A Friend in Need is a Friend Indeed: Theory and Evidence on the (Dis)Advantages of Informal Loans *

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Abstract

We study borrowers’ optimal choice between formal and informal sources of credit in a setting with strategic default due to limited enforcement. Informal loans (e.g., from friends or relatives) can be enforced by the threat of severing social ties which hurts both the borrower and the lender, while formal loans (e.g., from banks) are enforced by requiring collateral. We show that in this setting the optimal informal loan contract features zero interest rate and requires no physical collateral. In contrast, formal loans charge positive interest and are collateral-based, making them a priori less attractive to borrowers. At the same time, physical collateral is divisible, unlike the social capital pledged in informal credit. Default on formal loans is thus less costly than default on informal loans. Therefore, borrowers optimally choose formal credit for riskier (and larger) loans while informal credit is used for small investments and projects with zero or low default risk. Empirical results from a survey of rural Thai households are consistent with the predicted pattern of formal versus informal credit.

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1 Introduction

Informal financing is the prevalent form of credit used by households and small firms in developing countries and a large fraction of these loans originates from family or friends.\textsuperscript{1} One standard explanation for the abundance of informal credit in developing economies is that it has information or enforcement advantages that allow to mitigate credit market imperfections originating from moral hazard, adverse selection or limited commitment. In those countries, the widespread inability of households to pledge a physical collateral, as well as high transaction costs relative to the loan size (due to lack of credit history, financial illiteracy, lack of property titles, inefficient courts, etc.) cause the poor to be rationed out of the formal credit market.\textsuperscript{2} This often leaves informal credit, which is primarily based on social collateral, as their only option.\textsuperscript{3}

The above argument implicitly presumes that there is a shadow cost of informal funds – if they have choice, borrowers prefer to tap into the formal credit market but are unable to do so because of the above-mentioned market imperfections. This presumption seems to be broadly consistent with the empirical evidence. Countries whose formal financing sector grows as they develop generally experience a decline in the fraction of informal credit as a percentage of total lending. It is also in line with observed behaviour within countries.\textsuperscript{4} The figure below illustrates how the percentage of informal credit changed over time in the household data from the Townsend Thai Project, 1997 to 2001.\textsuperscript{5} Prior to the 1998 financial crisis, informal loans made up roughly 20 percent of all household loans in the survey. This number rose to 30 percent during the crisis, only to revert back to pre-crisis levels thereafter, indicating that many households used family and friends only as a “lender of last resort” at a time when credit from other sources was harder to obtain.

[Figure 1 here]

Yet, the existing literature offers little systematic guidance as to why the reluctance to borrow from friends and family, if choice is available, may be the case.\textsuperscript{6} One explanation could be that banks have a comparative advantage in lending (e.g., expertise, risk diversification, etc.). But on second thought, this is not plausible for small sums of money. Turning to friends and relatives seems to be a better option in many circumstances as they are often better informed about the personal circumstance of the borrower and do not incur monitoring or enforcement overhead costs. This is the ‘peer monitoring’ argument of Stiglitz (1990). For small loans, issues like risk aversion or liquidity constraints also are less likely to be a problem. The question arises, if relatives and friends can do everything a bank can

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\textsuperscript{1}Paulson and Townsend (2004), for example, report that about 30% of households in their 1997 Thailand survey have outstanding loans from other households while only 3% have loans from commercial banks. Banerjee and Dufo (2007) document that of all outstanding loans of households in Udaipur, India, 23% are from a relative, 37% from a shopkeeper and only 6% from formal sources. The latter number is also very similar in 12 other developing countries on which they report.

\textsuperscript{2}See Ghosh et al. (2000) for a review of the theory on credit rationing in developing countries.

\textsuperscript{3}The spread of microfinance in recent years provides another source of credit to poor households also based on the “social collateral” feature of informal credit.

\textsuperscript{4}Detailed and reliable data on interpersonal informal loans in developed countries are scarce, which may partly be due to negative tax implications of monetary transfers between households (in the US, for example, loans will subject to a tax if the treasure deems the interested that is charged is deemed “too low”. The US National Association of Realtors (2012) reports that 9% of home buyers received an intra-family loan to help with the downpayment in 2011.

\textsuperscript{5}The Townsend Thai Project is a panel database derived from micro surveys of Thai households. The data collection started in 1997 and is ongoing. See http://cier.uchicago.edu/ for details.

\textsuperscript{6}One notable exception is Lee and Persson (2014), which is discussed below.
do (in other words, charge interest and require collateral) but in addition can rely on social capital as a means of enforcing compliance, why rely on formal loans at all?

This puzzle is even more pronounced in light of the fact that loans from family and friends often have very favourable terms. For example, in their survey of financial management practices among the poor, Collins et al. (2010, ch. 2) report that family loans are frequently interest free. Similarly, according to the 2004 survey on informal finance conducted by the Global Entrepreneurship Monitor (GEM), between 60 and 85 percent of the investors were relatives or friends of the entrepreneur they financed and the majority of them were willing to accept low or negative returns (Bygrave and Quill, 2006). These observations are echoed in the Townsend Thai data we use in this paper where the median interest rate for loans from relatives is zero.\footnote{See Figure 3 in Section 3 below.}

In sum, the logic that loans based on social relations pose fewer contracting problems, together with the evidence that they have more favourable terms leads to the inevitable conclusion that borrowers should prefer informal over formal credit sources, unless the former have insufficient funds. If informal loans are a viable option, though, why do many households prefer the latter? Put differently, why are formal, market-based loans the preferred choice in developed countries, where most people rely on banks if they need to borrow even relatively small amounts of money?

This paper seeks to shed light on the issue by pointing to an inherent disadvantage of informal finance. Throughout the paper, we refer to \textit{informal credit} as loans that rely on informal or personal relationships and use social sanctions as a means for contract enforcement. The primary example we have in mind is money borrowed from family, neighbours, or friends although other similar sources, in particular credit cooperatives, rotating savings and credit associations, and some agricultural credit associations may also fit the description. The term \textit{formal credit}, in contrast, will refer to market-based loans, in which personal/social relationships between lender and borrower are absent and/or not used to enforce repayment.

The main trade-off between formal and informal credit in our model is as follows. Informal credit from relatives or friends uses “social collateral” measured by the value of the friendship or kinship ties between the borrower and the lender. This social collateral can serve as a substitute for physical collateral required by formal lenders, enabling borrowers to commit not to behave opportunistically. Using the social collateral is always feasible and allows for favourable loan conditions (low interest rates and no physical collateral requirement). On the surface, this makes informal credit very attractive, especially for poor households who lack collateralizable assets, and for small loans. However, using social collateral has a cost – unlike physical capital, the social capital embedded in a relationship is indivisible. If a borrower defaults on an informal loan, the relationship is severed or severely damaged and the embedded social collateral is lost in its entirety. As long as default may occur in equilibrium, the associated utility loss represents a strictly positive cost to the borrower. A related, and equally important difference between social and physical (asset-based) collateral is that a loan secured by the latter is, at least partially, recovered in case of default. In contrast, \textit{both parties} to an informal credit arrangement suffer from the loss of their social relationship. These costs, that occur whenever there is probability of default in equilibrium, which in our setting is more likely for more leveraged borrowers, imply that informal credit can in fact be more “expensive” than formal credit and inefficient to use despite its lower interest rate or lack of physical collateral requirement: friends can be too costly to lose.

We also show that even though informal lenders are able to use the same contract terms as formal
lenders (requiring collateral, charging interest), they may refrain from using them and instead rely solely on the value of their relationship as a means of enforcing compliance. Indeed, we prove that, as long as the social capital value is high enough, the optimal informal loan contract does not require physical collateral and charges zero interest. In contrast, formal loans always include a collateral requirement and – since the lender needs to be compensated for costs associated with liquidating the collateral, in addition to the probability of default – always demand a strictly positive interest rate. The comparative disadvantage of formal loans in terms of direct monetary costs notwithstanding, the loss of social capital associated with informal lending when default may occur prompts borrowers to choose formal over informal credit for a wide range of circumstances in the model; specifically, when the ratio of the loan size to borrower’s wealth (the LTW ratio) is relatively high, which corresponds to higher equilibrium probability of default.

Our model also offers several empirically testable implications that we take to the data. First, informal loans should have ‘better’ terms (lower interest and collateral) than formal loans, on average. Second, since informal lenders have limited funds, the likelihood of observing formal credit should increase in the loan size, ceteris paribus. Third, and at first glance surprisingly, there should be a negative (or U-shaped), relationship between the riskiness of a loan, measured by its LTW ratio, and the likelihood of observing informal credit. The reason is as follows: if the risk of equilibrium default is negligible, informal credit is always preferred due to its favourable terms. As the risk of default increases, however, informal loans become relatively more costly to borrowers because of the social capital value that would be lost in default, and thus borrowers prefer formal loans, ceteris paribus. This conclusion could be reversed only if the default risk becomes so high that access to formal credit is denied (due to the possibility of strategic default the lender cannot break-even at any interest rate) while informal credit remains the only option.

The patterns we find in the data from the 1997 Survey of Thai households (part of the Townsend Thai Project) are consistent with our model’s predictions. In our baseline specification we define as informal the loans from relatives or neighbors and as formal the loans from commercial banks or moneylenders. We first document that the majority of loans from friends and family carry zero interest and collateral. Moreover, loan size has a strong negative association with the likelihood of observing an informal loan, with and without controlling for household wealth. At the same time, riskier loans are less likely to be informal – using the ratio of the loan size to borrower’s wealth as a measure of how likely it is that the loan cannot be repaid in case of default, we find that lower-risk loans are associated with a higher incidence of informal credit than higher-risk loans.

At first glance, the latter finding is counterintuitive as it implies that more leveraged loans with higher default risk are taken from formal sources (e.g., banks), rather than from informal sources (e.g., relatives). Our model, however, offers an explanation for the observed pattern: if a borrower knows that she may default with sufficiently large probability, then it is cheaper for her to default on a formal lender than on family or friends since the physical collateral lost in case of a default is commensurate to the formal loan size. In contrast, the social capital lost in case of a default on an informal loan cannot be adjusted. We also find evidence that for very risky loans, for which formal lenders cease to extend credit as they cannot break even, borrowers resort to informal loans again. In the data, this happens in the top quintile of LTW ratios. Finally, we run various additional regressions to demonstrate that our empirical findings are robust to alternative definitions of formal and informal credit, selection bias related to who takes a loan, and the possible endogeneity of loan size.

\footnote{We also perform robustness checks with respect to these definitions.}
Related literature

Our paper contributes to a relatively small but growing literature on the coexistence of formal and informal credit. The work that is probably the closest to ours is Lee and Persson (2013) who develop an alternative and complementary explanation of the downside of informal finance. Among other key differences, while we model informal loans as arrangements in which compliance is enforced by the threat of severing social ties, Lee and Persson assume two-sided altruism – the borrower’s utility directly enters the lender’s utility and vice versa. While the implications regarding reduced agency problems and lower interest rates in informal credit arrangements are similar, the implied cost of informal credit is different. Specifically, unlike our paper, Lee and Person’s altruism-based model emphasizes the role of risk taking: informal credit directly amplifies borrowers’ aversion to failure, thereby undermining entrepreneurs’ willingness to take risk and potentially limiting investment and firm size.

Gine (2011) develops a model of limited enforcement and fixed transaction costs of accessing formal credit to formalize a trade-off between informal and formal credit. After structurally estimating the model using data from Thailand, he concludes that the limited ability of banks to enforce contracts, and not fixed costs, leads to the observed diversity of lenders. This finding is consistent with our assumption of limited enforcement as the key friction in the credit market. Jain (1999) proposes a model in which the formal sector’s superior ability in deposit mobilization (economies of scale and scope, security of deposit insurance) is traded off against the informational advantage that lenders in informal sector enjoy about their borrowers.

More generally the paper contributes to, and borrows from, the literature on social capital and the interdependence between economic development and the development of (financial) institutions. The theoretical foundations of sustaining cooperative outcomes in informal settings are two-fold. First, repeated interactions among members of the same social network improve enforcement (Hoff and Stiglitz, 1994; Besley and Coate, 1995). Here, our paper draws in particular on the work of Anderson and Francois (2008) who emphasize that the social collateral destroyed when default occurs represents a loss not only to the borrower but also to the other members of the social group (friends or family in our case). Second, informal lenders’ better access to local information allows them to write contracts that are more state-contingent than formal contracts, and as such, reduce risk (Bond and Townsend, 1996; Bose, 1997; Kochar, 1997; Guirkinger, 2008). Similar insights underlie the attempts to improve lending to the poor by exploiting their information sharing in setting up joint-liability lending schemes (see for example Ghatak and Guinnane, 1999 or Morduch, 1999). The literature on social capital (see Woolcock and Nanyan, 2000, for a survey) has also emphasized a downside of transactions based on ties between individuals, as the lack of these ties across other individuals can stifle the extent to which production can move beyond the kin group. Our focus differs in that we highlight how the possibility of losing the value of the personal relationship in a risky environment makes borrowers substitute informal for formal credit arrangements.

