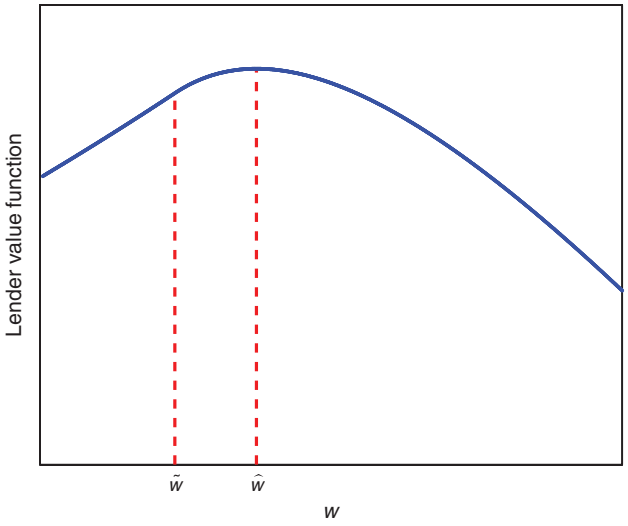
Microentrepreneurs in different markets have different opportunities if they decide to do something other than undertake a project. For example, a microentrepreneur in rural Congo can instead choose to fish in the river, making enough to provide one meal a day for his family; a microentrepreneur in China can choose to work at a factory, making enough to barely support their family; and a microentrepreneur in the United States can work at a retail chain, making minimum wage while potentially benefiting from government aid programs for the poor. In this section, we investigate how a borrower's outside option affects a lender's incentives to engage in an informal lending relationship described in Section 2.1.

The lender's incentive to engage in the informal lender–borrower relationship captured by her time 0 value function can be written (using Equation (3)) as

$$V = \frac{z[p(1+r^*) - e^z] + (1 - e^{-zx^*})(1-p)w}{z[e^z - p - (1-p)e^{-zx^*}]},$$

where r^* and x^* are the equilibrium loan rate and repayment period, respectively, and are specified in Proposition 1. An examination of the lender's incentive to participate in an informal lender–borrower relationship leads us to the following proposition.

Figure 2. (Color online) Lender's Incentives to Engage in Informal Lending



Proposition 3. *The lender's incentive to engage in informal lending*

(i) *is strictly positive and increases with w if w is sufficiently small,*

(ii) *is strictly positive and decreases with w if w is in the intermediate range, and*

(iii) *is negative if w is sufficiently large.*

The above results are also graphically presented in Figure 2. If the borrower's outside option w is very small ($w < \tilde{w}$), the lender's incentives to participate in informal lending increases with w. This increase is due to a higher loan rate r and repayment period x that the lender sets for a higher w. Note, however, that in the range ($\hat{w} > w > \tilde{w}$) when the equilibrium loan rate as well as the repayment period actually decrease with an increase in w, the lender's incentive to participate in informal lending keeps increasing. The intuition is that although a decrease in x leads to a lower repayment payoff, it also gets the borrower back into investing in the project more quickly. If the loan rate is sufficiently high, a decrease in x can actually create more value for the lender. Of course, if we increase w even higher ($w > \hat{w}$), both the loan rate and the repayment period become even smaller, which leads to a lower value for the lender. For a sufficiently large w, the lender loses all incentive to participate in informal lending.

The lender's incentive to informally lend to the borrower is the highest in the intermediate range of the borrower's outside option. The implication is that informal lending may be more likely to be prevalent in markets where workers' outside options w are in the intermediate range, such as in emerging markets. All else equal, we expect informal lending to be relatively less prevalent in developed markets where borrowers' outside options are relatively high or in poorer markets where borrowers' outside options are too low.

2.3. Increases in the Borrower's Outside Option

The outside option of the borrower captures regular income opportunities available to individuals in emerging markets. Policymakers often seek to increase income opportunities or reduce poverty by introducing employment-guarantee schemes, increasing the minimum wage, or introducing policies aimed at creating employment opportunities. The outside options of microentrepreneurs may increase as a result. In this section, we investigate the effect of an increase in the borrower's outside option on her expected utility.

Our analysis discovers some interesting new results as a consequence of considering certain aspects of the work and investment behavior of borrowers in the emerging markets that the prior literature has largely ignored. Although individuals, especially poor, in emerging markets may take regular jobs, they are constantly looking for better opportunities (possibly as microentrepreneurs), and when these opportunities arise, they jump in. These individuals, however, return to regular jobs if they fail at their projects, owe money to someone, and are unable to invest in other opportunities. Banerjee and Duflo (2011) provide evidence and discuss the entrepreneurial inclinations of individuals in many developing markets. Our model setup helps us investigate the question about the effect of an increase in the regular income opportunities available in these markets on the expected surplus of the microentrepreneurs. Our microentrepreneurs take regular jobs when their projects fail, but return to invest again as soon as funding becomes available. An investigation of a borrower's expected utility leads us to the following result.

Proposition 4. *A small increase in the borrower's outside option w,*

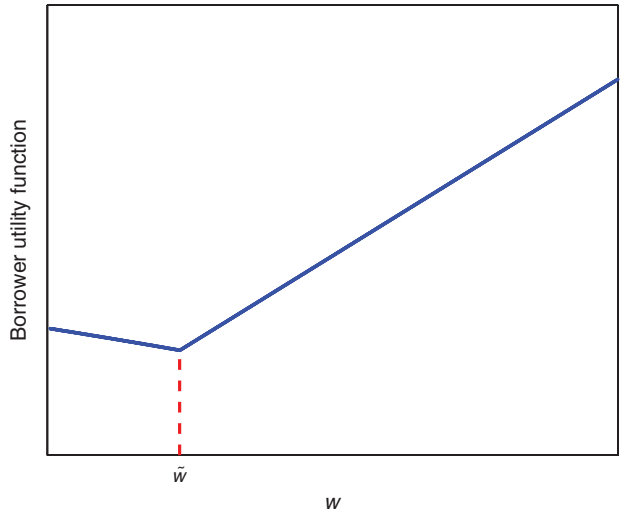
(i) *from an initial low w ($w < \tilde{w}$), decreases the borrower's expected utility.*

(ii) *from a sufficiently large w ($w \geq \tilde{w}$), increases the borrower's expected utility.*

These results are also presented graphically in Figure 3. The expected surplus of the borrower first decreases and then increases with the increase in her outside option. Surprisingly, an increase in the outside option of a microentrepreneur can lead to worse outcomes for her because an increase in the outside option of the borrower helps the lender more than the borrower. If $w < \tilde{w}$, a small increase in w leads to an increase in both the equilibrium loan rate as well as the repayment period, resulting in a lower surplus for the borrower. Only when $w \geq \tilde{w}$ does an increase in w result in lower equilibrium loan rates and repayment periods. Therefore, the expected surplus of the borrower increases with an increase in w if w is sufficiently large to start with.

The implication is that in the poor markets where regular income opportunities are scarce, an increase in

Figure 3. (Color online) Borrower's Expected Utility with Her Outside Option



the income opportunities may backfire and result in lower surplus for individuals who engage in microentrepreneurship. Therefore, in these markets, policymakers should either aim to significantly increase outside options for microentrepreneurs or leave them unchanged. The benefit of small increases in the outside income is often enjoyed by the (rich) lenders and not the (poor) microentrepreneurs.

2.4. Equivalence of Repayment Period and Loan Rate

In the analysis presented thus far, we assume the lender sets the loan rate r, which dictates the amount of money the borrower must return at the end of the project, and the repayment period x, during which the borrower repays at a continuous rate w using her outside option. The rationale for using a repayment period instead of a loan rate in the case in which the borrower does not repay in full at the end of the project is twofold. First, we wanted to capture both the routine lender–borrower relationship and the bonded labor model using similar modeling assumptions. Also, when borrowers fail to repay in full at the end of the project, lenders try to recover the money in the shortest possible time period. Lenders require the maximum possible repayment rate. In this section, we show our model is essentially equivalent to one in which the lender sets a loan rate instead of a repayment period in the event the borrower fails to repay in full at the end of the project. The lender sets two continuous loan rates, r_1 and r_2, where r_1 dictates the amount of money the borrower must return if she repays in full at the end of the project, and r_2 states the amount of money the borrower must return when she fails to repay in full at the end of the project. The remaining model assumptions are as described in Section 2. A detailed proof is provided in the appendix.

Because the outside option of the borrower pays at continuous rate w, the highest the lender can require the borrower to repay is at rate w. We represent by $x(r_2)$ the time the borrower takes to repay at rate r_2. The equivalent repayment period $x(r_2)$ is given by

$$x(r_2) = \min\left\{x \geq 0 \,\middle|\, e^{(r_2-z)(1+x)} = w\int_1^{1+x} e^{-zt}\,dt\right\}. \quad (5)$$

The interest rate r in the basic model is also a simple transformation ($r \equiv e^{r_1} - 1$) of the continuous rate r_1. The lender's decision to set (r, x) in the basic model and (r_1, r_2) in this section are two different ways of describing the amount of money the borrower repays in two situations (i.e., when her project is successful and when it fails). Adopting an alternative decision (r_1, r_2) to describe the loan payments does not distort the lender's and the borrower's incentives. Also, Equation (5) implies the mapping between (r, x) and (r_1, r_2) is one to one. The lender's and the borrower's problems are equivalent. Therefore, the model presented in Section 2 is equivalent to the model in which the lender sets a loan rate instead of a repayment period for the case in which the borrower, instead of repaying in full at the end of the project, repays over a period of time using her outside option or labor.

3. Repayment Through Bonded Labor

Bonded labor, an arrangement in which the borrower pledges her labor to repay the loan, is prevalent in many emerging markets (for more details, see Kara 2014). In this section, we investigate the issue of bonded labor. We assume that if the borrower is unable to repay at the end of the project, she chooses between defaulting and working as a bonded laborer for a period x, set by the lender. During this period x of bonded labor, the lender does not pay anything to the borrower. However, because the loan is considered repaid at the end of period x, the lender pays the borrower an implied wage w_b. If the borrower defaults, she gets her outside option w for the rest of her life. The lender–borrower relationship is terminated in this case. However, if the borrower repays by working as a bonded laborer, the relationship continues to sustain. We denote the income stream received by the lender as a result of the borrower's bonded labor by y. We assume $y > w$.[7] Other details of the model are the same as in Section 2. We look for a self-enforcing relational contract with bonded labor.

The income stream y received by the lender does not affect the borrower's payoff. Therefore, the borrower's incentives to engage in the relationship remain the same as in the basic model. In particular, the borrower's time 0 utility is described by Equation (2), and her constraints are described by Equations (C1) and (C2). The

lender manages at most one unit of funds at any time t. The lender's time 0 value function is

$$V = e^{-z}\left[p(1+r+V)+(1-p)\left(y\int_0^x e^{-zt}\,dt + e^{-zx}V\right)\right]-1. \quad (6)$$

An important objective of studying the scenario of bonded labor is to investigate the implications of increasing the borrower's outside option w on the equilibrium period during which the borrower works as a bonded laborer. We find an interesting effect of w on the equilibrium period of bonded labor as described in the following proposition.