The paper proceeds as follows. In Section 2 we describe the model and derive the optimal informal

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9See also Madestam (2012) who, unlike here, models formal lenders (banks) as having a monitoring disadvantage relative to informal lenders (moneylenders) and shows that formal and informal sources can be substitutes or complements depending on banks’ bargaining power.

10Empirical work on the question of formal versus informal finance generally highlights the same factors driving informal loans mentioned in the Introduction. In a study of Peruvian farmers, Guirkinger (2008), for example, finds that households resort to informal loans either when they are excluded from the formal sector, or face lower transaction costs. Using data from Vietnam, Barslund and Tarp (2008) find that demand for informal credit is positively associated with household wealth, informal credit is positively associated with a bad credit history and the number of dependents.
(Section 2.1) and formal (Section 2.2) credit contracts. The costs and benefits of the two credit types are compared and the optimal choice of credit source is analyzed in Section 3. Section 4 presents empirical results using the Thai rural data. Section 5 concludes.

2 Model

2.1 Basic Setting

The economy is populated by two types of agents: lenders and borrower entrepreneurs. Each entrepreneur has a single investment project that is financed by taking a loan at $t = 0$. The projects vary in size denoted by $\theta$, with $\theta \in (0, \bar{\theta}]$. A project requiring investment $\theta$ at $t = 0$ generates a stochastic return $y(\theta)$ at $t = 1$. The return $y(\theta)$ can take two possible values: $R\theta$ (‘project success’) with probability $p$, and 0 (‘project failure’) with probability $1 - p$, where $R > 1$ and $p \in (0, 1)$.

Borrowers are endowed with illiquid wealth/assets, $w > 0$ at $t = 0$, where $w$ can differ across agents. We assume that the wealth $w$ is collateralizable but subject to risk. Specifically, at time $t = 1$ only a fraction $\alpha$ of the agent’s wealth is available to compensate the lender, where $\alpha$ is a random variable with continuous cdf $G(\alpha)$ and support $[\alpha_{\min}, 1]$ and where $\alpha_{\min} \in (0, 1)$ and $E(\alpha) \in (\alpha_{\min}, 1)$. One interpretation of the parameter $\alpha$ is that it captures expenses that need to be incurred by the lender in acquiring or storing the collateral. Alternatively, one can think of $\alpha$ as a shock to the $t = 1$ asset value – for example, a bad harvest reducing the crop value, an accident lowering the resale value of a vehicle, or a drop in house or land prices.\(^{11}\) Importantly, the realization of $\alpha$ is unknown to both borrowers and lenders at $t = 0$ when loans are taken, while the $t = 1$ asset value $\alpha w$ is observable to both at $t = 1$ when repayment is due. The parameter $\alpha$ plays a key role in the model by directly tying default risk to the loan size-to-wealth (LTW) ratio, $\frac{\theta}{w}$.

Both lenders and borrowers are risk-neutral and, for simplicity, do not discount the future. We assume an environment with limited enforcement or, alternatively, that the project return $y(\theta)$ is non-verifiable. This gives rise to the possibility of strategic default – a borrower may choose to renege on her loan despite being able to pay back. Loan terms must therefore be such that a borrower has an incentive to repay the loan. In addition, as in most of the literature on rural credit, assume that the borrowers are subject to limited liability: if her project fails, $y(\theta) = 0$, a borrower defaults involuntarily, in which case the lender cannot punish her beyond seizing any posted collateral (if applicable). The lenders’ opportunity cost of funds is unity. The borrowers’ outside option (if they do not invest) is normalized to zero.

We distinguish between informal and formal credit. Informal creditors could be relatives, friends, neighbours, members of the same ethnic group, etc. For us, the key defining characteristic of ‘informal credit’ is a situation in which the lender has a (personal) relationship with the borrower characterized by social capital (friendship) with value $\gamma > 0$ for each party. The social value can differ across borrowers. We use the subscript $I$ to denote informal credit. We further assume that an informal lender has a maximum amount of $\bar{\theta} > 0$ available to lend out. In contrast, we define ‘formal credit’ (e.g., from a commercial bank) as a lending relationship in which the lender is a stranger to the borrower, that is, no personal relationship exists between them. We refer to any such creditors as formal and denote them by the subscript $F$.

\(^{11}\)We assume that the upper bound of $\alpha$ equals 1 for simplicity but our results easily generalize for an upper bound $\alpha_{\max} > 1$ as long as $E(\alpha) < 1$. 

6
The timing is as follows. First, the borrowers decide on a loan source. They can consider borrowing \( \theta \) either from an informal or a formal lender, although as will become clear, depending on the borrower circumstances only one of these sources may be available in equilibrium. Second, the terms of the loan contract, \( \{r_i, c_i\}, i = I, F \) are determined, where \( r_i \) denotes the required gross repayment (principal plus interest) if the borrower does not default (announces that her project was a success) and \( c_i \) denotes the required physical collateral in terms of borrower assets which will be seized by the lender if the borrower defaults (declares that her project failed). We assume that nominal interest rates cannot be negative, that is, the gross repayment cannot be smaller than the loan size, \( r_i \geq \theta \) for \( i = I, F \). We also assume that forced asset liquidation in case of default is costly in the sense that, because of transaction costs, each $1 of borrower’s assets is worth only $\lambda \in (0, 1)$ to the lender.\(^{12}\) Third, nature determines the value of \( \alpha \) and whether the investment project has succeeded or failed.

Third, nature determines the value of \( \alpha \) and whether the investment project has succeeded or failed. The former is observed by both parties. The latter is observed only by the borrower. Fourth, the contract terms are executed and payoffs are realized.

We impose the following assumption on the model parameters,

**Assumption.**

\[
(i) \ p R > 1/\lambda \quad \text{and} \quad (ii) \ p > 1/2
\]

Part (i) ensures that all investment projects are socially efficient and that borrowers would be always willing to take a formal loan in equilibrium (see Section 2.2.2 for details). Part (ii) assumes that the probability of success \( p \) is sufficiently high, which helps simplify the analysis by eliminating non-essential cases.

We also assume that the social value parameter \( \gamma \) is sufficiently large, so that people who borrow from informal lenders always have an incentive to repay in equilibrium – they never default strategically.\(^{13}\) To ensure this we impose (see Section 2.1.2 for details),

**Assumption.**

\[
\gamma > \frac{p(R - 1)}{1 - p} \tilde{\theta}
\]

### 2.2 Informal Credit

Informal credit allows the borrower and lender to use the threat of terminating their social relationship and the associated utility loss of \( \gamma > 0 \) for each party as a means of ensuring compliance and repayment beyond what can be achieved by physical collateral. For simplicity and ease of exposition, we motivate and represent the social value \( \gamma \) using a simple coordination (‘handshake’) game. In this game, the borrower and an informal lender either ‘confirm’ or ‘reject’ their friendship at \( t = 1 \) after the project return has been realized and the contract terms \( (r_I, c_I) \) have been executed.

<table>
<thead>
<tr>
<th>Lender \ Borrower</th>
<th>confirm</th>
<th>reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>confirm</td>
<td>( \gamma, \gamma )</td>
<td>-1,0</td>
</tr>
<tr>
<td>reject</td>
<td>0,1</td>
<td>0,0</td>
</tr>
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</table>

\(^{12}\) The liquidation cost parameter \( \lambda \) serves a different role to that of the collateral value parameter \( \alpha \) introduced earlier. \( \lambda \) is a pure transaction cost that applies if the borrower strategically defaults on the repayment \( r_i \); it is certain and known ex-ante. In contrast, the ex-ante unknown \( \alpha \) determines the ex-post collateral value \( \alpha w \) available to compensate the lender and as such directly determines the risk of strategic default for given loan size \( \theta \) and borrower assets \( w \).

\(^{13}\) Alternatively, we could assume away strategic default in informal credit upfront, for example by referring to superior enforcement ability or information between the parties, as in many papers from the literature.
This game should be interpreted as a reduced form of a repeated interaction between the agents subject to limited commitment, as modelled for instance in Coate and Ravallion (1993) or Kocherlakota (1996) who study risk sharing via reciprocal transfers. Similarly, Fafchamps (1999) shows that contingent credit can arise as an equilibrium in a long-term risk-sharing arrangement while Boot and Thakor (1994) provide conditions under which long-term credit relationships can achieve the first-best in a repeated moral hazard problem without risk sharing motive.

We assume that the Nash equilibrium (confirm, confirm) is played whenever the required loan repayment is made and the Nash equilibrium (reject, reject) is played otherwise. An isomorphic game is played when a borrower asks an informal lender for a loan. Consequently, there is an equilibrium in which, if the lender refuses to give an informal loan, he also loses the friendship value $\gamma$. In Section 2.2.3 we relax these assumptions and show that our results hold if the lender instead loses some $\gamma_2 < \gamma$ if he refuses to make a loan as long as $\gamma_2$ is sufficiently large. We also show that all results hold if the lender forgives the loan in case of involuntary default.

2.2.1 The contracting problem

Note that if the social value $\gamma$ is sufficiently large (we will show that this is guaranteed by Assumption A2), an informal borrower would always try everything possible to avoid the loss of the friendship. This means that when the project succeeds the borrower will always repay $r_I$ – there is no strategic default. When the project fails and the borrower cannot repay the lender from the project return, when $\gamma$ is large the borrower would still prefer not to default, even if no collateral is required ($c_I = 0$). Instead, for such $\gamma$, the borrower would find it optimal to repay $r_I$ voluntarily liquidating her assets with $t = 1$ value $\alpha w$. This is feasible when $\alpha w \geq r_I$, or $\alpha \geq \frac{r_I}{w}$, which occurs with probability $1 - G(\frac{r_I}{w})$. In sum, under Assumption A2, for large $\gamma$, an informal borrower would only default if she is unable to repay the lender, that is, when $y(\theta) = 0$ and $r_I > \alpha w$, which happens with probability $(1 - p)G(\frac{r_I}{w})$. The friendship value $\gamma$ is lost only in this case.

If the contract also specifies physical collateral, $c_I > 0$ then, if the borrower does not repay $r_I$ (when $y(\theta) = 0$ and $\alpha < \frac{r_I}{w}$), an amount $c_I$ of his assets is seized by the lender provided $c_I \leq \alpha w$. Otherwise, if $c_I > \alpha w$, all borrower assets are taken over by the lender and liquidated. The actual asset transfer from the borrower to the lender therefore equals $\min\{c_I, \alpha w\}$ which is worth $\lambda \min\{c_I, \alpha w\}$ to the lender. We will show that under our assumptions no collateral would be required in informal credit.

In general, the terms of the loan contract would depend on the market structure or the outcome of bargaining between borrowers and lenders. To simplify the analysis, we assume that the borrowers receive all of the surplus – that is, the contract terms $(r_I, c_I)$ are chosen to maximize the borrower’s expected utility subject to participation constraints.

Given the above, the $t = 0$ contracting problem between an informal lender and a borrower with
project size θ ∈ (0, $\bar{\theta}$], social value γ > 0, and initial wealth w > 0 can be written as:

$$\max_{r_I,c_I} p(R\theta - r_I) - (1-p)[(1 - G(\frac{c_I}{w}))r_I + G(\frac{c_I}{w})\gamma + \int_{\alpha_{\min}}^{r_I/w} \min\{c_I, \alpha w\}dG(\alpha)] \quad (OBJ_B)$$

s.t. $[p + (1-p)(1-G(\frac{c_I}{w}))] r_I - (1-p)G(\frac{c_I}{w})\gamma + (1-p)\lambda \int_{\alpha_{\min}}^{r_I/w} \min\{c_I, \alpha w\}dG(\alpha) \geq \theta - \gamma \quad (PC_L)$

$$p(R\theta - r_I) - (1-p)[(1 - G(\frac{c_I}{w}))r_I + G(\frac{c_I}{w})\gamma + \int_{\alpha_{\min}}^{r_I/w} \min\{c_I, \alpha w\}dG(\alpha)] \geq 0 \quad (PC_B)$$

$$r_I \leq \gamma + c_I \quad (IC_B)$$

$$r_I \geq \theta \text{ and } c_I \geq 0 \quad (NN)$$

The objective is the borrower’s expected payoff which equals the sum of her payoff under project success (the term multiplied by $p$) and the payoff under project failure (the term multiplied by $1-p$). Remember that default and loss of the social value occurs only when the project fails and the $t=1$ asset/collateral value is small, $\alpha < \frac{c_I}{w}$ – this is shown formally below using Assumption A2.