Proposition 5. *If the borrower's outside option w*

(i) *is smaller than w', the equilibrium bonded labor period x^* does not change with w;*

(ii) *is greater than w', the equilibrium bonded labor period x^*decreases in w.*

First, consider that w is small ($w < w'$). In this range of w, because the outside option of the borrower is very small and default is not very attractive, the lender's primary concern is that the borrower might pretend the project has failed even if it is successful. Note that regardless of whether the borrower repays in full at the end of the successful project or repays through bonded labor, the lender's payoff does not depend on w. As a result, an increase in w has no effect on the equilibrium period of bonded labor. Now, we consider w is sufficiently large ($w > w'$). Because w is large, the borrower finds defaulting attractive. To ensure the borrower does not default and chooses to work as a bonded laborer, the lender reduces the bonded labor period with an increase in w.

The relationship between the outside option of the borrower and the equilibrium bonded labor period has important implications for policymakers. A reduction in poverty or an increase in the outside options of the borrower reduces the prevalence of bonded labor only if borrowers find the outside option attractive enough that they consider defaulting on their loan. Therefore, the outside option of the borrower must be raised significantly. A small increase from an initial low might not have any effect, which may be one of the reasons the practice of bonded labor still persists in many emerging markets.

4. Conclusion

This paper studies the microentrepreneurs' and informal lenders' incentives to participate in lender–borrower relationships in emerging markets. The microentrepreneurs' borrowing needs are usually short term, immediate, and repetitive. The microentrepreneurs do not have assets to offer as collateral, so they seek collateral-free loans. The informal lenders are usually not registered, so the law does not protect their loans to the microentrepreneurs. To ensure repayments, the lender designs a contract that aims to sustain a long-term lender–borrower relationship with the microentrepreneur. When designing the contract, the lender worries not only about default but also that the borrower may choose to repay over a period of time (pretending the project fails when it is actually successful) when she should immediately repay in full. The equilibrium contract induces the borrower to repay in full if her project is successful, and to repay over a period of time using her outside option if her project fails. When the loan is fully repaid, the borrower may once again borrow funds from the lender and invest in subsequent projects. The lender–borrower relationship is sustained even in the absence of any collateral and legal protection. The expected future benefit of staying in the relationship acts as collateral.

We find the equilibrium loan rate and the repayment period display a nonmonotonic relationship with the wage rate (i.e., the microentrepreneur's outside option). If the wage rate is small, and the microentrepreneur's outside option is unattractive, the lender creates a contract that induces the borrower to repay immediately in full instead of over a period of time when her project is successful. In this case, an increase in the wage rate raises the microentrepreneur's cost of pretending the project was unsuccessful. The lender increases the loan rate and the repayment period because of the increase in the borrower's outside option. Yet if the wage rate is high, the microentrepreneur's outside option becomes appealing, and she becomes tempted to default. In this case, an informal lender has to reduce the loan rate and repayment period to restore the microentrepreneur's incentives to stay in the relationship when the wage rate increases.

A consequence of the above nonmonotonic relationship is that in markets where the outside option of microentrepreneurs is too low, a small increase in the outside option may backfire and result in lower surplus for the microentrepreneurs it is intended to help. Therefore, policymakers should either aim to significantly increase the outside options of microentrepreneurs or leave them unchanged. Moreover, we show informal lending is likely to be relatively more prevalent in markets where workers' outside options (e.g., wages) are in the intermediate range, such as in emerging markets.

Our work highlights the economic and social impacts of informal lending in emerging markets. In our model, microentrepreneurs are homogenous in their entrepreneurial ability. Examining the optimal loan contract when microentrepreneurs are heterogeneous can be an interesting avenue for future research. Microentrepreneurs may differ in their abilities, which affects the probability with which the projects they undertake become successful. In this case, informal lenders

would want to screen the low-ability microentrepreneurs while still keeping them in the lender–borrower relationship. Our paper also abstracts away from the role of intermediaries occasionally observed in emerging markets where the informal lenders could unofficially or officially hire some agents to screen possible borrowers. Such agents add value to the lending process by identifying the credit risk of potential borrowers. Kim et al. (2016) find the existence of private information and argue customer relationship maintenance incentives could help mitigate such private information (both ex ante adverse selection and ex post moral hazard). If the agents do hold private information, such as the borrowers' outside options in our model, this private information could allow the lenders to better design the contract by setting corresponding loan rates and repayment periods (and the agents' maintenance incentives). Finally, testing some of our model predictions using real-world data may be interesting. For example, our model predicts a nonmonotonic relationship between the equilibrium interest rate and borrowers' outside options. With cross-region-level data of both outside options (i.e., average work wage) and informal bank rates, such hypotheses could be tested (Ni and Shen 2016).

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Appendix

Proof of Proposition 1

The lender sets a loan rate r and repayment period x that maximizes her value function V given by

$$V = e^{-z}\left[p(1+r+V)+(1-p)\left(w\int_0^x e^{-zt}\,dt + e^{-zx}V\right)\right]-1, \quad \text{(A.1)}$$

subject to the conditions (C1) and (C2), which ensure the borrower (1) repays in full when the project is successful and (2) repays using her outside option if her project fails.

Claim. *At least one of the two constraints* (C1) *and* (C2) *binds.*

The lender value function is increasing in the loan rate r. Suppose neither of the two constraints binds. In this situation, the lender can increase the loan rate by some small amount $\epsilon > 0$ such that both (C1) and (C2) still hold and the lender earns more profits. Therefore, in the equilibrium, at least one of the two constraints (C1) and (C2) definitely binds. We first consider the case in which (C1) holds as an equality, and then consider the case in which (C2) holds as an equality.

Case 1. Constraint (C1) holds as an equality.

Suppose constraint (C1) binds. Therefore,

$$U-(1+r)=e^{-zx}U.$$

Substituting the expression for U from Equation (2) and simplifying, we get

$$e^{-zx}=\frac{p(1+R)-e^z(1+r)}{p(1+R)-(1+r)}. \quad \text{(A.2)}$$

We can rewrite the lender's value function as

$$\hat{V}_1=\frac{(e^z-1)(1-p)(1+r)w-z[e^z-p(1+r)][p(1+R)-(1+r)]}{zp(e^z-1)(R-r)}, \quad \text{(A.3)}$$

which the lender maximizes by setting r, subject to the constraint (C2) given by the following (which is obtained by substituting the value of e^{-zx} from Equation (A.2) in constraint (C2) and simplifying):

$$\frac{zp(1+R)+w-e^z[z(1+r)+w]}{z(e^z-1)}\geq 0. \quad \text{(A.4)}$$

The above profit-maximization problem has a real solution (if $0\leq w\leq (zp(1+R)-ze^z)/(e^z-1)$), which is given by

$$\hat{r}_1=R-\frac{\sqrt{z(1-p)p(1+R)[zp(1+R)+w-e^z(z+w)]}}{zp}.$$

The loan rate at which the constraint (C2) also binds can be calculated from Equation (A.4) and is given by $(zp(1+R)+w-e^z(z+w))/(ze^z)$. If the interior solution of the lender's maximization problem is higher than $(zp(1+R)+w-e^z(z+w))/(ze^z)$, we get a corner solution because once constraint (C2) also binds, the loan rate cannot increase any further. Therefore, we get an interior solution for the loan rate corresponding to only constraint (C1) binding if

$$R-\frac{\sqrt{z(1-p)p(1+R)[zp(1+R)+w-e^z(z+w)]}}{zp} < \frac{zp(1+R)+w-e^z(z+w)}{ze^z},$$

or

$$w<\tilde{w}\equiv (ze^{3z}\sqrt{(1-p)(1+R)[4pR+e^z(1-p)(1+R)]} - z[e^{2z}(1-p)+2e^zp-2p^2](1+R))\cdot(2(e^z-1)p)^{-1}. \quad \text{(A.5)}$$

Therefore, if the borrower's outside option is small ($0\leq w\leq (zp(1+R)-ze^z)/(e^z-1)$), the optimal loan rate is given by

$$\hat{r}_1=\begin{cases} R-\dfrac{\sqrt{z(1-p)p(1+R)[zp(1+R)+w-e^z(z+w)]}}{zp} \\ \quad \text{if } w<\tilde{w}, \\ \dfrac{zp(1+R)+w-e^z(z+w)}{ze^z} \\ \quad \text{if } \tilde{w}\leq w\leq \dfrac{zp(1+R)-ze^z}{e^z-1}, \end{cases}$$

and the equilibrium length of the repayments, in the case when the project fails, is given by

$$\hat{x}_1=\frac{1}{z}\ln\left(\frac{p(1+R)-(1+\hat{r}_1)}{p(1+R)-e^z(1+\hat{r}_1)}\right).$$

Case 2. Constraint (C2) holds as an equality.

Suppose, the constraint (C2) binds. We have

$$e^{-zx}U = w\int_0^\infty e^{-zt}\,dt.$$

We substitute the value of U from Equation (2) in the above equation and simplify to get

$$e^{-zx} = \frac{(e^z-p)w}{zp(R-r)+(1-p)w}. \tag{A.6}$$

The lender sets the equilibrium loan rate to maximize her value function given by

$$\hat{V}_2 = \left([zp(R-r)+(1-p)w]\left[z[p(1+r)-e^z] + (1-p)w\left(1-\frac{(e^z-p)w}{zp(R-r)+(1-p)w}\right)\right]\right) \cdot (z^2p(e^z-p)(R-r))^{-1}, \tag{A.7}$$

subject to the constraint (C1), which simplifies to

$$\frac{zp(1+R)+w-e^z[z(1+r)+w]}{z(e^z-1)} \geq 0. \tag{A.8}$$

Equation (A.8) requires that $w < (zp(1+R)-ze^z)/(e^z-1)$. However, if $w < (zp(1+R)-ze^z)/(e^z-1)$, the lender's value function $\hat{V}_2$ is increasing in the loan rate r. No interior solution exists, and the corner solution corresponds to both (C1) and (C2) binding.

Note if the worker's outside option is small ($w < \tilde{w}$), the lender's value function $\hat{V}_1$ is higher when (C1) is binding compared to when both (C1) and (C2) are binding. Also, if w is higher ($\tilde{w} \leq w \leq (zp(1+R)-ze^z)/(e^z-1)$), $\hat{V}_1$ is higher when both (C1) and (C2) are binding compared to when only (C1) is binding. Therefore, the optimal contract is given by

$$r^* = \begin{cases} R - \dfrac{\sqrt{z(1-p)p(1+R)[zp(1+R)+w-e^z(z+w)]}}{zp} \\ \quad \text{if } w < \tilde{w}, \\ \dfrac{zp(1+R)+w-e^z(z+w)}{ze^z} \\ \quad \text{if } \tilde{w} \leq w \leq \dfrac{zp(1+R)-ze^z}{e^z-1}, \end{cases} \tag{A.9}$$

and

$$x^* = \frac{1}{z}\ln\left(\frac{p(1+R)-(1+r^*)}{p(1+R)-e^z(1+r^*)}\right).$$

We need the expected project returns to be large enough for the lender–borrower contract to be feasible. If $(zp(1+R)-ze^z)/(e^z-1) \leq 0$ (or $p(1+R) \leq e^z$), no lending takes place in the equilibrium. Also, if the wage is too high, $w > (zp(1+R)-ze^z)/(e^z-1)$, there is no positive loan rate that sustains the lender–borrower relationship.