Constraint (PC_L) is the lender’s participation constraint – if an informal lender gives a loan, she is repaid $r_I$ in two cases: (i) the project succeeds (which occurs with probability $p$) or (ii) the project fails and the borrower repays using her assets (which occurs with probability $(1-p)(1-G(\frac{c_I}{w}))$). Otherwise, when the project fails and the borrower has insufficient assets to repay, both the borrower and the lender lose the value $\gamma$ and the lender receives the collateral (possibly not in full if $\alpha w < c_I$) net of liquidation costs, $\lambda \min\{\alpha w, c_I\}$. The right hand side of (PC_L) reflects the opportunity cost of lending, $\theta$ and the assumption that if an informal lender refuses to lend to his friend he would lose the value $\gamma$ (see Section 2.2.3 for relaxing this assumption).

The next constraint, (PC_B) is the borrower’s participation constraint stating that the borrower’s expected payoff from taking a loan with terms $(r_I, c_I)$ and investing it in her business project must exceed her outside option of zero. The third constraint, (IC_B) is the borrower’s incentive constraint which ensures that the borrower prefers to repay the loan if feasible, instead of renege and lose $\gamma$ plus any collateral. Under Assumption A2 the social value $\gamma$ is sufficiently large so that constraint (IC_B) will not bind at the optimum (see below). The final constraint, (NN) reflects the assumption of non-negative interest rate and collateral.

Note that the social value parameter $\gamma$ enters the contracting problem (OBJ_B) in four distinct places, in the objective and constraints (PC_L), (PC_B) and (IC). In Section 2.2.3 below we discuss what happens if we allow $\gamma$ to differ across its various instances and also to what extent our results depend on Assumption A2.

### 2.2.2 The optimal informal loan contract

We start the analysis of the optimal informal loan contract with the following:

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16Relaxing this assumption is discussed in Section 2.2.3 below.
Lemma 1. Under Assumptions A1 and A2, the participation constraint (PC\textsubscript{L}) of an informal lender is not binding for any \( r_{I} \geq \theta \) and \( c_{I} \geq 0 \).

Proof: see Appendix.

Intuitively, for a sufficiently large friendship value \( \gamma \) an informal lender never finds it optimal to refuse a loan and lose a friend knowing that, for the same reason, the borrower has an incentive to repay whenever feasible. The assumption that an informal lender would lose social capital if he does not extend a loan when asked is important for this result since it relaxes the lender’s participation constraint. The latter also ensures that the lender would offer the loan at favorable terms. Note that, depending on \((r_{I}, c_{I})\), it may happen that an informal lender incurs a monetary loss on an informal loan – the desire to preserve the social relationship makes it worthwhile to lend to a friend or relative even if there is risk of non-payment and consequently negative expected monetary payoff.\(^{17}\)

Next, from the objective function, observe that it is optimal to set \( r_{I} \) and \( c_{I} \) as low as possible \((r_{I} = \theta \) and \( c_{I} = 0)\) as long as all constraints are satisfied.\(^{18}\) By Lemma 1 (PC\textsubscript{L}) is satisfied. In addition, Assumptions A1 and A2 imply \( \gamma \geq \bar{\theta} \) which means that (IC\textsubscript{B}) is also satisfied at \( r_{I} = \theta \) and \( c_{I} = 0 \). What remains to be checked is the borrower’s participation constraint (PC\textsubscript{B}). At \( r_{I}^{*} = \theta \) and \( c_{I}^{*} = 0 \), it is equivalent to

\[
(pR - 1)\frac{\theta}{w} + (1-p)G\left(\frac{\theta}{w}\right)(\frac{\theta}{w} - \gamma) \geq 0
\]

(1)

We show that whether (PC\textsubscript{B}) is satisfied and hence a borrower benefits from an informal loan depends on the value of the loan size and the loan size to wealth (LTW) ratio, \( \frac{\theta}{w} \).

Proposition 1 (Informal Credit). Suppose Assumptions A1 and A2 hold. The optimal informal loan has zero interest rate, \( r_{I}^{*} = \theta \), requires no physical collateral, \( c_{I}^{*} = 0 \), and

a) informal credit is unavailable for large investment projects, with \( \theta > \bar{\theta} \).

b) for projects with \( \theta \leq \bar{\theta} \) for which informal credit is available, there exists a threshold loan size to wealth (LTW) ratio, \( \hat{\alpha}_{I} \in (\alpha_{\text{min}}, 1) \) such that:

i) no informal credit is optimally taken for ‘high default risk’ (high LTW ratio) projects, with \( \frac{\theta}{w} > \hat{\alpha}_{I} \);

ii) informal credit with terms \( r_{I}^{*} = \theta \) and \( c_{I}^{*} = 0 \) is optimally taken for ‘low default risk’ (low LTW ratio) projects, with \( 0 < \frac{\theta}{w} \leq \hat{\alpha}_{I} \). If \( \frac{\theta}{w} \in (\alpha_{\text{min}}, \hat{\alpha}_{I}] \) default occurs and the social value is lost with positive probability.

Proof: see Appendix.

\(^{17}\)Alternatively, instead of losing social value when refusing to make a loan, one can think of the lender receiving social value when an informal loan is made (pleasure of helping out). In this case nothing changes since \( \gamma \) is added to the left hand side of (PC\textsubscript{L}) while the right hand side is the opportunity cost of funds \( \theta \).

\(^{18}\)It is obvious that the objective is strictly decreasing in \( c_{I} \). To see that it is also strictly decreasing in \( r_{I} \) at \( c_{I} = 0 \), denote \( M \equiv (1 - G\left(\frac{\theta}{w}\right))r_{I} + G\left(\frac{\theta}{w}\right)\gamma \). We have \( \frac{\partial M}{\partial r_{I}} = 1 - G\left(\frac{\theta}{w}\right) + \frac{\gamma}{w} G'\left(\frac{\theta}{w}\right)(\gamma - r_{I}) \geq 0 \) since \( \gamma \geq r_{I} \) from (IC\textsubscript{B}) at \( c_{I} = 0 \).
2.2.3 Discussion

The role of $\alpha$ and the LTW ratio

Looking at Proposition 1, intuitively, small loans or loans that are not too large relative to the borrower’s wealth, namely those with $\theta \leq \hat{\theta}$ and $\frac{\theta}{w} \leq \alpha_{\text{min}}$, are feasible and mutually beneficial to both lender and borrower since there is no risk of default – the borrower always has sufficient assets to repay given $\tau_I^* = \theta$. For projects with higher LTW ratios, $\frac{\theta}{w} > \alpha_{\text{min}}$, default does occur in equilibrium and the social value is lost to both parties with positive probability (see below on relaxing this). The probability of default increases in the LTW ratio as it becomes more likely that a realization of $\alpha$ would be drawn for which $\alpha < \frac{\theta}{w}$ $= \frac{\theta}{\hat{\theta}}$. In such case, the borrower has to weigh the risk of defaulting and losing the social value against the expected gain from undertaking the project. The latter outweighs the former if $\theta_{\text{w}}$ is below the threshold $\hat{\alpha}_I$. For high LTW values, $\frac{\theta}{w} > \hat{\alpha}_I$, informal credit is still available (PC$_L$ holds) but undesirable to the borrower. Even though an informal loan would be given and have zero interest and collateral, it is not optimal for the borrower to ask her friend or relative for it since the risk of losing the social value is too large.

The role of the social value $\gamma$

Proposition 1 shows that informal credit is characterized by no collateral requirement and zero interest rate, as is also largely confirmed in the data, see Section 4. Note that in our setting this is a result and not an assumption – we only ruled out negative interest rates. The assumption that the lender loses the social value $\gamma$ (see the right hand side of constraint PC$_L$) is important for this result – the relaxed participation constraint arising from the threat of losing the friendship is what makes the lender extend a loan with such favorable conditions (below we discuss what happens if we relax this).

We next analyze in detail and disentangle the role of each of the four distinct instances of the social value $\gamma$ in the contracting problem (the objective function and PC$_B$ are counted as the same instance). Specifically, we discuss whether relaxing the simplifying assumption that these values are all equal and positive matters for the results.

First, the social value parameter $\gamma$ appears in the borrower’s payoff, both in the objective function and the borrower’s participation constraint. Call this instance $\gamma_1$. It can be interpreted as the “shame”, “loss of face”, or other similar cost to the borrower incurred when she is unable to repay the informal loan. As seen in the proof of Proposition 1, for our results to hold as stated, a sufficient condition is that

$$\gamma_1 \geq \frac{p(R - 1)}{1 - p} \hat{\theta} \quad (C0)$$

When $\gamma_1 = \gamma$ as assumed above, condition (C0) is guaranteed by Assumption A2. If, instead, we set the shame cost $\gamma_1 = 0$ (or sufficiently low) then the borrower would be willing to take an informal loan for any LTW ratio $\theta/w$. Hence, our result that risky informal loans, those with $\frac{\theta}{w} > \hat{\alpha}_I$, are avoided by borrowers hinges on condition (C0), that is, Assumption A2 applied to the social value $\gamma_1$.

Second, the social value parameter appears in the left-hand side of the lender’s participation constraint (PC$_L$) – call this instance $\gamma_2$. It can be interpreted as the lender’s cost of being ‘upset’ or ‘angry’ for not being repaid if the borrower’s project fails and the borrower has insufficient wealth. Note that nothing changes in our results if we allow ‘forgiveness’ in this case, that is, set $\gamma_2 = 0$. The reason is that Lemma 1 still holds since setting $\gamma_2 = 0$ (or any $\gamma_2 < \gamma$) relaxes the lender’s participation constraint. If lenders were willing to make informal loans when $\gamma_2 = \gamma$ they are still willing to do so if $\gamma_2 \in [0, \gamma)$. 

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Third, the social value appears in the right-hand side of the lender’s participation constraint (PC_L) – call this instance $\gamma_3$. It can be interpreted as the utility loss to the lender of refusing to give a loan to a friend. One can imagine this loss to be quite high in case of close friends, parents, etc. Going back to the proof of Lemma 1, we see that for its result to hold we need (PC_L) to be satisfied at $r_I = \theta$ and $c_I = 0$. Using that $\theta \leq \theta$ and $g = G(\frac{\theta}{w}) \leq 1$, a sufficient condition for this is

$$\gamma_3 \geq (\gamma_2 + \theta)(1 - p) \quad (C1)$$

In the baseline setting above which assumed $\gamma_2 = \gamma_3 = \gamma$ condition (C1) followed from Assumptions A1 and A2 since they imply $p > 1/2$ and $\gamma > \theta$. We see from (C1) that these sufficient conditions can be too strong. For example, if $\gamma_2 = 0$ (the forgiveness scenario discussed above) then for $p$ large enough, we can still have $\gamma_3 < \gamma$ in the left hand side of (PC_L) with all our previous results intact. In practice, a likely scenario with large $\gamma_3$ and small or zero $\gamma_2$ could be taking a loan from one’s parents – they may not be upset at all ($\gamma_2 = 0$) with a borrower who fails to repay for exogenous reasons (project failure), but on the other hand may have a high utility cost ($\gamma_3$) of refusing a loan when asked. In the other extreme, if $\gamma_3 = 0$ (the lender has no qualms about refusing a loan to a friend), then the lender would still optimally charge zero interest and require no collateral for riskless loans, those with $\frac{\theta}{w} \leq \alpha_{\text{min}}$ but, in resemblance to formal lenders, would optimally require positive collateral and interest for risky loans (those with $\frac{\theta}{w} > \alpha_{\text{min}}$).

Fourth, the social value $\gamma$ appears in the incentive constraint (IC) – call this instance $\gamma_4$. It can be interpreted as a ‘shame’ or ‘ostracism’ cost to the borrower of strategically defaulting on an informal loan, that is, not paying back $r_I$ when being able to. For the results in Proposition 1 to hold as stated, we need to ensure that no strategic default happens at $c_I = 0$. A sufficient condition for this is

$$\gamma_4 \geq \theta \quad (C2)$$

Note that condition (C2) is weaker than what was assumed in the baseline setting (Assumption A2) when all $\gamma_i$, $i = 1, ..., 4$ were set equal. If the shame or ostracism cost did not exist, i.e., $\gamma_4 = 0$, then physical collateral (setting $c_I > 0$) would be needed to support informal loans in a way similar to the formal credit case discussed in the next section.