Proof of Proposition 2

(i) Consider first that $w < \tilde{w}$. From Equation (A.9), we have

$$r^* = R - \frac{\sqrt{z(1-p)p(1+R)[zp(1+R)+w-e^z(z+w)]}}{zp}.$$

Therefore,

$$\frac{\partial}{\partial w}r^* = \frac{(e^z-1)(1-p)(1+R)}{2\sqrt{z(1-p)p(1+R)(zp(1+R)+w-e^z(z+w))}} > 0.$$

Also, because

$$x^* = \frac{1}{z}\ln\left(\frac{p(1+R)-(1+r^*)}{p(1+R)-e^z(1+r^*)}\right),$$

differentiating with respect to w and simplifying, we get

$$\frac{\partial}{\partial w}x^* = \frac{p(1+R)(e^z-1)}{z(p(1+R)-(1+r^*))(p(1+R)-e^z(1+r^*))} \cdot \frac{\partial}{\partial w}r^*.$$

Since $(p(1+R)(e^z-1))/(z(p(1+R)-(1+r^*))(p(1+R)-e^z \cdot (1+r^*))) > 0$, the equilibrium repayment period x^* increases with w when $w < \tilde{w}$.

(ii) Now consider $\tilde{w} \leq w \leq (zp(1+R)-ze^z)/(e^z-1)$. From Equation (A.9), we have

$$r^* = \frac{zp(1+R)+w-e^z(z+w)}{ze^z}.$$

Therefore,

$$\frac{\partial r^*}{\partial w} = \frac{e^{-z}-1}{z} < 0.$$

Also, similar to part (i), since $(p(1+R)(e^z-1))/(z(p(1+R)-(1+r^*))(p(1+R)-e^z(1+r^*))) > 0$, the equilibrium repayment period x^* decreases with w when $\tilde{w} \leq w \leq (zp(1+R)-ze^z)/(e^z-1)$.

Proof of Proposition 3

We can write the lender's time 0 value function using Equation (3) as

$$V^* = \frac{z[p(1+r^*)-e^z]+(1-e^{-zx^*})(1-p)w}{z[e^z-p-(1-p)e^{-zx^*}]}, \tag{A.10}$$

where r^* and x^* are the equilibrium loan rate and repayment period as given in Proposition 1.

(a) If $w < \tilde{w}$, the equilibrium loan rate is $r^* = R-(z(1-p)\cdot p(1+R)[zp(1+R)+w-e^z(z+w)])^{1/2}/(zp)$. We substitute this r^* and the corresponding expression for x^* in Equation (A.10) and simplify to get the lender's time 0 value function as

$$V^* = -\frac{1}{zp(e^z-1)}[z\{e^z-p(2-p)(1+R)\}+(e^z-1)(1-p)w + 2\sqrt{zp(1-p)(1+R)\{zp(1+R)+w-e^z(z+w)\}}],$$

which gives

$$\frac{\partial}{\partial w}V^* = \frac{1-p}{zp} \cdot \left(\frac{zp(1+R)}{\sqrt{zp(1-p)(1+R)\{zp(1+R)+w-e^z(z+w)\}}}-1\right).$$

Since $zp(1+R)+w-e^z(z+w)$ is positive and decreases with an increase in w, we know $(zp(1+R))/(zp(1-p)(1+R)\cdot \{zp(1+R)+w-e^z(z+w)\})^{1/2}$ increases in w. Therefore, if $w > 0$, the following inequality holds: $(zp(1+R))/(zp(1-p)\cdot (1+R)\{zp(1+R)+w-e^z(z+w)\})^{1/2} > 1$.

As a result (if $w < \tilde{w}$),

$$\frac{\partial}{\partial w}V^* > 0.$$

(b) Now we consider the case when $w > \tilde{w}$. In this case, the equilibrium loan rate is given by $r^* = (zp(1+R) + w - e^z(z+w))/(ze^z)$. Similar to part (a), we substitute this expression for r^* and the corresponding expression for x^* in Equation (A.10) to get

$$V^* = -\frac{1}{zp[z(e^z-p)(1+R)+(e^z-1)w]}[e^{-z}(p\{zp(1+R)+w\}^2 + e^z\{zp(1+R)+w\}(1-2p)w - e^{2z}\{z^2p(1+R)+zw + (1-p)w^2\})].$$

It is straightforward to show

$$\begin{cases} \frac{\partial}{\partial w}V^* > 0 & \text{if } 0 < w < \hat{w}, \\ \frac{\partial}{\partial w}V^* < 0 & \text{if } w > \hat{w}, \end{cases} \tag{A.11}$$

where $\hat{w}$ is the larger of the two roots of the equation $(\partial/\partial w)V^* = 0$ and is given by

$$\hat{w} = (\sqrt{z^2e^{3z}R[e^z(1-p)+p](1-p)(1+R)} - z(1+R)[e^{2z}(1-p)+(e^z-1)p^2]) \cdot ((e^z-1)(e^z(1-p)+p))^{-1}. \tag{A.12}$$

To complete the proof, we show by an example that the parameter space $w > \hat{w}$ is nonempty, which is equivalent to showing

$$\hat{w} < \frac{zp(1+R) - ze^z}{e^z - 1}.$$

The inequality above holds when $0<p<1$ and $R>e^z(1-p)/p$, so the parameter space $w > \hat{w}$ is nonempty.