The threshold value $\tilde{\alpha}_I$

We next show how the LTW ratio threshold $\tilde{\alpha}_I$ in Proposition 1 depends on the model parameters $p, R, w$ and $\gamma$. The threshold $\tilde{\alpha}_I$ determines the extent of informal credit at optimum when borrowers vary in their $\frac{\theta}{w}$ ratios.

Lemma 2. The threshold $\tilde{\alpha}_I$ defined in Proposition 1 is decreasing in the social value $\gamma$ and increasing in the project success probability $p$, the project return $R$, and the borrower’s wealth $w$.

Proof: see Appendix.

Intuitively, as the social value $\gamma$ increases, informal loans become more costly to both parties due to the risk of default. This reduces the range of LTW ratios $\frac{\theta}{w}$ for which informal loans are desirable –

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19 A tighter sufficient condition but depending on the endogenous threshold $\tilde{\alpha}_I$, is

$$\gamma_3 \geq (\gamma_2 + \tilde{\alpha}_I w)(1 - p)G(\tilde{\alpha}_I)$$

using that informal loans are optimally taken only for LTW ratios $\frac{\theta}{w} \leq \tilde{\alpha}_I$. 

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there is a shift to safer loans. In contrast, larger wealth \( w \) can support a wider range for loan size as the risk of default is lower. The effects of larger \( p \) and/or \( R \) go in the same direction since borrowing becomes more profitable in expectation.

The effects from raising \( w, R \) and \( p \) are intuitive – ‘better quality’ borrowers can use informal credit for a wider range of project sizes. The effect of varying the social value \( \gamma \) is less obvious as it implies that more closely related people are less likely to lend to each other ceteris paribus (for given \( w \), the feasible range of project sizes that can be supported by informal credit is smaller). The reason is the potential loss of the value \( \gamma \) upon equilibrium default. Note, however, that borrower-lender pairs with low \( \gamma \) may be unable to support any informal loans with zero collateral (here such outcome is ruled out by Assumption A2 but would obtain if we relax this assumption, as discussed above).

### 2.3 Formal Credit

#### 2.3.1 The contracting problem

There are two main differences between borrowing from a formal lender (e.g., a bank) versus borrowing from an informal lender (e.g., a friend). First, we assume that, unlike informal lenders, formal lenders have ‘unlimited’ funds: there is no ex-ante cap \( \bar{\theta} \) on the loan size, as long as sufficient collateral is provided. Second, there is no social capital value when taking a formal loan. Consequently, formal loans need to be secured by physical collateral – otherwise borrowers cannot commit not to always claim project failure, \( y(\theta) = 0 \).

Subject to the above two differences, we treat formal and informal loans symmetrically. We maintain the assumption that borrowers receive the whole surplus, in other words, the formal credit sector can be thought of as perfectly competitive and the optimal formal loan contract maximizes the borrower’s expected utility subject to participation and incentive compatibility. Limited liability still applies – if a borrower does not make the required repayment, \( r_F \), the lender cannot do anything beyond seizing any posted collateral \( c_F \).

In case the borrower’s project fails (probability \( 1 - p \)), the lender obtains the contracted collateral amount \( c_F \) if \( c_F \leq \alpha w \). Otherwise, if \( c_F > \alpha w \), the lender receives the \( t = 1 \) value of the borrower’s assets, \( \alpha w \). Net of liquidation costs, the lender thus receives \( \lambda \min\{c_F, \alpha w\} \) upon project failure.

In case the borrower’s project succeeds (probability \( p \)), after observing \( \alpha \) the borrower can either report truthfully, \( y(\theta) = R\theta \) and pay back \( r_F \) or strategically default (lie that \( y(\theta) = 0 \) or escape with the project return). In the latter case the lender receives \( \lambda \min\{c_F, \alpha w\} \) as explained above. To prevent the borrower from always strategically defaulting and forfeiting the collateral we must have \( r_F \leq c_F \) in the optimal contract. However, even if \( r_F \leq c_F \), the borrower would still find it optimal to default strategically after observing \( \alpha \) if \( \alpha w < r_F \) (\( \leq c_F \)). Hence, the payment to the lender in case of project success equals \( \min\{r_F, \alpha w\} \) – the lender either receives \( r_F \) when the realization of \( \alpha \) is such that \( r_F \leq \alpha w \) and the borrower chooses to repay, or the lender receives \( \lambda \alpha w \) when \( \alpha \) is such that \( r_F > \alpha w \) and the borrower’s strategic default triggers costly liquidation of the assets backing the collateral.

The result that the borrower can choose to strategically default in equilibrium depending on the realization of \( \alpha \) is an important difference with the informal credit case in which we assumed (Assumption A2) that the social value \( \gamma \) is sufficiently large to prevent strategic default.
The $t = 0$ contracting problem between a formal lender and a borrower with project size $\theta > 0$ and assets $w > 0$ is:

$$\max_{r_F, c_F} \ p[R\theta - \frac{1}{\alpha_{\min}} \min\{r_F, \alpha w\}dG(\alpha)] - (1 - p) \frac{1}{\alpha_{\min}} \min\{c_F, \alpha w\}dG(\alpha) \quad (\text{OBJ}_B)$$

subject to:

$$p[\int_{\alpha_{\min}}^{1} \lambda\alpha w dG(\alpha) + (1 - G(\frac{r_F}{w}))r_F] + (1 - p) \lambda \int_{\alpha_{\min}}^{1} \min\{c_F, \alpha w\}dG(\alpha) \geq \theta \quad (\text{PC}_L)$$

$$p[R\theta - \frac{1}{\alpha_{\min}} \min\{r_F, \alpha w\}dG(\alpha)] - (1 - p) \frac{1}{\alpha_{\min}} \min\{c_F, \alpha w\}dG(\alpha) \geq 0 \quad (\text{PC}_B)$$

$$r_F \leq c_F \quad (\text{IC})$$

$$r_F \geq \theta \text{ and } c_F \geq 0 \quad (\text{NN})$$

The optimal loan contract maximizes the borrower’s expected payoff, $(\text{OBJ}_B)$ subject to four constraints. Constraint $(\text{PC}_L)$ is the lender’s participation constraint ensuring that the lender breaks even in expectation. The expected value of making the loan and collecting the respective repayment under success or failure, as explained above (the left hand side) must be larger than the opportunity cost of lending, $\theta$ (the right hand side). Constraint $(\text{PC}_B)$ is the borrower’s participation constraint, stating that the expected payoff from taking formal loan with terms $(r_F, c_F)$ must exceed the borrower’s outside option of zero. Constraint (IC) is the borrower’s incentive constraint ensuring that she does not always strategically default. Constraint (NN) ensures non-negative interest rate and collateral requirement.

### 2.3.2 The optimal formal loan contract

Note first that it is optimal to set $r_F$ and $c_F$ as low as possible in the objective $(\text{OBJ}_B)$ while satisfying all constraints. Also, from (IC) and the fact that liquidating collateral is costly, we must have $r_F = c_F$ at optimum. We obtain:

**Lemma 3.** The optimal formal loan contract features positive interest rate, $r^*_F > \theta$ and positive collateral, $c^*_F > 0$.

**Proof:** see Appendix.

Note the difference with informal loans (Proposition 1). The lack of social value necessitates using wealth as collateral since this is the only way to support repayment in the presence of limited enforcement. The cost of liquidating the collateral when strategic or involuntary default occurs causes the positive interest rate.

Given the above, the optimal formal loan contract consists of the gross repayment, $r_F$ and collateral requirement, $c_F$ satisfying $c_F = r_F \equiv r^*_F$ and such that the lender’s participation constraint $(\text{PC}_L)$ holds at equality (the borrower’s participation constraint $\text{PC}_B$ is verified below). That is, $r^*_F$ solves

$$\frac{r_F}{w} \int_{\alpha_{\min}}^{1} \lambda dG(\alpha) + (p + (1 - p)\lambda)(1 - G(\frac{r^*_F}{w})) \frac{r^*_F}{w} = \frac{\theta}{w} \quad (2)$$
We discuss the conditions under which a solution to (2) exists and characterize the optimal formal loan contract. In addition to Assumption A1(i), assume:

**Assumption.**

\[ \frac{E(\alpha)}{\phi} > \alpha_{\text{min}} \text{ where } \phi \equiv \frac{1}{p + (1-p)\lambda}. \]  

(A3)

As we show below, Assumption A3 ensures that formal loans are taken not only when informal loans are infeasible (for \( \theta > \bar{\theta} \)). As in the case of informal credit, the optimal loan contract depends critically on the loan-to-wealth (LTW) ratio, \( \frac{\theta}{w} \).

**Proposition 2** (Formal Credit). Suppose Assumptions A1(i) and A3 hold. Then, there exists an LTW ratio threshold \( \hat{\alpha}_F \in (\alpha_{\text{min}}, E(\alpha)/\phi) \) such that the optimal formal loan contract satisfies:

a) no formal loans are given for ‘high default risk’ (high LTW ratio) projects, with \( \frac{\theta}{w} > \hat{\alpha}_F \).

b) formal loans with positive collateral and positive interest rate, \( r_F = c_F = r^*_F = \phi \theta \), are given for zero strategic default risk (low LTW ratio) projects, with \( \frac{\theta}{w} \leq \alpha_{\text{min}}/\phi \). The lender always receives \( r^*_F \) from the borrower, either from the project return or from liquidating the collateral.

c) formal loans with positive collateral and interest rate, \( r_F = c_F = r^*_F > \phi \theta \) where \( r^*_F \) solves (2), are given for ‘intermediate default risk’ (intermediate LTW ratio) projects, with \( \alpha_{\text{min}}/\phi < \frac{\theta}{w} \leq \hat{\alpha}_F \).

There can be strategic default in equilibrium depending on the realization of \( \alpha \).

**Proof:** see Appendix.

### 2.3.3 Discussion

Intuitively, since the optimal formal loan contract requires collateral larger than the loan size (\( c_F^* = r^*_F > \theta \)), the lender faces only one type of risk, namely that the ex-post value of the borrower’s assets, \( \alpha w \) falls short of the contracted collateral amount \( c_F \) or the repayment \( r_F \). Default by itself is otherwise irrelevant to the lender, unlike in the informal credit case. Hence, projects with high default risk (high LTW ratio) are ineligible for formal loans since the lender cannot break even — his expected payout in case of default is too small. For the same reason low-LTW projects (with \( \frac{\theta}{w} < \alpha_{\text{min}}/\phi \)), for which there is no default risk are charged lower and size-independent interest rate relative to riskier, higher LTW ratio projects.

The asset value parameter \( \alpha \) links the probability of strategic default (realizations of \( \alpha \) for which \( \alpha w < r^*_F \) or \( \alpha w < c_F^* \)) to the loan size to wealth ratio. Larger loans require larger repayment and collateral amount, \( r^*_F \), therefore, for given borrower’s wealth \( w \) they are more risky for the lender since the probability that \( \alpha w \) would be insufficient increases.

The liquidation cost parameter \( \lambda \in (0,1) \) plays a role in determining the loan interest rate, which for formal loans is positive even when the lender is repaid in full (Proposition 2, part b). The reason is that, in case of project failure, the lender has to liquidate the collateral to be paid (see footnote 14). Assuming away liquidation costs by setting \( \lambda = 1 \) would not change the results of Proposition 2 in any major way, except that zero interest would be charged in part (b) for riskless loans while positive collateral would still be required.
Finally, comparing between the optimal informal and formal loan contracts described in Propositions 1 and 2, we see that when using informal credit both the lender and the borrower share a common incentive to avoid default since each stands to lose the social value $\gamma$. Hence, both parties would like to avoid risky loans, those with high LTW ratios, and such loans would not be taken from informal sources. In contrast, when using formal credit, the lender’s and borrower’s incentives regarding the risk of default are not aligned. The borrower does not mind riskier loans since her loss is capped at $\alpha w$. The lender, however, cannot break even for high-LTW ratio loans. This is the reason why the LTW upper bound $\hat{\alpha}_F$ in Proposition 2 above which loans are not given is determined by the lender’s participation constraint while the corresponding bound $\hat{\alpha}_I$ in Proposition 1 is determined by the borrower’s participation constraint.

3 Optimal Choice between Formal and Informal Credit

We use the results in Propositions 1 and 2 to compare the optimal formal and informal loan contracts and discuss their respective pros and cons from the borrower’s perspective. The advantage of using informal loans is twofold. First, provided the social value is large, informal lenders do not require the borrower to pay back the loan with interest or to post physical collateral – informal loans are thus cheaper than formal loans. Intuitively, informal lenders do not need to be compensated for the additional risk of strategic default – they know that the borrower has an incentive to pay them back, whenever it is feasible, in order to preserve the friendship. If the risk of losing the social collateral is high, borrowers would not enter an informal credit agreement in the first place. Second, because of the social capital that is pledged, informal credit can be extended to borrowers with low or no assets. Formal lenders such as banks, in contrast, always require physical collateral to ensure repayment.

Borrowing from informal sources does comes with a cost, however. Specifically, two characteristics of informal credit put it at disadvantage relative to formal credit. The first is the upper limit $\theta$ on the loan size – friends or relatives generally do not have unlimited loanable funds. Second, unlike physical collateral that can be freely adjusted, the friendship value $\gamma$ which acts as social collateral to secure the loan is indivisible – the entire amount $\gamma$ is pledged to support repayment, even though for small loans only a fraction may suffice (see the discussion in Section 2.2.3). This has broader implications (not modeled here) regarding to which person from one’s set of friends one would turn, depending on the needed loan size.

We next analyze formally the optimal choice between formal and informal credit given borrower’s wealth and loan size, $w$ and $\theta$ and the parameters $p, R, \gamma$. Recall that $\hat{\alpha}_I \in (\alpha_{\min}, 1)$ is the upper bound on the loan-to-wealth ratio $\frac{\theta}{w}$ for which informal credit is taken implicitly defined by (1) holding at equality. Loans with LTW ratios above $\hat{\alpha}_I$ are too costly in terms of the risk of losing the social value. For formal credit, the corresponding upper bound on the LTW ratio is $\hat{\alpha}_F \in (\frac{\alpha_{\min}}{\phi}, \frac{E(\alpha)}{\phi})$ which was implicitly defined by (2) holding at equality. For larger LTW ratios, formal credit is not feasible since the borrower does not have sufficient collateral to secure repayment and so the lender cannot break even.

Assume that $\theta \leq \bar{\theta}$ – that is, informal credit is a priori feasible. The above discussion implies that borrowers with LTW ratios $\frac{\theta}{w} \leq \min\{\hat{\alpha}_I, \hat{\alpha}_F\}$ can borrow from both formal and informal lenders. We characterize the optimal loan source choice for such borrowers depending on their LTW ratio.

Proposition 3 (Optimal choice of loan source). Suppose Assumptions A1, A2, and A3 hold. (a) If $\frac{\theta}{w} \leq \alpha_{\min}$, then borrowers optimally use informal loans.
(b) Suppose $\alpha_{\min} < \hat{\alpha}_F$. Then, for LTW ratios $\frac{\theta}{w} \in (\alpha_{\min}, \min(\hat{\alpha}_I, \hat{\alpha}_F)]$, borrowers optimally choose informal credit for lower values of the LTW ratio in this interval and formal credit otherwise.

(c) Consider LTW ratios $\frac{\theta}{w} \in (\min(\hat{\alpha}_I, \hat{\alpha}_F), \max(\hat{\alpha}_I, \hat{\alpha}_F)]$. If $\hat{\alpha}_I > \hat{\alpha}_F$, then borrowers use informal credit since formal credit is unavailable. If $\hat{\alpha}_I \leq \hat{\alpha}_F$, borrowers optimally use formal credit.

(d) Borrowers with $\frac{\theta}{w} > \max\{\hat{\alpha}_I, \hat{\alpha}_F\}$ would not or cannot borrow from any source – either the risk of losing the social value is too high or the lender cannot break even.

Proof: see Appendix.

Intuitively, when the LTW ratio and hence the risk of losing the social value $\gamma$ is low (part a), borrowers prefer informal loans since they have more favorable terms – zero interest and zero collateral. In contrast, for higher values of the LTW ratio (part b), borrowers prefer formal loans despite their less favorable terms. The expected cost of losing the social value is smaller in this case than the larger repayment required under project success or failure. The case in part (c) in which $\hat{\alpha}_I > \hat{\alpha}_F$ and informal loans are used arises when the LTW ratio $\theta/w$ is large enough so that the borrower’s preferred choice of a formal loan is not feasible (the lender cannot break even due to the insufficient collateral) but informal loans still generate positive expected payoff for the borrower.

Numerical example

Let $p = 2/3$, $R = 3$, $\lambda = .8$, $\bar{\theta} = 1$, $\alpha_{\min} = .2$, $\gamma = 5$ and $\alpha$ be uniformly distributed on $[\alpha_{\min}, 1]$. For simplicity, set borrower’s wealth to $w = 1$. It is easy to verify that Assumptions A1-A3 are satisfied. For these parameter values we obtain: $\hat{\alpha}_I = .42$ – informal loans are not taken for $\frac{\theta}{w}$ values above this threshold, and $\hat{\alpha}_F = .49$ – formal loans are not given for $\frac{\theta}{w}$ values above this threshold. Using Proposition 3, we find that informal loans are optimal for the borrower if $\frac{\theta}{w} \in (0, .21]$ while formal loans are optimal for riskier loans, with $\frac{\theta}{w} \in (.21, .49]$. No loans of either type are feasible for $\frac{\theta}{w} > \hat{\alpha}_F = .49$. The net interest rate for formal loans, $\frac{\ell_p}{\theta} - 1$ equals 7.1% for loans with LTW ratios less or equal to $\frac{\alpha_{\min}}{\theta}$, $\ell_p = .187$ and then, for larger LTW ratios, increases monotonically to reach 84.2% at $\frac{\theta}{w} = \hat{\alpha}_F = .49$. The formal loan collateral requirement $c^*_F$ equals $\phi \theta = 1.07 \theta$ for LTW ratios below $\frac{\alpha_{\min}}{\theta}$ (for instance, $c^*_F = .11$ at $\frac{\theta}{w} = .1$) and strictly increases in the LTW ratio up to .84 for the riskiest possible formal loan with $\frac{\theta}{w} = \hat{\alpha}_F = .49$.

Testable Implications

Our model has several testable implications about the optimal choice between formal and informal credit which we are able to study empirically using data on Thai rural households. The empirical analysis in the next section focuses on the two key variables in the model for which we also have corresponding data: the loan size, $\theta$ and the loan-size-to-wealth ratio, $\frac{\theta}{w}$. We also provide some descriptive evidence regarding collateral requirements, $c_j$ and the interest rate $\frac{\ell_p}{\theta} - 1$, $j = I, F$.

The first implication that we test empirically concerns the effect of loan size, $\theta$ on the optimal choice between formal and informal credit. Our model predicts that the prevalence of informal loans should, on average, decrease in the loan size $\theta$. There are two mechanisms behind this result. On the one hand, a negative relationship between loan informality and loan size arises directly from the assumption that informal lenders have limited funds, that is, informal loans larger than $\bar{\theta}$ cannot be made. On the other hand, smaller loans are less favorable terms – zero interest and zero collateral. In contrast, for higher values of the LTW ratio (part b), borrowers prefer formal loans despite their less favorable terms. The expected cost of losing the social value is smaller in this case than the larger repayment required under project success or failure. The case in part (c) in which $\hat{\alpha}_I > \hat{\alpha}_F$ and informal loans are used arises when the LTW ratio $\theta/w$ is large enough so that the borrower’s preferred choice of a formal loan is not feasible (the lender cannot break even due to the insufficient collateral) but informal loans still generate positive expected payoff for the borrower.

\footnote{One might imagine that borrowers could tap into multiple informal sources if their credit requirements exceed $\bar{\theta}$.}
other hand, Proposition 3 implies that when both loan sources are available for a borrower with given wealth \( w \) formal credit is optimally used for larger (riskier) loans, those with larger \( \frac{\theta}{w} \) ratios. This implies that when controlling for borrower’s wealth \( w \), we should once again observe a negative relationship between loan size \( \theta \) and loan informality.

The second implication that we test empirically concerns the effect of the LTW ratio \( \frac{\theta}{w} \) on the optimal choice between formal and informal loans. For low LTW values, our model predicts that informal credit is optimal (Proposition 3a and b). For larger LTW ratios, borrowers switch to formal credit (Proposition 3b). As the LTW ratio grows even larger, Proposition 3(c) shows that one of two cases can occur. Either formal credit is still available and thus preferred (the case \( \hat{\alpha}_I < \hat{\alpha}_F \)); or, formal credit becomes unavailable (the case \( \hat{\alpha}_F < \hat{\alpha}_I \)). In the latter scenario, informal credit is used as long as \( \theta \leq \bar{\theta} \). In sum, Proposition 3, parts (a)-(c) predicts that either: (i) the relationship between loan informality and the LTW ratio is strictly decreasing – the case \( \hat{\alpha}_F \geq \hat{\alpha}_I \) in part (c); or (ii) the relationship between loan informality and the LTW ratio is U-shaped: initially informal loans become less attractive as the LTW ratio grows, but are used again for high values of the LTW ratio – the case \( \hat{\alpha}_I > \hat{\alpha}_F \) in part (c).

In sum, we obtain the following testable implications of the model that we take to the data in the next section:

A. Choosing an informal loan is negatively associated with the loan size \( \theta \).

B. Choosing an informal loan is negatively associated with the loan size \( \theta \) when controlling for borrower wealth \( w \).

C. Choosing an informal loan is negatively associated with the LTW ratio or U-shaped in the LTW ratio, \( \frac{\theta}{w} \).

4 Empirical Analysis

4.1 Data Description

We test the predictions of our model with data on rural households in Thailand. The data source is a socio-economic survey of 2880 Thai households conducted in 1997 by the Townsend Thai Project to gather information on the existence and use of informal and formal financial mechanisms and institutions.\(^{21}\) The sample comes from four provinces located in two distinct regions of Thailand – the more developed Central region located near Bangkok, and the poorer, semi-arid Northeast region (see Figure 1). The dataset also contains various socioeconomic and financial variables, including current and retrospective information on wealth, occupational history, household demographics, entrepreneurial activities, and education. Most importantly for our purposes, the data provide unique detailed information on the usage of a variety of formal and informal financial institutions such as commercial banks, agricultural banks, village lending institutions, moneylenders, as well as friends, neighbors or family.

However, adding such loans will increase the risk of default and a costly loss of social capital. The main point is that if borrowers may default, then they would rather default with a formal lender than with an informal lender.

\(^{21}\) The survey was fielded in May, prior to the economic/financial crisis which began with the devaluation of the Thai baht in July 1997. For further details, including sample selection and the administration of the survey see the Townsend Thai Project website [http://cier.uchicago.edu/about/](http://cier.uchicago.edu/about/).
Households were asked detailed questions about their borrowing and lending activities such as their total number of outstanding loans, the value of each loan, the date it was taken, the length of the loan period, the reason why the money was borrowed, and from whom it was borrowed. The latter contains a range of possible answers: a neighbor, a relative, the Bank for Agriculture and Agricultural Cooperatives (BAAC), a commercial bank, an agricultural cooperative, a village fund, a moneylender, a store owner or other business, a landlord, or other. Table 1 breaks down the loan sources into the respective categories. We see that borrowing from neighbors and family comprises about 25% of all loans in the sample. Borrowing from commercial banks, in contrast, is relatively rare (3% of all loans), reflecting the fact that a large fraction of households in this rural setting do not have access to commercial banks. Instead, they more often resort to moneylenders or the Bank for Agriculture and Agricultural Cooperatives (BAAC). The BAAC is a state-owned bank established to provide loans primarily for “agricultural infrastructure” (Ministry of Finance, Thailand, 2008). While most of the loans it gives are individual, the borrowers are often organized in borrowing groups with a joint liability clause. The interest rates on BAAC loans are usually about 1% to 2% lower than those of commercial banks. Since the BAAC is a hybrid institution in terms of our model – it charges interest and often requires collateral but may use informal relations (via the joint liability clause) to secure repayment – we will initially exclude the BAAC loans from the analysis below, focusing on commercial bank loans and moneylender credit versus loans from relatives and neighbours. We then perform robustness checks including BAAC loans in Section 4.3.

In our baseline specification we define ‘formal’ credit as loans from commercial banks or moneylenders and ‘informal’ credit as loans from relatives or neighbors. We drop the remaining households. While moneylenders may arguably be considered ‘informal’, remember that what matters for our model is not formality in terms of registration or regulation but whether or not personal or social ties are employed to secure the loan. In that sense, we group moneylenders along with commercial banks. We do consider various robustness checks to our definitions of formal and informal credit in Section 4.3 below.

Summary statistics of the data are provided in Table 2. In addition to the variables discussed above, the categorical variable ‘salary’ indicates whether the household draws a regular monthly or weekly income or works for the government. The binary variable ‘tenure’ equals one if the household has resided in the village for more than six years and zero otherwise. The variable ‘bank’ is an indicator variable that equals one if the household was a customer of a commercial bank. All other variables listed in the Table are self-explanatory. As a reference, note that the average annual income in Thailand in 1996 was 105,125 baht, or roughly $4,200 (Paulson and Townsend, 2004).