If $\hat{w} \geq (zp(1+R) - ze^z)/(e^z-1)$, V^* will be increasing in the entire range of w where the lender–borrower relationship is feasible.

Proof of Proposition 4

By Equation (2), the entrepreneur's time 0 utility is

$$U^* = \frac{p(R-r^*)}{e^z - e^{-zx^*}(1-p) - p}, \tag{A.13}$$

where r^* and x^* are given by Proposition (1). We differentiate both sides of Equation (A.13) with respect to w and get

$$\frac{\partial}{\partial w}U^* = (-p[e^z - (1-p)e^{-zx^*} - p](\partial/\partial w)r^* + pe^{-zx^*}z(1-p) \cdot (R-r^*)(\partial/\partial w)x^*) \cdot ([e^z - e^{-zx^*}(1-p) - p]^2)^{-1}. \tag{A.14}$$

We take the same $\tilde{w} > 0$ as we did in Proposition 1. When $0 < w < \tilde{w}$, by Proposition 2, we have $(\partial/\partial w)r^* > 0$ and $(\partial/\partial w)x^* > 0$. It follows that

$$p[e^z - (1-p)e^{-zx^*} - p]\frac{\partial}{\partial w}r^* + pe^{-zx^*}z(1-p)(R-r^*)\frac{\partial}{\partial w}x^* > 0.$$

Therefore, when $0 < w < \tilde{w}$, we have $(\partial/\partial w)U^* < 0$. Similarly, when $\tilde{w} < w < (zp(1+R) - ze^z)/(e^z-1)$, by Proposition 2, we have $(\partial/\partial w)r^* < 0$ and $(\partial/\partial w)x^* < 0$. It follows that

$$p[e^z - (1-p)e^{-zx^*} - p]\frac{\partial}{\partial w}r^* + pe^{-zx^*}z(1-p)(R-r^*)\frac{\partial}{\partial w}x^* < 0.$$

Therefore, when $\tilde{w} < w < (zp(1+R) - ze^z)/(e^z-1)$, we have $(\partial/\partial w)U^* > 0$. When $w > (zp(1+R) - ze^z)/(e^z-1)$, by Proposition 1, the lender–borrower relationship is not sustainable.

Equivalence of Repayment Period and Loan Rate

Suppose the informal lender sets two continuous loan rates. Let r_1 denote the continuous loan rate if the borrower repays in full at the end of the project. We can write the time 0 value of this repayment as e^{r_1-z}. Let r_2 denote the continuous loan rate if the borrower repays using her outside option w starting one period after borrowing. The duration x of the time the entrepreneur repays at rate w is given by

$$x(r_2) = \min\left\{x \geq 0 \mid e^{(r_2-z)(1+x)} = w\int_1^{1+x} e^{-zt}\,dt\right\}. \tag{A.15}$$

Because $x(r_2)$ is unique, the mapping between r_2 and x is one to one. We denote its inverse by x^{-1}.

The entrepreneur repays in full when her project is successful; therefore, she must be better off paying e^{r_1} for the potential benefit of future borrowing compared to defaulting. The following inequality captures this condition:

$$U - e^{r_1} \geq w\int_0^{\infty} e^{-zt}\,dt. \tag{A.16}$$

Moreover, the entrepreneur must also be better off paying back e^{r_1} and getting back to investing in her next project immediately rather than waiting for a period $x(r_2)$ (during which she uses her outside option w to repay the loan). Therefore, we get the following condition:

$$U - e^{r_1} \geq e^{-zx(r_2)}U. \tag{A.C1}$$

If the project fails, the entrepreneur can either choose to default or repay using her outside option. The entrepreneur chooses to repay using her outside option instead of defaulting if she finds the expected payoffs from potential future projects more attractive compared to taking the outside option for the rest of her life. The comparison leads us to the following condition:

$$e^{-zx(r_2)}U \geq w\int_0^{\infty} e^{-zt}\,dt. \tag{A.C2}$$

Together, (A.C1) and (A.C2) imply (A.16). The time 0 expected utility U of the borrower can be written as follows:

$$U = e^{-z}[p(1+R-e^{r_1}+U) + (1-p)e^{-zx(r_2)}U].$$

Solving U in the above equation, we get

$$U = \frac{p(1+R-e^{r_1})}{e^z - e^{-zx(r_2)}(1-p) - p}. \tag{A.17}$$

Next, we derive the lender's time 0 value function V. The relationship status at time 0 is *CON*. With probability p, the project is successful and the borrower repays e^{r_1}. The relationship status remains in the *CON* state. Therefore, the expected payoff, if the project is successful, is $e^{r_1} + V$. However, if the project fails, the lender receives a continuous repayment of w for a period $x(r_2)$, during which the relationship status is *SUS*. Once the borrower has fully repaid the loan, the relationship status updates to *CON*. Therefore, the expected payoff if the project fails is given by $w\int_0^{x(r_2)} e^{-zt}\,dt + e^{-zx(r_2)}V$. The lender's time 0 value function can be written as

$$V = e^{-z}\left[p(e^{r_1}+V) + (1-p)\left(w\int_0^{x(r_2)} e^{-zt}\,dt + e^{-zx(r_2)}V\right)\right] - 1. \tag{A.18}$$

The lender sets the two continuous loan rates, r_1 and r_2, that maximize her value function V, described above, subject to constraints (A.C1) and (A.C2).