Motivated by the theoretical results, we investigate empirically the relationship between borrowers’ loan source choices and the two main explanatory variables: household wealth and loan size. Before doing so, however, it is instructive to take a look at two other important loan characteristics about which our model also makes predictions: collateral requirements and interests rates. Although the survey did not directly ask about interest rates, we were able to manually compute those from the
data by using the length of the loan period, the total required repayment value, and the initial loan size. Figure 2 a) shows the mean and median loan interest rates and ratios of collateral to loan size (‘collateral ratio’) for the four different loan sources we use: commercial banks, moneylenders, neighbours, and relatives. Consistent with our model, we see that informal credit (loans from relatives or neighbors) is significantly ‘cheaper’ than formal credit (loans from commercial banks or moneylenders) – the median interest rate on loans from relatives is zero which is considerably lower than the median commercial bank loan interest rate (7%) or the median moneylender rate (25%). In addition, the majority of neighbours and relatives require no explicit collateral, presumably using in its place social capital arising from personal ties.

The fact that informal credit is considerably cheaper than borrowing from a bank or a moneylender does not mean, however, that formal credit is non-existent in the data. Figure 2 b) illustrates that while informal loans can be found over the entire range of observed wealth, moneylender credit is also widespread. At the same time, only relatively wealthy households borrow from commercial banks. A likely explanation is that access to banks is limited in our rural setting, and that commercial banks require more collateral than moneylenders, which is a serious constraint for poorer households. The question remains, though, why observe formal credit at all? Certainly, an important reason is that funds available from neighbors/friends and relatives are more limited a priori than funds available through a commercial bank. However, we see from Figure 2 b) that there are some very large informal loans obtained by relatively wealthy households.

The relation between the chosen loan source (formal vs. informal) and the main indicator of how risky is the loan, the loan size-to-wealth ratio (LTW), is non-monotonic in the data, as Figure 3 shows. For smaller LTW ratios households primarily resort to informal credit. As the loan size rises relative to household wealth, formal credit becomes more prominent. For very high LTW ratios, however, the negative relationship between the prevalence of informal credit and the LTW ratio seems reversed – more informal credit occurs. Note that the observed U-shaped relationship between the loan source and the LTW ratio is consistent with our theory – see Propositions 3-5. As we show below, the relationship is also preserved once we control for other important observables.

4.2 Results

We now formally investigate the relationship between the loan source choice (formal versus informal), loan characteristics, and household characteristics. In doing so, we initially assume that the size of loan is exogenously determined by the needs of the household.\(^\text{22}\) In our baseline specification the dependent variable is the loan source choice, \(L_{\text{source}}\) and the main regressors of interest are log loan size, \(L_{\text{size}}\), log wealth, \(\text{Wealth}\), or the logged loan-to-wealth ratio, \(LTW\). Specifically, we run the

\(^{22}\)This is obviously a strong assumption, but may be justified if most loans are taken for a specific purpose, as the data seem to indicate. A related issue is that some households may borrow from several sources to finance a single investment project (Kaboski and Townsend, 2000). In the data, we observe the calendar dates at which each household took any given loan, as well as rough categories regarding the reported purpose of the loan. If we count loans that are taken for the same purpose within an year of each other as potentially being part of a larger loan that was split up (e.g., due to cash constraints on the lenders’ side or due to the required collateral), we arrive at a fraction of roughly 17% of all informal credit loans and only 0.2% of all formal credit loans. We deal with the possibility that the loan size is endogenous in the robustness section below.
following three regressions as suggested by the testable hypotheses A-C in Section 3:

\[ y_{kij} = \delta_j + \gamma_0 \text{Lsize}_{ki} + \beta X_i + u_{kij} \quad (A) \]
\[ y_{kij} = \delta_j + \gamma_1 \text{Lsize}_{ki} + \gamma_2 \text{Wealth}_{ki} + \beta X_i + u_{kij} \quad (B) \]
\[ y_{kij} = \delta_j + \gamma_3 \text{LTW}_{ki} + \beta X_i + u_{kij} \quad (C) \]

where \( i \) refers to the household, \( j \) refers to the region, and \( k \) to the loan (one household can have several loans in our sample). The dependent variable \( y_{kij} \in \{0, 1\} \) equals one if the loan is ‘informal’, that is, originates from a neighbor or a relative, and zero if the loan is ‘formal’, that is, originates from a commercial bank or a moneylender. For the reasons explained above, in our baseline regressions we exclude BAAC loans from both loan source categories.\(^{23}\) Altogether, formal credit, as defined, constitutes 36 percent of the sample used in the regressions. The vector \( X \) is a list of observable household characteristics and \( \delta_j \) are regional dummies. Estimation is done by probit and the baseline results are reported in Table 3.

[Table 3 here]

Columns (1)-(3) in Table 3 are the most parsimonious specifications of the regression equations (A)–(C). They only include as controls basic demographic characteristics of the household head, such as gender, education, marital status, and age.\(^{24}\) The estimates reveal that the incidence of informal loans is significantly lower, the larger the loan size, \( ceteris paribus \). This is true both with and without controlling for household wealth (Table 3, columns 1-2). At the same time, significantly fewer informal loans are also taken out as the loan-to-wealth ratio increases (Table 3, column 3). These results are in line with the testable implications (A)–(C) listed in Section 3. The magnitude of these effects is significant, for example, in column (1) a one standard deviation increase in log loan size from its mean decreases the probability of a loan being informal by 14 percentage points. Similarly, in column (3), the estimated coefficients suggest that a one standard deviation increase in the log LTW ratio from its mean decreases the likelihood of a loan being informal by 0.11.

Columns (4)–(6) in Table 3 add four additional control variables to regressions (A)–(C), namely whether or not the household head is a business owner, whether (s)he is a farmer, whether (s)he has lived in the village longer than 6 years, and whether (s)he draws a regular salary. Although those covariates are potentially important in determining interpersonal credit, we see that none adds much explanatory value – the coefficient estimates of our main variables of interest (\( L\text{size} \) and \( \text{LTW} \)) remain largely unchanged and statistically significantly negative.

In columns (7)–(9), we include three additional controls. Namely, we add a dummy variable for BAAC access and another indicator on whether or not a member of the household is a customer of a commercial bank.\(^{25}\) In rural areas, access to commercial banks is often severely restricted and travel times to the nearest bank branch may be prohibitive while the government-funded BAAC may act as a backup credit source. The third added control is household income. Clearly, these factors could possibly affect the choice of loan source and since they are highly correlated with loan size and borrower’s wealth, not including them could potentially bias the previously estimated coefficients. We

\(^{23}\)See Section 4.3 on the robustness of our results with regard to the coding of the dependent variable including BAAC loans.
\(^{24}\)With the exception of age, none of these variables has a statistically significant effect on formal versus informal loan choice and are therefore suppressed in the reported output for brevity of exposition. Full details are available from the authors.
\(^{25}\)Note that having access to the BAAC or a commercial bank does not imply that the household has a loan with any of these institutions
see, however, that the coefficients on both the loan size and the LTW ratio are virtually unaffected and remain statistically significantly negative.

Looking next at the coefficients on the controls, column (9) shows that direct access to a commercial bank increases the probability of formal loans, as expected. For households with access to a commercial bank, the estimated effect translates into a reduced likelihood of observing informal credit of 10 percentage points. Perhaps less obvious is the observed statistically significantly positive correlation between household income and the choice of informal credit in columns (7) and (8). We propose two possible explanations. First, households with higher incomes are more likely to socialize with other people with higher incomes, implying that the upper bound on the available funds from informal lenders (fixed at $\theta$ in our model) may in fact increase in one’s income in practice. Alternatively, household income could serve as a form of guarantee against default which in our model is more important for informal loans. In this view, the desirability (as opposed to the feasibility) of informal loans increases in a household’s income, since the probability of not being able to repay the loan and lose the social value decreases. This effect is quantitatively significant: increasing log income by one standard deviation increases the likelihood of observing an informal loan by roughly 6.6 percentage points, evaluating all other controls at their means. The (marginally significant) positive coefficient on wealth in columns (5) and (8) is also consistent with this interpretation.

The last column (10) investigates the possibility of a non-linear effect of the LTW ratio. Specifically, we split the observed LTW ratios into five quintiles and allow for a different slope coefficient for each LTW ratio interval. The results replicate the pattern in the raw data shown in Figure 3. For smaller LTW ratios, the incidence of informal loans declines with the loan-to-wealth ratio, although for sample size reasons some estimates are statistically significant. In the highest LTW ratio quintile, the estimated effect turns positive and statistically significant. These findings are suggestive of the U-shaped relationship in testable implication C in Section 3. Note also that the estimated negative relationship between loan source and loan size is not affected when we allow for non-linear effect of the LTW ratio.

4.3 Robustness

4.3.1 Alternative definitions of formal and informal credit

We next examine the sensitivity of our results to alternative definitions of formal versus informal credit. As explained earlier, we have so far excluded village-level organizations such as production credit groups (PCGs), rice or buffalo banks, poor and elderly funds, as well as the agricultural lending institutions such as the Bank for Agriculture and Agricultural Cooperatives (BAAC) and agricultural cooperatives. The latter two in particular are common and make up for almost 45 percent of all loans in our sample. At the outset, one could think of those institutions as formal; indeed, roughly 85 percent of BAAC loans and almost 95 percent of agricultural cooperative loans require collateral and virtually all carry a positive interest rate. For the village-based organizations these numbers are somewhat lower. While PCG loans require collateral in roughly 60% of all cases, the corresponding number for village fund and rice bank loans is only 30%. At the same time, however, loans from all these institutions often rely on group-liability or community monitoring for enforcement and thus could be viewed as secured by social (rather than physical) capital. For example, about 50 percent of BAAC loans are reported as backed by multiple guarantors (group lending). As such, they bear more resemblance to informal loans, as defined in the theory section.
To investigate the sensitivity of our results to variations in the definitions of formal vs. informal loans, we re-run our main specifications from Table 3 using alternative categorizations of informal and formal credit. Table 4 reports the corresponding estimates. All regressions are identical in specification to the regressions in Section 4.2 which include all co-variates (columns (7)–(9) in Table 3). For brevity we only report the estimates of the main coefficients of interest, namely loan size and the LTW ratio.

Columns (1)–(1”) in Table 4 replicate the estimated coefficients of these original regressions. In columns (2)–(2”), we augment our benchmark definition of formal loans by also classifying all loans from agricultural organizations (BAAC and agricultural cooperatives) or from village-level institutions as formal. This is the broadest definition of formal credit we consider. In columns (3)–(3”), we take the opposite view and instead classify all these loans as informal which broadens our definition of informal credit relative to the one used in Table 3.

The results in Table 4, columns (2)–(3”) show that the definition of formal vs. informal loans matters for the coefficients’ magnitude but not for their sign and significance – they remain negative and hence consistent with implications (A)–(C) from our model. The coefficient magnitudes are similar to the baseline when using a broader definition of formal loans (compare columns (1)–(1”) to (2)–(2”) but are reduced in magnitude by up to a half when instead we broaden the definition of informal loan by including BAAC, agricultural cooperatives and village funds. Taking our theoretical model at face value, these estimates suggest that village-level and agricultural lending organizations are more akin to formal than informal credit sources. Our theory also provides an explanation for why the estimated effects of loan size are less prominent if village-level and agricultural institutions are classified as informal rather than formal (compare columns (2)–(2”) and (3)–(3”) in Table 4). Those institutions presumably have more loanable funds than neighbours and relatives. In the terminology of the model the upper bound on lender’s resources \( \theta \) should thus be binding less often once those organizations are included among the informal loan sources.

Finally, columns (4)–(4”) in Table 4 report the results obtained when we define formal credit very narrowly – as only loans extended by commercial banks. This reduces the fraction of formal loans in the sample significantly.\(^{26}\) We see that the coefficient estimates on loan size and the LTW ratio more than double compared to the baseline estimates in columns (1)–(1”). The coefficient signs and significance remain in line with the theoretical predictions.

### 4.3.2 Selection

An important issue in our identification strategy that we have neglected so far is that we may not observe the loan choice related characteristics of households in our sample who decide not to take out a loan in 1997. It is easy to imagine that, for instance, households who have an outstanding loan have higher credit needs or may be more trustworthy than those who do not have a loan. If the propensity to take out a loan is correlated with unobserved characteristics that are also important in determining the selected type of credit, our baseline estimates in Table 3 would tend to be biased since selection into our sample could be correlated with the error term. To correct for this potential bias we use a Heckman (1979) sample selection correction for probit models.\(^{27}\) In the first stage, we estimate a

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\(^{26}\)From the 906 observations used in columns (4)–(4”), only 104 are instances of formal credit.

\(^{27}\)We use a special application of Heckman’s sample selection model in which the second stage equation is also probit. The corresponding STATA command is ‘heckprob’. 

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selection equation as probit regression of the form

\[ s_{ij} = \delta_j + \alpha Z_i + e_{ij}, \quad D_{ij} = 1 \Leftrightarrow s_{ij} \geq \bar{s} \]

where \( s^*_{ij} \) is the propensity to be included in the sample, \( D_{ij} = 1 \) if the household took out a loan and zero otherwise, \( Z_i \) is a vector of observable household characteristics, and \( e_{ij} \) is the error term. In the second stage, we can then correct for self-selection by incorporating a transformation of the predicted choice probabilities as an additional explanatory variable. The estimated models are

\[ Pr\{y_{kij} = 1 | D_{ij} = 1\} = \delta_j + \gamma M_{ki} + \beta X_i + \beta \lambda \lambda(\alpha Z_i + \delta_j) + u_{kij}, \]

where \( \lambda(\cdot) \) is the inverse Mills ratio, evaluated at \( \alpha Z_i + \delta_j \) and \( M_{ki} \) is either \( Lsize_{ki} \) or \( (Lsize_{ki}, Wealth_{ki}) \) or \( LTW_{ki} \) corresponding to equations (A)–(C) in Section 4.2.

The results from the Heckman-corrected regressions, reported in Table 5 strongly support our previous findings. The estimated coefficients on the main variables of interest (\( Lsize \) and \( LTW \)) remain very similar in magnitude and significance to those reported in the baseline Table 3. In addition, the estimate of \( \rho \) (the correlation between the error terms in the regression equation and the selection equation) shows a relatively weak relationship and the corresponding Wald test is not statistically significant, suggesting that sample selection bias does not pose a significant problem for the validity of our estimates.

In addition, the estimates of the coefficients in the selection equation (the columns with primes in Table 5) have the expected sign. Namely, controlling for other household characteristics, the propensity to take out a loan increases in income and decreases in the amount of household savings. The indicator variable ‘credit constrained’ equals 1 if the respondent answered “yes” to the question whether additional funds would be useful to increase the profitability of the family business or farm. As expected, the estimated coefficient is positive, that is, households who state that expanding would be profitable are more likely to borrow than those who do not.

### 4.3.3 Loan size endogeneity

Finally, we tackle the potential issue of loan size endogeneity. If informal lenders have limited available funds, as we hypothesize, and if the credit needs of a household exceed this limit, then an alternative to taking a more expensive formal loan is to split up the needed amount into several smaller loans using multiple informal sources (e.g., personal relations) to arrive at the desired sum. If this is a widespread practice, then the causal link from loan size to the choice of credit source that we model would be reversed: rather than choosing to rely less often on informal sources for larger loans, households would endogenously choose smaller loans once they have decided not to enter the formal credit market. This possibility does not invalidate our theory \textit{a priori} – allowing households to split up larger loans in the model would not alter our conclusions qualitatively except for increasing the range for which informal credit is feasible (the upper limit \( \bar{\theta} \)). For the empirical analysis, however, the assumed exogeneity of loan size is important, since otherwise the estimated coefficients on both explanatory variables of interest, loan size and the loan-to-wealth ratio could be biased.

Fortunately, our survey data contain a question which allows us to address the loan size endogeneity concern by using an exogenous proxy for loan size. Specifically, surveyed households were asked to
imagine a hypothetical situation in which they need funds for an emergency and how they would get the needed amount. The possible answers included selling assets (land, equipment, livestock, car, etc.); using savings; or taking out a loan in which case the source had to be specified. The same questions were posed for two different hypothetical loan amounts, 2,000 Baht and 20,000 Baht. Neither amount is particularly high (both are below the median loan size in the sample) but, since everyone was confronted with the same numbers, these hypothetical loan amounts are clearly exogenous to any observed and unobserved household characteristics. If we reasonably assume that households answered the hypothetical question in a way that would correspond to their actual behaviour had they faced the same situation in reality, we can then employ an indicator variable for the two hypothetical loan sizes as a regressor and the corresponding answer about the loan source as the outcome variable. The results are reported in Table 6. For brevity of exposition, we only report the estimated coefficients for the main explanatory variables of interest, loan size and the LTW ratio. The fixed effects specifications in columns (1) and (2) use only Lsize as the regressor. All regressions include the full set of covariates from Table 3 as well as regional dummies (for the random effects model).

Table 6 shows that our baseline results continue to hold: in the model with household fixed effects, columns (1) and (2), an exogenous increase in the loan size has a statistically significantly negative effect on the choice of informal credit, as in the baseline runs. Similarly, in the random effects model (columns (3)–(8)), the probability that a household reports relatives or neighbours as their preferred loan source decreases in the loan size (with and without controlling for wealth) and in the loan-to-wealth ratio, just as in the baseline results in Table 3.

5 Conclusions

We model borrowers’ optimal choice between formal (collateral-based) and informal (relationship-based) credit in a setting with imperfect enforcement, risk, and strategic default. Our model delivers several testable predictions which we show are consistent with data from rural Thai households. First, informal lenders charge zero interest rate and do not require physical collateral. Second, the likelihood of observing informal loans decreases with the loan size. Third, the prevalence of informal loans either monotonically decreases or has a U-shaped relationship with the ratio of loan size to borrower’s wealth (the LTW ratio) which in our model proxies for the risk of default.

We study informal loans between agents who are in a relationship characterized by a sufficiently high and indivisible utility value that is lost to both parties in case of default. The presence of this social value is key in supporting repayment and for the absence of strategic default at zero collateral and interest rate in informal loans. Relaxing the indivisibility in losing the friendship value or relaxing the reciprocity in the loss could make informal contracts look more like formal ones. Allowing forgiveness in case of involuntary default does not change our results though. Unlike informal loans, formal loans can only be supported by posting (divisible) physical collateral which does not eliminate the possibility of strategic default and results in a positive interest rate. Our assumptions on the value of the social collateral make our model better applicable in more traditional settings such as rural or immigrant-group environments where the value of maintaining interpersonal links is high. This is consistent with the observed prevalence of informal credit in such settings, as reviewed in the introduction.

In addition to the optimal choice between formal and informal credit for a project of given size by a
borrower of given wealth, our model has indirect implications for the types of projects that are likely
to be financed via formal or informal loan. Importantly, if formal credit is not available, the utility
loss from default may have negative consequences for the types of projects that are financed: although
we do not model the borrowers’ choice of investment project explicitly, it is possible to consider an
extension of the model and show that projects based on informal credit involve less risk taking than
in the absence of credit market imperfections. As a result, households or regions primarily relying on
informal credit may experience limited business growth.

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6 Appendix

Proof of Lemma 1:

Call \( g \equiv G\left(\frac{r_I}{w}\right) \) and \( d \equiv \int_{\alpha_{\min}} \min\{c_F, \alpha w\} dG(\alpha) \). Then \((PC_L)\) can be written as:

\[
[p + (1-p)(1-g)]r_I + (1-p)d - \theta \geq \gamma[(1-p)g - 1]
\]

(3)

Given (NN) we have \( r_I \geq \theta \) and \( d \geq 0 \) and thus the left hand side of (3) is larger or equal to \( \theta[p + (1-p)(1-g) - 1] = -g(1-p)\theta \). The latter is larger or equal to \( \theta[(1-p)g - 1] \) as long as \( 1 \geq 2g(1-p) \) which holds by Assumption A1(ii) and since \( g \leq 1 \). We also have that \( \theta[(1-p)g - 1] \geq \gamma[(1-p)g - 1] \), which is the right hand side of (3), since \( (1-p)g \leq 1 \) and since \( \gamma \geq \theta \) for all \( \theta \leq \bar{\theta} \) by Assumption A2. This implies that under our assumptions the lender’s participation constraint \((PC_L)\) is always satisfied for any \( r_I, c_I \) that satisfy (NN). ■

Proof of Proposition 1:

The result that \( r_I^* = \theta \) and \( c_I^* = 0 \) at optimum was shown in the main text. There are three possible cases depending on the value of the (project) loan size to wealth ratio (LTW), \( \frac{\theta}{w} \).

1. Case I1 (low loan-to-wealth ratio): \( \frac{\theta}{w} \leq \alpha_{\min} \). Then \( G\left(\frac{\theta}{w}\right) = 0 \) and hence \((PC_B)\) given by (1) is satisfied for any such loan size \( \theta \) since \( pR > 1 \) by Assumption A1(i). No default occurs for such small loans (relative to the borrower’s wealth) with size \( \theta \leq \min\{\bar{\theta}, \alpha_{\min}w\} \) and the social value is never lost.

2. Case I2 (high loan-to-wealth ratio): \( \frac{\theta}{w} \geq 1 \). Then \( G\left(\frac{\theta}{w}\right) = 1 \) and hence \((PC_B)\) given by (1) is violated since \( \gamma > \frac{p(R-1)\bar{\theta}}{1-p} \) by Assumption A2. Thus, no informal loans with such values of the LTW ratio \( \frac{\theta}{w} \) are taken.

3. Case I3 (intermediate low loan-to-wealth ratio): \( \alpha_{\min} < \frac{\theta}{w} < 1 \). From cases I1 and I2 we know that for given \( w \) the borrower’s participation constraint \((PC_B)\) is satisfied when \( \frac{\theta}{w} \) is sufficiently small and violated when \( \frac{\theta}{w} \) is sufficiently large. Call \( \hat{\alpha}_I \in (\alpha_{\min}, 1) \) the value of \( \frac{\theta}{w} \) at which (1) holds with equality. Informal loans thus satisfy the borrower’s participation constraint \((PC_B)\) for LTW ratios satisfying \( \alpha_{\min} < \frac{\theta}{w} \leq \min\{\hat{\alpha}_I, \frac{\theta}{w}\} \). Note that in Case I3 it is possible that the borrower is unable to repay the required amount \( r_I = \theta \), depending on the realization of \( \alpha \). Thus, such loans are risky and friendships are broken with positive probability.

Summarizing the above three cases and taking into account the upper bound on informal loan size, \( \bar{\theta} \) we obtain the proposition statement.

Proof of Lemma 2: Using the definition of \( \hat{\alpha}_I \), we have from (1),

\[
(pR - 1)\hat{\alpha}_I + (1-p)G(\hat{\alpha}_I)(\hat{\alpha}_I - \frac{\gamma}{w}) = 0
\]

(4)

28By continuity such value always exists since at \( \frac{\theta}{w} = \alpha_{\min} \) (Case I1) the LHS of (1) is strictly positive, while at \( \frac{\theta}{w} = 1 \) (Case I2) it is negative and since the LHS is a continuous function. See Lemma A1 below for a sufficient condition for the uniqueness of \( \hat{\alpha}_I \).
By Assumption A1, \( pR > 1 \) and so for the above equality to hold it must be that \( \hat{\alpha}_I < \frac{2}{w} \), so we can write (4) as:

\[
G(\hat{\alpha}_I) = \frac{(pR - 1)\hat{\alpha}_I}{(1 - p)(\frac{2}{w} - \hat{\alpha}_I)}
\]

(5)

The left and right hand sides of (5) can be viewed as functions of \( \alpha \) on the interval \([\alpha_{\text{min}}, 1]\) with equality holding when evaluated at \( \alpha = \hat{\alpha}_I \). Both sides are strictly increasing in \( \alpha \). The left hand side equals 0 at \( \alpha = \alpha_{\text{min}} \) and 1 at \( \alpha = 1 \). The right hand side is positive at \( \alpha = \alpha_{\text{min}} \) and less than 1 at \( \alpha = 1 \).

29Hence, assuming a unique crossing \( \hat{\alpha}_I \) (see Lemma A1 below for sufficient conditions), the graph of the right hand side of (5) as function of \( \alpha \) crosses the left hand side from above at \( \hat{\alpha}_I \). We thus obtain:

(i) An increase in the friendship value \( \gamma \) shifts the graph of the right hand side of (5) down, thus \( \hat{\alpha}_I \) decreases in \( \gamma \) ceteris paribus.

(ii) An increase in the borrower’s assets \( w \), the project’s return upon success \( R \) or the project’s probability of success \( p \) shifts the graph of the right hand side of (5) up, thus \( \hat{\alpha}_I \) increases ceteris paribus.

**Lemma A1:** \( G'' \leq 0 \) is a sufficient condition for uniqueness of the threshold \( \hat{\alpha}_I \) in Proposition 1.