Now we define the loan rate r as

$$r = e^{r_1} - 1, \tag{A.19}$$

and the repayment period x as

$$x = x(r_2), \tag{A.20}$$

where $x(r_2)$ is given in Equation (A.15). We substitute Equations (A.19) and (A.20) into Equations (A.C1), (A.C2), (A.17), and (A.18) and get

$$U - (1+r) \geq e^{-zx}U, \tag{A.C1*}$$

$$e^{-zx}U \geq w\int_0^{\infty} e^{-zt}\,dt, \tag{A.C2*}$$

$$U = \frac{p(R-r)}{e^z - e^{-zx}(1-p) - p}, \tag{A.21}$$

and

$$V = e^{-z}\left[p(1+r+V) + (1-p)\left(w\int_0^x e^{-zt}\,dt + e^{-zx}V\right)\right] - 1. \tag{A.22}$$

The lender's profit-maximization problem is to set the loan rate r and the repayment period x that maximize her value function V, described by Equation (A.22), subject to constraints (A.C1*) and (A.C2*). This optimization problem is the same as the one described in Section 2.1.

Let r^* and x^* be the solution to the optimization problem described in Section 2.1. Then, in equilibrium, the lender's optimal continuous loan rates are

$$r_1^* = \log(1+r^*), \tag{A.23}$$

and

$$r_2^* = x^{-1}(x^*). \tag{A.24}$$

Therefore, the two continuous loan rates modeling approach and the loan rate and repayment period modeling approach are essentially equivalent.

Proof of Proposition 5

The proof of Proposition 5 is similar to the proofs of Propositions 1 and 2. Here we provide the main results and present a sketch of the proof.

It is straightforward to show that at least one of the two constraints (C1) and (C2) must bind. Consider first that constraint (C1) binds. We rewrite the lender's value function by substituting for e^{-zx} in Equation (6) and get

$$\hat{V}_1 = \frac{(e^z-1)(1-p)(1+r)y - z[e^z - p(1+r)][p(1+R)-(1+r)]}{zp(e^z-1)(R-r)}. \tag{A.25}$$

The lender maximizes her time 0 value function by setting r, subject to constraint (C2). If the borrower's outside option is small ($0 \leq w < y \leq (zp(1+R) - ze^z)/(e^z-1)$), the optimal loan rate (derived by following the steps of the proof of Proposition 1) is given by

$$\hat{r}_1 = \begin{cases} R - \dfrac{\sqrt{zp(1-p)(1+R)[zp(1+R)+y-e^z(y+z)]}}{zp}, \\ \quad \text{if } w < w', \\ \dfrac{zp(1+R)+w-e^z(w+z)}{ze^z}, \\ \quad \text{if } w' \leq w < y, \end{cases} \tag{A.26}$$

where

$$w' \equiv (e^z\sqrt{zp(1-p)(1+R)(zp(1+R)+y-e^z(y+z))} - zp(1+R)(e^z-p)) \cdot (p(e^z-1)), \tag{A.27}$$

and the equilibrium period of bonded labor, in the case when the project fails, is given by

$$\hat{x_1} = \frac{1}{z}\ln\left(\frac{p(1+R)-(1+\hat{r_1})}{p(1+R)-e^z(1+\hat{r_1})}\right). \tag{A.28}$$

Next, we consider the case in which constraint (C2) is binding. In this case, no interior solution exists for the loan rate r, and the corner solution corresponds to both constraints (C1) and (C2) binding. Therefore, the optimal contract is given by

$$r^* = \begin{cases} R - \dfrac{\sqrt{zp(1-p)(1+R)[zp(1+R)+y-e^z(y+z)]}}{zp}, \\ \quad \text{if } w < w', \\ \dfrac{zp(1+R)+w-e^z(w+z)}{ze^z}, \\ \quad \text{if } w' \leq w < y, \end{cases} \tag{A.29}$$

and

$$x^* = \frac{1}{z}\ln\left(\frac{p(1+R)-(1+r^*)}{p(1+R)-e^z(1+r^*)}\right).$$

It follows that $(\partial/\partial w)x^* = 0$ if $w < w'$, and $(\partial/\partial w)x^* < 0$ if $w > w'$.

We can compute the implied wage of bonded labor w_b using the above equilibrium contract. The analysis of bonded labor is equivalent to the case in which the lender pays a wage w_b to the borrower and the borrower uses this wage to repay the loan. Therefore, we have

$$1 + r^* = w_b\int_0^{x^*} e^{-zt}\,dt,$$

which gives

$$w_b = \frac{z[p(1+R)-(1+r^*)]}{e^z-1}.$$

Endnotes

[1] UBS estimated the size of China's so-called shadow banking system at $3.4 trillion, equal to 45% of its gross domestic product. Almost 20% of the Indian economy is driven by financing obtained through informal channels.

[2] In the remainder of the paper, we refer to the informal moneylender as the lender and the microentrepreneur as the borrower.

[3] Dai et al. (2016) is another paper that considers credit constraints and investigates how the manufacturers construct their distribution channels by choosing and granting distribution rights to downstream players in an emerging market.

[4] We need the outside option of the lender to be small enough for her to want to engage in informal lending.

[5] This assumption is equivalent to the lender setting the corresponding interest rate that translates in the borrower repaying at a continuous rate w over a period x. In Section 2.4, we show that the two approaches (setting the interest rate or repayment period) are equivalent.

[6] Equivalently, we can say the borrower works at a factory or as domestic help and earns a wage w, which she repays to the lender.

[7] Because the outside option w is still available to the borrower, the lender requires the borrower to work as a bonded laborer only if $y > w$.

References

Agrawal A, Catalini C, Goldfarb A, Luo H (2017) Slack time and innovation. Working paper, University of Toronto, Toronto.

Allen F, Qian J, Qian M (2005) Law, finance, and economic growth in China. *J. Financial Econom.* 77(1):57–116.

Amar M, Ariely D, Ayal S, Cryder CE, Rick SI (2011) Winning the battle but losing the war: The psychology of debt management. *J. Marketing Res.* 48(SPL):S38–S50.

Banerjee A, Duflo E (2011) *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty* (PublicAffairs, New York).

Brown M, Falk A, Fehr E (2004) Relational contracts and the nature of market interactions. *Econometrica* 72(3):747–780.

Chandy R, Narasimhan O (2015) Millions of opportunities: An agenda for research in emerging markets. *Customer Needs Solutions* 2(4):251–263.

Cheung S, Sundaresan S (2006) Lending without access to collateral–A theory of micro-loan borrowing rates. Working paper, Columbia University, New York.

Dai T, Ni J, Tang C (2016) Competitive screening in frontier markets. Working paper, Johns Hopkins University, Baltimore.

Desai PS, Purohit D, Zhou B (2016) The strategic role of exchange promotions. *Marketing Sci.* 35(1):93–112.

Galak J, Small D, Stephen AT (2011) Microfinance decision making: A field study of prosocial lending. *J. Marketing Res.* 48(SPL): S130–S137.

Gennaioli N, Shleifer A, Vishny RW (2013) A model of shadow banking. *J. Finance* 68(4):1331–1363.

Ghatak M, Guinnane TW (1999) The economics of lending with joint liability: Theory and practice. *J. Development Econom.* 60(1): 195–228.

Hoff K, Stiglitz JE (1997) Moneylenders and bankers: Price-increasing subsidies in a monopolistically competitive market. *J. Development Econom.* 52(2):429–462.

Hu Y, Ni J, Yao J (2017) How risky is China's informal banks: A dynamic model. Working paper, Johns Hopkins University, Baltimore.

Kara S (2014) *Bonded Labor: Tackling the System of Slavery in South Asia* (Columbia University Press, New York).

Kim M, Sudhir K, Uetake K, Canales R (2016) Multidimensional sales incentives in CRM settings: Customer adverse selection and moral hazard. Working paper, Yale University, New Haven, CT.

Kowalik M, Martinez-Miera D (2010) Creditworthiness of the poor: A model of the Grameen Bank. Working paper, Federal Reserve Bank of Kansas City, Kansas City, MO.

Levin J (2003) Relational incentive contracts. *Amer. Econom. Rev.* 93(3): 835–857.

Li J, Matouschek N (2013) Managing conflicts in relational contracts. *Amer. Econom. Rev.* 103(6):2328–2351.

Li S, Sun B, Wilcox RT (2005) Cross-selling sequentially ordered products: An application to consumer banking services. *J. Marketing Res.* 42(2):233–239.

Macchiavello R, Morjaria A (2015) Competition and relational contracts: Evidence from Rwanda's coffee mills. Working paper, Harvard University, Cambridge, MA.

Narasimhan L, Srinivasan K, Sudhir K (2015) Editorial–Marketing science in emerging markets. *Marketing Sci.* 34(4):473–479.

Navarro-Martinez D, Salisbury LC, Lemon KN, Stewart N, Matthews WJ, Harris AJL (2011) Minimum required payment and supplemental information disclosure effects on consumer debt repayment decisions. *J. Marketing Res.* 48(SPL):S60–S77.

Ni J, Shen Q (2016) Informal banking and relational borrowing: An empirical analysis. Working paper, Johns Hopkins University, Baltimore.

Ni J, Srinivasan K (2015) Matching in the sourcing market: A structural analysis of the upstream channel. *Marketing Sci.* 34(5): 722–738.

Qian Y, Gong Q, Chen Y (2014) Untangling searchable and experiential quality responses to counterfeits. *Marketing Sci.* 34(4): 522–538.

Singh S (2017) Competition in corruptible markets. *Marketing Sci.* 36(3):361–381.

Stiglitz JE (1990) Peer monitoring and credit markets. *World Bank Econom. Rev.* 4(3):351–366.

Straub S (2005) Informal sector: The credit market channel. *J. Development Econom.* 78(2):299–321.

Sudhir K, Talukdar D (2015) The "Peter Pan Syndrome" in emerging markets: The productivity-transparency trade-off in IT adoption. *Marketing Sci.* 34(4):500–521.

Sudhir K, Priester J, Shum M, Atkin D, Foster A, Iyer G, Jin G, et al. (2015) Research opportunities in emerging markets: An interdisciplinary perspective from marketing, economics, and psychology. *Customer Needs Solutions* 2:264–276.

Turvey CG, Kong R (2010) Informal lending amongst friends and relatives: Can microcredit compete in rural China? *China Econom. Rev.* 21(4):544–556.

Zhang J, Liu P (2012) Rational herding in microloan markets. *Management Sci.* 58(5):892–912.

Zhang K (2015) Breaking free of a stereotype: Should a domestic brand pretend to be a foreign one? *Marketing Sci.* 34(4): 539–554.