**Proof of Lemma A1:** The first derivative of the left hand side of (1) (multiplied by \( w \)) with respect to \( \theta \) is,

\[
pR - 1 + (1 - p)G(\theta/w) + (1 - p)G'(\theta/w) \frac{1}{w}(\theta - \gamma)
\]

which cannot be signed in general. The second derivative has the same sign as

\[
2G'' + G'' \frac{1}{w}(\theta - \gamma)
\]

If \( G'' \leq 0 \) (the cdf \( G \) is weakly concave), the above expression is positive since \( \gamma > \theta \) for all \( \theta \in [0, \overline{\theta}] \) by Assumptions A1 and A2. That is, the left hand side of (1), call it \( \Phi(\theta) \), is a strictly convex function of \( \theta \) over the interval \([\alpha_{\text{min}}w, w]\). This implies that \( \Phi(\theta) \) can cross the horizontal axis exactly once since it is continuous and since \( \Phi(\alpha_{\text{min}}w) > 0 \) and \( \Phi(w) < 0 \). So, if \( G'' \leq 0 \), then the threshold \( \hat{\alpha}_I \), defined as the value \( \theta/w \in (\alpha_{\text{min}}w, w) \) such that \( \Phi(\theta) = 0 \), is unique.

**Proof of Lemma 3:** Constraint (IC) implies that formal loans always require positive collateral since \( c_F = r_F \geq \theta > 0 \). Next, evaluating the expected payoff of the lender, the left-hand side of (PC\(_L\)), at zero interest rate, \( r_F = \theta = c_F \), we have

\[
p^{\theta/w} \int_{\alpha_{\text{min}}}^{\theta/w} \lambda \alpha w dG(\alpha) + (1 - G(\frac{\theta}{w}))\theta + (1 - p)\lambda \int_{\alpha_{\text{min}}}^{\min\{\theta, \alpha w\}} dG(\alpha) \\
\leq p\theta + (1 - p)\lambda \theta < \theta
\]

29The latter follows noting that at \( \alpha = 1 \) we have \( w = \theta \) and using Assumption A2.
3. Case F3 (intermediate loan-to-wealth ratio): \( \frac{\theta}{w} \leq \frac{\alpha_{\min}}{\phi} \) and so \( \lambda \alpha w \leq \lambda \theta < \theta \) holds inside the integral whenever it is well-defined (thus the value of the integral in the first term is less than \( G(\frac{\theta}{w}) \theta \)) and since \( \min\{\theta, \alpha w\} \leq \theta \) and \( \lambda < 1 \). Overall, this implies that whenever a formal loan is feasible (a solution to the contracting problem exists) the interest rate charged by formal lenders must be strictly positive \( (r_F > \theta) \) for them to break even.

**Proof of Proposition 2**

Consider the three possible cases depending on the value of the (project) loan size to wealth ratio (LTW); \( \frac{\theta}{w} \).

1. **Case F1 (low loan-to-wealth ratio):** \( \frac{\theta}{w} \leq \frac{\alpha_{\min}}{\phi} \). In this case \( r_F^* = \phi \theta \) solves (2) and satisfies \( r_F^* \leq \alpha_{\min} w \), i.e., \( r_F^* \leq \alpha w \) for all \( \alpha \) and \( G(\frac{\theta}{w}) \theta \) = 0. The borrower always has sufficient funds to repay the loan and there is no risk for the lender. In case of project failure the money comes from liquidating part of \( t = 1 \) assets. There is no default in equilibrium. Positive interest, \( r_F^* = \phi \theta > \theta \) is charged because of the liquidation cost \( \alpha w \).

2. **Case F2 (high loan-to-wealth ratio):** \( \frac{\theta}{w} \geq \frac{E(\alpha)}{\phi} \). In this case we have,

\[
\begin{align*}
\theta & \geq w \frac{E(\alpha)}{\phi} \\
& \geq \frac{1}{\phi} \int_{\alpha_{\min}}^{r_F^*/w} \min\{r_F^*, \alpha w\} dG(\alpha) = \frac{1}{\phi} \int_{\alpha_{\min}}^{r_F^*/w} \alpha w dG(\alpha) + \frac{1}{\phi} \int_{\alpha_{\min}}^{r_F^*/w} (1 - G(\frac{r_F^*}{w}) ) r_F^* \\
& > \lambda \int_{\alpha_{\min}}^{r_F^*/w} \alpha w dG(\alpha) + (p + (1 - p)\lambda)(1 - G(\frac{r_F^*}{w}) ) r_F^* = \theta
\end{align*}
\]

The second inequality holds since \( \alpha w \geq \min\{r_F^*, \alpha w\} \) for all \( \alpha \) and hence \( u \frac{E(\alpha)}{\phi} = \frac{1}{\phi} \int_{\alpha_{\min}}^{r_F^*/w} \alpha w dG(\alpha) \geq \frac{1}{\phi} \int_{\alpha_{\min}}^{1} \min\{r_F^*, \alpha w\} dG(\alpha) \). The third inequality follows since \( \frac{1}{\phi} > \lambda \). Thus, for \( \frac{\theta}{w} \geq \frac{E(\alpha)}{\phi} \) the lender’s break-even constraint (PC\(_L\)) cannot be satisfied (no feasible \( r_F, c_F \) exist due to the possibility of strategic default when \( \alpha \) is small).

3. **Case F3 (intermediate loan-to-wealth ratio):** \( \frac{\alpha_{\min}}{\phi} < \frac{\theta}{w} < \frac{E(\alpha)}{\phi} \). From cases F1 and F2 we know that, for given \( w \), the lender’s participation constraint (PC\(_L\)) is satisfied when \( \frac{\theta}{w} \) is sufficiently low and violated for \( \frac{\theta}{w} \) sufficiently high. By continuity, there exists a threshold LTW ratio value, \( \hat{\alpha}_F \) with \( \hat{\alpha}_F \in (\frac{\alpha_{\min}}{\phi}, \frac{E(\alpha)}{\phi}) \) such that formal loans are feasible for \( \frac{\theta}{w} \in (\frac{\alpha_{\min}}{\phi}, \hat{\alpha}_F) \) and not otherwise. Specifically, the threshold \( \hat{\alpha}_F \) is defined as the maximum value of \( \frac{\theta}{w} \) for which a real solution \( r_F^* \) to (2) exists. The optimal repayment \( r_F^* \) solves (2) and satisfies \( r_F^* > \phi \theta \). Note that, depending on the realization of \( \alpha \), in case F3 it is possible for the borrower to be unable to repay \( r_F^* \) – default can occur.

Finally, we need to check the borrower’s participation constraint (PC\(_B\)) for cases F1 and F3 in which formal loans are feasible. From (OBJ\(_B\)) and (2), the borrower’s expected utility \( U_F^* \) in case F1, where \( r_F^* = \phi \theta \) equals \( \theta (pR - \phi) \) which is positive by Assumption A1(i) since \( \phi < 1/\lambda \). In case F3,
the borrower’s expected utility $U_{F3}$ in the optimal formal loan contract equals

$$U_{F3} = pR\theta - \int_{\alpha_{\min}}^{1} \min\{r^*_F, \alpha w\}dG(\alpha) = pR\theta - \int_{\alpha_{\min}}^{r^*_F/w} \alpha wdG(\alpha) - (1 - G(\frac{r^*_F}{w}))r^*_F >$$

$$> pR\theta - \frac{\theta}{\lambda} > 0$$

where the first inequality follows by (2) and $\lambda < 1$ and the second inequality holds by Assumption A1. Thus, (PCB) is satisfied whenever formal loans are feasible.

**Proof of Proposition 3:**

(a) Suppose first $\alpha_{\min} < \hat{\alpha}_F$, so formal loans are feasible over the entire interval $\frac{\theta}{w} \in (0, \alpha_{\min}]$. If $\frac{\theta}{w} \leq \frac{\alpha_{\min}}{\hat{\alpha}_F}$, then since $\phi > 1$, Propositions 1 and 2 imply $r^*_F = \phi \theta > \theta = r_I$ and $G(\frac{\theta}{w}) = 0$. In this range of loan-to-wealth ratios, the risk of non-repayment is zero for both formal and informal lenders. The borrower’s expected utility from taking an informal loan is equal to $U_I = (pR - 1)\theta$ while her expected utility from a formal loan is $U_F = \theta(pR - \phi) < \theta(pR - 1) = U_I$. Because of the liquidation cost $\lambda < 1$, informal loans are thus strictly preferred when feasible. The same result obviously holds for LTW ratios $\frac{\theta}{w} \in (\hat{\alpha}_I, \alpha_{\min}]$ since, in addition to what was said above, in this interval the formal interest rate is higher, $r^*_F > \phi \theta$ (see the discussion surrounding Proposition 2). Formal loans could therefore be used in this case only if $\theta > \hat{\theta}$. Finally, if $\alpha_{\min} \geq \hat{\alpha}_F$, the above arguments apply for all values $\frac{\theta}{w} \leq \hat{\alpha}_F$ while for $\frac{\theta}{w} \in (\hat{\alpha}_I, \alpha_{\min}]$ formal loans are infeasible and the proposition claim follows trivially.

(b) By Proposition 2, in this range of the LTW ratio, $r^*_F$ solves (2) while $r^*_I = \theta$ from Proposition 1. For such $\frac{\theta}{w}$ we thus have $G(\frac{\theta}{w}) \in (0, 1)$ and $\gamma > \theta$. The borrower’s expected utility from using informal credit is

$$U_I = (pR - 1)\theta - (1 - p)G(\frac{\theta}{w})(\gamma - \theta)$$

which she would compare to the expected utility from using formal credit. The optimal loan source choice in this case depends on the parameter values. Recall from the discussion above that: (i) $U_I > U_F$ at $\theta/w = \alpha_{\min}$, (ii) $U_I \leq 0$ at $\theta/w \geq \hat{\alpha}_I$, and (iii) $U_F > 0$ for any $\theta/w$. Thus, informal loans are preferred for relatively small $\theta/w$ ratios while formal loans are chosen for larger $\theta/w$ ratios in the assumed LTW ratio range. Finally, note that the case $\alpha_{\min} \geq \hat{\alpha}_F$ is contained in part (a).

(c) and (d) The results follow directly from the discussion above.

**Tables and Figures**
Figure 1: Thailand

Figure 2: Interest Rates and Collateral (a) and Size of Loan and Wealth (b) by type of credit
Figure 3: LTW ratio and type of credit
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<th>Freq.</th>
<th>Percent</th>
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*Note: Category "Other" includes the following possible answers: Rice Bank, Landlord, Purchaser of Output, Supplier of Input, as well as the answer “other” (the latter has 344 observations). Some households hold multiple loans.*
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<th>Mean</th>
<th>St. Dev</th>
<th>Min</th>
<th>Max</th>
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*Note:* Observational units are households. Any personal demographics refer to the household head. A household’s wealth was computed by adding up the (self-reported) value of all assets of the household as given in the data, including house and land holdings, durable assets (TV, car, etc.), agricultural assets (tractor, seeds), fishing assets (boat), animals, and business assets.
## Table 3: Probit Regressions for Loan Source

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*Note:* Dependent variable is Lsource, which equals 1 if the source is a neighbour or relative, and 0 if the source is a commercial bank or moneylender. With the exception of indicator variables, all independent variables are in log form. The regressions include regional fixed effects and control for age, gender, marital status and education of the household head. The standard errors reported in parentheses are heteroskedasticity-robust, and clustered at the regional level. Superscripts ***, **, and * indicate significance at .1%, 1%, and 5%, respectively.
Table 4: Heckman Correction Probit Regressions for Loan Source

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*Note:* The regression with primes are the selection equations. Dependent variable is Lsource, which equals 1 if the source is informal and 0 otherwise. With the exception of the indicator variables, all independent variables are in log form. Both the loan source and the selection regressions include regional fixed effects and control for age, gender, marital status, and education of the household head. The co-variates business owner, tenure, and salary have been dropped as they were statistically insignificant, as before. The standard errors reported in parentheses are clustered at the regional level. Superscripts ***, **, and * indicate significance at .1%, 1%, and 5%, respectively.
Table 5: Alternative classification of formal and informal credit

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*Note: Dependent variable is the source of the loan which equals 1 if the source is informal, and 0 otherwise (see the main text for the categorization in different samples). All regressions include regional fixed effects, household demographics, and the co-variates specified in the main regression (3) in Section 4.2. The standard errors reported in parentheses are clustered at the regional level. Superscripts ***, **, and * indicate significance at .1%, 1%, and 5%, respectively.
Table 6: Exogenous Loan Size Regressions

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*Note: Dependent variable is Lsource, which equals 1 if the household answered that it would obtain the loan from a friend or relative, and 0 if the answer was a commercial bank or a moneylender. Independent variables are in log scale. In specification (2), 1793 households were dropped because their answers did not vary with the size of the loan. The standard errors reported in parentheses are heteroskedasticity–robust, and clustered at the regional level. Superscripts ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.